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AMERICAN PHARMACEUTICAL EDUCATION BEFORE 1900

By

GLENN ALLEN SONNEDECKER

A Thesis Submitted in Partial Fulfillment

of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

at the

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Until well into the 19th century it could not have occurred to a young American interested in getting into the business of dispensing drugs that he should obtain any formal professional education. Fascinated by the strange names and pungent smells he encountered on the shelves of the drug shop, he resolved to learn to read and cypher so well that he would be accepted as the doctor's next apprentice. Perhaps he would even become a physician, because the village "doctor" operated the drug shop as a branch of his medical practice. Or perhaps he would be like the druggist-merchant whom he had visited with his father at the county seat, a man of some means who imported drugs from outlandish places, who knew about chemicals and even tried to make some himself, and who appraised with discerning eyes the community's household needs, of whatever kind.

It was a free country where a poor boy with ambition could make his way in pharmacy. The law recognized no rule but <u>caveat emptor</u> in the supply of drugs; and nowhere in America, during the two centuries after Jamestown was settled did anyone--as far as we know--offer formal instruction for the practice of pharmacy as a separate calling. In contrast, European pharmaceutical education had begun to take definite shape by the end of the 18th century.

The acquisition of technical skill and knowledge, such as in pharmacy, may be conceptualized as evolving along two lines: training versus education.[1] In the principal countries of the Continent pharmacy had made a choice, was in a transitional stage between training for a trade and scientific study for a profession. This product of an older culture could not possibly be transplanted into the pioneering climate of America,[2] but it would become influential among conflicting goals, as pharmaceutical education developed under peculiarly American conditions.

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1 - Charles F. Thwing, A History of Higher Education in America (New York, 1906), 423.

2 - Edward Kremers and George Urdang, History of Pharmacy (Philadelphia, 1951), 280.

On the Continent. Formal education appeared first in cultural centers of Europe as a supplement to the apprenticeship developed under the gradually outmoded system of pharmaceutical guilds.[3] The nature of this apprenticeship varied with the power and function of particular guilds and with the extent to which pharmacy had emerged as a separate calling in different countries.

Where pharmaceutical guilds were strong, as in Italy and France, conditions met by the 17th-century apprentice were much like those encountered by his friends who entered other crafts. Among the customs more or less general were a term of five to seven years; an examination including the preparation of a "masterpiece"—for one youth perhaps a finely wrought silver candlestick, for another an elegant pharmaceutical preparation; and service as a journeyman ("clerk" in pharmacy), sometimes lasting until a man could show sufficient funds to operate a shop of his own satisfactorily.[4]

Perhaps the only distinctive educational prerequisite for the apprentice entering pharmacy was a knowledge of Latin.[5] This he used not only to decipher physicians' prescriptions but to read most of the literature of the time. The few books at his disposal in the shop were mostly pharmacopoeias and dispensatories, usually authored by physicians. Unless he had an

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3 – On the pharmaceutical guilds, see Kremers and Urdang, History of Pharmacy, 68-71, 80-83, 114 and 136f.

4 – Witt Bowden, Michael Karpovich, and Abbott Payson Usher, An Economic History of Europe Since 1750 (New York, 1937), 25 ff.

5 – George Urdang, "Pharmaceutical Education from the Historical Point of View," American Journal of Pharmaceutical Education, 6: 55, 1942.

unusual master, the apprentice rarely would "get more out of these books than the formulas which he had to follow in the preparation of the compounded medicines concerned."[6]

During the rather long term, the apprentice learned empirically the technic and customs of the shop. The term for mastership was five years as an apprentice and three years as a clerk in Venice, and more or less generally in Italy, during the latter part of the 16th century and long thereafter. During the 17th and 18th centuries in France, one worked four to ten years as apprentice and clerk. And in 17th-century Germany--where in pharmacy guilds were few and government decrees many--a six-year apprenticeship was the custom, but official requirements were vague. In Spain at the same time the apprentice served between four and eight years.[7]

Were these long training periods necessary for mastery of the technic and business of dispensing drugs? The answer hinges on a question even now sharply argued in American pharmacy: Should education be the minimum for public safety and professional function, or the practicable maximum for optimal professional benefits as well as function? Pharmacy, like the

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6 - George Urdang, "Pharmaceutical Education from the Historical Point of View," American Journal of Pharmaceutical Education, 6: 55, 1942.

7 - Kremers and Urdang, History of Pharmacy, 75, 91, 107, and 120; for a general discussion of the evolution of the apprenticeship system, with a pharmaceutical orientation, see Edward Kremers, "The Apprenticeship System," Proceedings of the American Pharmaceutical Association, 42: 399-421, 1894.

other crafts, seems to have leaned toward the latter alternative. The masters undoubtedly wanted to prevent overcrowding of the field, to guarantee a high standard of workmanship, and to be sure of adequate assistance in the shop, at the same time gaining some advantage during the late apprenticeship period to compensate for the time and trouble of initiating the tyro into the art during the early period.[8]

Up to the 16th century the pharmacy student's objectives remained traditional and relatively simple. He studied the ancient materia medica--using such books as the Circa instans of Matthaeus Platearius and the antidotaria, especially the Grabadin of Pseudo-Mesuë; he became wise in procuring, garbling, and storing a host of botanical simples; and learned how to concoct the syrups, confections and similar forms of medication that were largely an Arabian inheritance.

But after the time of Paracelsus (1491-1542) a new vista opened to the apothecary and his apprentices. The focus of attention on "spagyric" remedies was only sharpened by the opposition of Galenic medicine, which could be nothing more than a delaying action. If chemistry remained "feeble as a science" during the 16th and 17th centuries it became "strong as a trade"[9]--of which Paracelsian pharmacy was only one aspect. Of this Meyer said: "Die Herstellung der neuen Arzneimittel setzte Bekanntschaft mit chemischen Thatsachen und Vorgangen

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8 - Cf. Bowden, An Economic History, 25 f.

9 - H. T. Pledge, Science Since 1500 (New York, n.d.), 103.

voraus; die Pharmazeuten mussten also sich fortan bemühen, diese Kenntnisse zu erwerben, und damit nahm die Pharmazie im eigentlichen Sinne ihren Anfang." Although there is often discussion as to "Pharmazie im eigentlichen Sinne," everyone will agree with Meyer that "Paracelsus gave a tremendous impetus to the higher development of the apothecary's calling."[10]

Besides the idea that chemistry could be of much greater service to medicine, there were other stimuli to an apprentice's aspirations. By the middle of the 16th century a new pharmaceutical literature began to emerge, together with tentative beginnings of formal instruction. The year 1561 marks the issuance of two important books: the Antidotarium Generale by the physician J. J. Wecker of Basel, and the Enchiridion su manipul des miropoles by the apothecary Michel Dussemy of Paris. In France there were a few ordinances requiring apprentices here and there to attend a lecture series; and in 1559 this acquired the dignity of a course in pharmacy at the University of Montpellier. At the University of Valencia in Spain there seems to have been a half year of "syllogisms" especially for pharmacists' apprentices. In 1576 the apothecary Nicolas Houel, under a special ordinance, established the Jardin des apothicaires, which was maintained through several centuries by the Parisian apothecaries for the general scientific instruction of apprentices.[11]

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10 - Ernst von Meyer, Geschichte der Chemie von den Ältesten Zeiten bis zur Gegenwart (Leipzig, 1889), 60.

11 - Kremers and Urdang, History of Pharmacy, 91, 93, 107 and 125. The course at Montpellier, established by apothecaries at their own expense, was given by Bernhardin de Rano, the first practicing apothecary on the official teaching staff of a European university.

Later on, in the 17th century, the more fortunate Parisian apprentices had the advantage of special study at the Jardin du Roi. "Parmi les cours du Jardin du Roi, créé en 1626," says Bouvet,[12] qu'ont pu suivre les futurs apothicaires, rappelons les plus fameux: vers 1652, ceux de Nicaise Le Febvre... auteur d'un cours particulier, cours dont les données essentielles paraîtront en 1660 dans son Traité de la Chymie; ceux de son successeur Christophe Glaser, qui publiera un ouvrage similaire en 1663; enfin, beaucoup plus tard, ceux de Guillaume-François Rouelle (1703-1770)..."[13]

The well-known book by Le Febvre (also called Cours de chymie, and translated into English in 1664 under the title A Compleat Body of Chymistry) was among the first of a series of important books published during the last half of the 17th century by French pharmacists, such as Moise Charas and Nicolas Lémery. The same period spawned German books important to pharmacy likewise, such as those by Oswald Croll, J. R. Glauber and D. Ludovici, although it was about a century later in Germany before the flowering of apothecary-authored books.

By the end of the century this literature provided a stimulus to educational ambitions, reinforced during the 18th century by the rise of experimentalism, learned societies and a periodical literature in science generally.

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12 - In 1626 the Garden was authorized in letters patent; but organization did not seriously begin until 1635 (the founding date given by Kremers and Urdang); and the formal inauguration was not until 1640. (La Grande Encyclopedie (Paris, n.d.), vol. 24, 598.

13 - M. Bouvet, Histoire de la pharmacie en France (Paris, 1937), 88.

Up to now, except for the isolated beginnings referred to, that minority of pharmacists who attended universities studied medicine. Quite a few gained medical degrees, "and a considerable number of them continued to practice pharmacy."[14] In Germany, an ever larger sprinkling of apprentices who had absolved the required "gymnasium" education entered the universities, mostly to attend the materia medica courses in the medical faculty, occasionally going on to obtain the Bachelor of Medicine.[15] During the 18th century pharmacy became more independent of medicine, educationally as well as professionally.

The strivings of a group that medicine liked to consider subordinate, coupled with incomplete separation of the practice of pharmacy and medicine, has led to inter-group tensions over a wide range of times and places. In France the bitterness left by interprofessional quarrels blocked attempts of the Parisian guild of apothecaries to organize academic courses of its own. Such courses finally got under way in 1705 but were suspended eight years later. Resumed in 1753, the course again had to be abandoned after twelve years because of medical opposition. Bouvet comments: "Quant aux cours organisés par la communauté elle-même, ils ne peuvent prendre aucune extension, aucun développement régulier, par suite de l'opposition de la Faculté de Médicine qui voit d'un

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14 - Urdang, "Pharmaceutical Education from the Historical Point of View," Amer. J. Pharm. Edu., 6: 54, 1942.

15 - A. Adlung and G. Urdang, Grundriss der Geschichte der deutschen Pharmazie (Berlin, 1935), 133.

mauvais oeil cet empiètement sur ce qu'elle estime faire partie de ses prérogatives personnelles..."[16]

In Prussia such fitful beginnings were avoided by a government edict of 1725 that introduced the first obligatory academic course for pharmacists in an entire state, or country. Anyone who wanted to practice in one of the larger towns appearing on an official list had to take a course at the new "Collegium Medico-Chirurgicum" in Berlin. This plan, which created the special category of "pharmacist first-class," was adopted on the initiative of the apothecary Caspar Neumann, a prominent exponent of early scientific chemistry. As the first professor of pharmacy at the Collegium, Neumann's main course was on Chymiam rationalem Pharmaceuticam, meaning the description of chemical drugs, their manufacture and the "chymical-physical reasons and bases of this work." Either demonstrations or actual laboratory work probably was included.[17]

And at Göttingen we find for the first time official mention of pharmaceutical science in a university curriculum, study intended for pharmaceutical as well as medical students.[18] From about this time on the University of Göttingen, joined later by Halle, took the lead among German universities in "blossoming out of their pedantry" and getting into touch with daily life.[19]

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16 - Bouvet, Histoire, 38.

17 - Adlung and Urdang, Grundriss der Geschichte der deutschen Pharmazie, 139. Before qualifying for the first-class privilege, it was also necessary to have an apprenticeship and seven years of experience as a clerk.

18 - Ibid., 134.

19 - Pledge, Science Since 1500, 102.

Several private institutes were also established before the end of the century in Germany, which became internationally known centers for the study of pharmacy and chemistry. These were conducted by leading pharmacists such as J. C. Wiegleb at Langensalza, S. Hermbstaedt at Berlin and J. B. Trommsdorff at Erfurt, who drew together the more ambitious apprentices for lectures and laboratory work in connection with their pharmacies.[20]

At Paris the pharmacy course resumed in 1777 when the Collège de Pharmacie replaced the old guild. Its successor, the Société libre des pharmaciens de Paris, established the École gratuite de pharmacie (later École supérieure Faculté de pharmacie de Paris).[21]

The College of Pharmacists of Madrid established optional courses during the second quarter of the century, later opening a botanical garden (1751) and a chemical laboratory (1757) for teaching. This served as a pattern for similar ventures launched in several other Spanish cities. By the end of the century the Madrid College made attendance at classes obligatory for apprentices, a move that had been attempted unsuccessfully at Barcelona due to medical opposition.[22]

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20 - Adlung and Urdang, Grundriss der Geschichte der deutschen Pharmazie, 134 f.

21 - A. Phillippe, Histoire des Apothicaires (Paris, 1853), 198 ff. and 212 ff.

22 - Kremers and Urdang, History of Pharmacy, 107 f.

In Poland, one of the more developed Slavic countries, a chair of pharmacy and materia medica was founded at Krakow in 1782, where apothecary Jan Szaster lectured to students of pharmacy and medicine in his own shop, where he had a laboratory and a materia medica collection. Three years later a chair of pharmacy and medical chemistry was established at Wilno, and in 1809 a chair in pharmacology (i.e., pharmacy and pharmacognosy) was established at Warsaw. In Russia during the 19th century practical instruction of apprentices in pharmacy and chemistry was supplemented by academic study of Latin and Russian.[23]

During the first part of the 19th century pharmacy built rather rapidly on the foundation that had been laid. This foundation rested upon the assumption that an academic education for pharmacists was socially necessary, that pharmacy was a separate and not subordinate branch of medicine, and that the desired function and prestige called for competence in the science as well as the art of pharmacy.

In 1803 "academic courses became a general requirement for pharmacists in the whole of France as in Prussia, for pharmacists of the first class," and legislation provided for the establishment of six higher schools of pharmacy.[24]

The next year a Spanish statute authorized a Royal College of Pharmacy in Madrid entirely devoted to instruction (opened 1806), other schools opening within a decade in Barcelona, Santiago and Seville.

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23 - Witold Saski, "Notes on the Development of Pharmacy in Poland," Montana Pharmacist, 3: 12, 1951; Wilhelm Adolphi-Pinneberg, "Die Entwicklung der Chemie und Pharmazie in Russland," Pharmazeutische Zeitung, 81: 1195, 1936.

24 - Phillippe, Histoire des Apothicaires, 221 ff.; and Kremers and Urdang, History of Pharmacy, 92.

During the short-lived Napoleonic Kingdom of Italy (1805) academic and examination requirements were extended to the whole peninsula (effective since 1778 in Northern Italy through Austrian legislation); and education was transferred thereby from the old guilds to the universities.[25]

Bavaria took a similar step in 1808, becoming the first German state to require university study of those to be licensed as pharmacists. Besides five years of apprenticeship and clerkship, the applicant had to have four semesters of study covering pharmacy, pharmacognosy, human anatomy, physics, mineralogy, chemistry, mathematics, zoology, toxicology and botany. Prussia was the next German state to require academic study of its pharmacists (two semesters, 1825, which for several decades, however, could be replaced as a prerequisite for the obligatory examination by a longer period of pharmaceutical practice), and the other states gradually followed suit before the founding of the second German empire.[26]

The rich texts, the active schools, the scientific rivalry of the Continent would one day fructify American pharmacy. Yet, it was the British homeland that offered not only the most convenient heritage but also the most adaptable pattern for culturally primitive America.

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25 - Kremers and Urdang, History of Pharmacy, 75 and 108.

26 - Adlung and Urdang, Grundriss der Geschichte der deutschen Pharmazie, 136, 141 and 143.

England. It is of commanding importance that in England there was no systematic curriculum primarily for instruction in pharmacy until after an educational system already had begun to develop in her former American colonies. Thus the English colonists offered only an apprenticeship system tinctured by a tangled tradition in which pharmacy and medicine never had achieved clear-cut separation.

The broad outlines of this system were already drawn for colonial America by English guild and municipal legislation of the 13th and 14th centuries.[27] By 1400 in most towns there were guild requirements for apprentices, undoubtedly including the apothecaries.[28] It was customary to require that the apprentice's covenant be with a freeman and for a term of not less than seven years, "according to the ancient usage."[29] These and other guild regulations were codified by the Statute of Artificers of 1562, which transformed local and variable practices into a nationally uniform system.[30]

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27 - Robert F. Seybolt, Apprenticeship and Apprenticeship Education in Colonial New England and New York (New York, 1917), 1.

28 - Ibid., 4 and 8; cf. C. J. S. Thompson, The Mystery and Art of the Apothecary (London, 1929). It may be noted, incidentally, that Seybolt found apothecaries among the 50 crafts and trades of London that in 1309-1313 had adopted a uniform apprenticeship fee, according to Guildhall records.

29 - Seybolt, Apprenticeship, 3.

30 - Paul Douglas, American Apprenticeship and Industrial Education (New York, 1921), 15 f. and 25 f.

This climaxed sporadic attempts to enforce generally the seven-year indentured term, but compliance still remained imperfect.[31]

The first official indenture period for apothecaries known to us appears in the 1617 charter of the Society of Apothecaries of London (f. 1606), which follows the Statute of Artificers in requiring seven years.[32] Within a decade the London apothecaries had established optional botanical courses (1627) to supplement the apprenticeship. But it was not until 1753 that similar courses in materia medica were offered.[33]

Meanwhile, already in the 17th century, the apothecaries became embroiled in a two-pronged controversy: defense of their claim as minor medical practitioners, against the physicians; and defense of assumed pharmaceutical prerogatives, against the "druggists"[34] and "chemists".[35] An account of the peculiarly

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31 - Jonathan F. Scott, Historical Essays on Apprenticeship and Vocational Education (Ann Arbor, 1914), 35 f. After the 16th century many guilds required the "masterpiece" for admittance to mastership, but it was not as generally required in England as on the Continent. (Ibid., 24.)

32 - C. R. B. Barrett, Society of Apothecaries of London (London, 1905), xxxii (cited by Kremers and Urdang).

33 - Ibid., 197.

34 - Merchants selling unprepared drugs and other commodities.

35 - Preparers of medicines by chemical processes, including distillation.

British development that ensued lies outside our present field of interest. Suffice it to say that from the early 18th century on the apothecaries were socially and legally accepted as second-class medical practitioners who also operated drug shops. They thus attempted to satisfy prestige goals by occupying part of the physician's function, with the result that the first regular curriculum of the Society of Apothecaries of London (1827) was mainly medical.[36] Defaulting on their primary pharmaceutical function,[37] lacking the conditions and the zest for developing a vigorous pharmacy based on chemistry, the way was left open--and smoothed by English laissez faire policy--for the rise of a new representative of pharmacy proper, the "chemist and druggist."

Out of this "free wheeling" and rather chaotic development, pharmacy came to America. When the first school of pharmacy was established in the United States in 1821, the Pharmaceutical Society of Great Britain and its school remained a far goal for the "chemist and druggist."

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36 - Barrett, Society of Apothecaries of London, 197.

37 - For examples of the controversy on this score between the members of the Society of Apothecaries and the College of Physicians, see Jacob Bell and Theophilus Redwood, Historical Sketch of the Progress of Pharmacy in Great Britain (London, 1880), 16 f.; Howard Bayles, "The Rose Case," Chemist and Druggist, 133: 8, 1940.

II. AMERICAN AMBITIONS AND ATTEMPTS BEFORE 1820

In the Colonial period educated physicians were few and apothecaries fewer still.[1] Medicine and pharmacy usually were united in the same person; and even with this combined function professed physicians often turned to other fields to supplement their income—such as teaching, farming, or the ministry. On the other hand, aid to the sick or injured often had to come from colonial officials, churchmen,[2] or housewives.

As the population and towns grew the number of drug shops grew likewise. These shops were manned by a motley group, for in the United States there was no legal requirement for pharmaceutical practice anywhere until the 19th century (mostly after 1850) and no formal education required anywhere until the 20th century. American preparers and dispensers of drugs after the Revolution were of three main types:

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1 - For example, there was much difficulty in obtaining qualified men for the post of apothecary at the Pennsylvania Hospital. Feeling the need for "a person properly Qualified for that Business," the medical staff wrote to the Board of Managers in 1767 that "We are of the opinion that the best way will be to apply to some Person in England." (Thomas G. Morton, The History of the Pennsylvania Hospital, 1751-1895 (Philadelphia, 1897), 527).

2 - It was not unusual for the Colonial clergy to enter into medical controversies or to write practical works on the subject. (Joseph Carson, A History of the Medical Department of the University of Pennsylvania (Philadelphia, 1869), 20 f.)

By far the greater number, especially outside the larger towns, were the storekeepers who either specialized in drugs or carried them as a sideline, often in complete ignorance of the nature or dangers of the merchandise they purveyed. A shopkeeper could rarely afford to stock only a particular line of merchandise, although by the early 19th century a tendency toward specialization appeared in the larger towns.[3]

Drug retailing, at a time when most shops never saw a physician's prescription, drifted with this general trend. It was somewhat modified in that segment of the field taken over by a second type of drug dispenser one met on 18th-century streets: the American physician-apothecary, who like his English counterpart might give primary attention to either his medical or pharmaceutical function depending upon his inclinations, location, and background. In the apprenticeship, which we shall examine presently, such men "learned the practice of all these branches of medicine [pharmacy, surgery and medicine] ; for the most part, they tried to make the best of all of them."[4]

The physician-operated drug shop notably declined only after the beginning of the 19th century. For example, when members of the New York College of Pharmacy systematically solicited the drug stores of the city in 1829 for support of their new school, one-third of the establishments appear to

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3 - John A. Krout and Dixon R. Fox, The Completion of Independence, 1790-1830 (New York, 1944), 241 and 245.

4 - Kremers and Urdang, History of Pharmacy, 211.

have been physician-owned.[5]

The third type of drug dispenser, not frequently met except in port cities, was the educated or trained pharmacist, the immigrant German Apotheker, a French apothicaire, or an English "apothecary" or "chemist". Under American conditions even "most of these preferred medical practice combined with dispensing..."[6] Among these men and their apprentices, especially, the American "druggist" arose beginning in the late 18th century, a man who imported drugs, conducted some manufacturing as best he could, and not only operated a retail shop but wholesaled drugs to country physicians and storekeepers.

No lines were clearly drawn. Men drifted into and out of pharmacy and medicine as in any trade. If knowledge were sought at all in pharmacy it was within the general system of apprenticeship, a basic concept of vocational education brought over from England.

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5 - See Curt P. Wimmer, The College of Pharmacy of the City of New York (New York, 1929), 27 f.

6 - Kremers and Urdang, History of Pharmacy, 212.

Apprenticeship. The English conception of apprenticeship placed its stamp on early Colonial statutes. Many of these provided that an apprentice should be taught to read and write, should be given biblical instruction, and insisted that the master be a moral man. At least in the early period the enrolled indenture was still required. Customarily, the term was not completed until the apprentice was twenty-one years old and had served at least seven years.[7]

Under pioneer conditions this empirical pattern of training became imbedded in American utilitarianism and persisted much longer and covered a broader occupational area than might be expected. The basic idea of preceptorship dominated pharmacy and medicine (and law as well) long after the industrial revolution brought the decline of the system in industry.[8]

First-hand evidence is sparse concerning early pharmaceutical apprenticeships; and an investigation of possible records in court and town-meeting minutes remains a task for the pharmaceutical historian.

Apparently there were no apothecaries among the preceptors to whom poor boys were bound in colonial New York, according to records checked by Seybolt.[9] Apothecaries are

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7 - R. F. Seybolt, Apprenticeship, 22-25, and P. Douglas, American Apprenticeship, 20.

8 - Paul Monroe, Founding of the American Public School System (New York, 1940), 35.

9 - Seybolt, Apprenticeship, 91.

likewise not represented among enrolled indentures at New York in the early 18th century.[10]

One of the earliest apothecary indentures reported is that of Thomas Boulter,[11] who was bound in 1766 to the managers of Pennsylvania Hospital.[12] Boulter's indenture is a printed form, stating the same obligations, and even phraseology, that Seybolt found in English indentures of the 14th and 15th centuries.[13] All callings were considered an "Art, Trade and Mystery," in this case designated, in handwriting, as that of "Apothecary." Significantly, the term was for five-and-a-half years, rather than seven. According to standard obligations, the apprentice "his Master faithfully shall serve, his Secrets keep, his lawful Commands every where readily obey. He shall do no Damage to his said Master, nor see it done by others, without letting or giving Notice to his said Master; he shall

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10 - "Citty of New Yorke: Indentures of Apprenticeship begun February ye 19th 1694 and ends January ye 29th 1707," Collections of the New York Historical Society, 18: 565-622, 1886; and "Indentures of Apprentices, 1718-1727," loc. cit., 42: 113-199, 1909.

11 - Not "Boulton," as given by Joseph England, The First Century of the Philadelphia College of Pharmacy (Philadelphia, 1922), 22.

12 - This hospital had become in 1752 the first place of definite record where an American apothecary was employed "to fill prescriptions, other than his own or those of his preceptor..." (Kremers and Urdang, History of Pharmacy, 205)

13 - Seybolt, Apprenticeship, 13.

not waste his said Master's Goods, nor lend them unlawfully to any. He shall not commit Fornication, nor contract Matrimony, within the said Term: At Cards, Dice or any other unlawful Games, he shall not play, whereby his said Master may have Damage. With his own Goods, nor the Goods of others, without Licence of his said Master he shall neither buy nor sell. He shall not absent himself Day or Night from his said Master's Service, without his Leave: Nor haunt Ale-houses, Taverns, or Play-houses, but in all Things behave himself as a faithful Apprentice, ought to do, during the said Term."

On the Master's part, he "shall use the utmost of his Endeavour to teach and instruct, or cause to be taught and instructed, the said Apprentice, in the Trade or Mystery of an Apothecary and procure and provide him sufficient Meat Drink, Apparel, Washing, Lodgings fitting for an Apprentice, during the said Term of Five years and six months and shall likewise teach him or cause him to be taught to read write and cypher and shall also give him at the Expiration of S. Term one new Suit of Apparel besides his common apparel."[14]

The obligation to give the apothecary's apprentice a more or less complete elementary education is typical of 17th- and 18th-century indentures in all callings.[15]

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14 - Underlining indicates hand-written portions. Reproduced in Thomas G. Morton, The History of the Pennsylvania Hospital, 1751-1895 (Philadelphia, 1897), facing 480; and in England, The First Century, 22.

15 - Seybolt, Apprenticeship, 65.

It is noteworthy that an indenture of 1782 apprenticed John Hart of Philadelphia to Townsend Speakman to learn the Art, Trade and Mystery of a "Druggist," rather than of an apothecary. The term of six years, five months, and 11 days, undoubtedly terminated on John's twenty-first birthday. The printed references to meat, drink, lodging and washing were crossed out in this indenture, possibly because the apprentice lived at home during his term.[16] Otherwise the obligations and the wording of the Boulter and Hart indentures are the same.

Most 18th-century youths who learned the pharmaceutical art could not be apprenticed to a druggist such as Speakman. A far larger number served with a medical practitioner who either prepared and dispensed his own drugs or kept an open shop. La Wall colorfully pictures their services with such physician-apothecaries as follows: "Apprentices served terms with these men of from three to six years, devoting their time partly to books, partly to the study of anatomy, and partly to the compounding of medicines. The extract kettle was always simmering on the hearth and the clang of the iron contusion mortar and pestle resounded throughout the land. The physicians and their apprentices gathered the simples in their seasons and either dried them or made them up immediately into stock preparations. Advanced students attended to cupping and leeching, tooth pulling and the dressing of minor wounds...

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16 - Reproduced in Charles H. La Wall, Four Thousand Years of Pharmacy (Philadelphia, 1927), facing 456. The drugstore of the preceptor, Speakman, was the place of meeting for a group of naturalists who founded the Academy of Natural Sciences of Philadelphia in 1815. (Ibid., 495.)

At the close of the apprenticeship the preceptor gave the pupil a certificate of proficiency and the youth was then ready to enter medicine or pharmacy, or both, on his own account."[17]

Drawing a similar picture, Norwood points out that the apprentices often were not bound by indenture and that rather soon after the Revolutionary War the apprenticeship period ordinarily was ended after three years, but might be longer or even shorter.[18] "This change," he suggests, "perhaps resulted from the establishment of several medical schools, each of which required not more than three years of apprenticeship of candidates for the M. D. degree."[19]

While this action by early schools may have mediated the change, it seems necessary to look for other influences, since apprenticeship standards were breaking down in various fields. One can hardly overlook the influence of a middle class that had come to glorify unrestricted liberty and the self-made man. There was naturally an impatience with traditional restrictions that delayed an industrious man from rising to the top. Moreover, the growth of the factory system in the Northeast and the extension of slavery in the South tended to break up the old apprenticeship pattern.[20]

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17 - La Wall, Four Thousand Years of Pharmacy, 399 f.

18 - William F. Norwood, Medical Education in the United States Before the Civil War (Philadelphia, 1944), 32 and 380.

19 - Ibid., 32.

20 - Merle Curti, The Social Ideas of American Educators (New York, 1935), 24.

Preparatory work for entering law had fallen below colonial standards by the early 19th century and continued to decline. "The general decline in standards came after 1830," Krout and Fox point out, "as frontiersmen and urban workers demanded that the lawyer's special privileges be made more easily available to ambitious young men."[21]

When the renowned medical teacher Daniel Drake looked back upon the early 19th century, he felt that the apprenticeship system was not only bad but that "we have no system." The term was too short, students often entered medicine too early, and parents generally "consult economy and convenience" when selecting a preceptor for their son.[22] Since pharmacy was so poorly separated from medicine in America, as in England, these conditions applied equally to youths whose inclinations would keep them at the mortar and pestle.

By 1820 there were thirteen cities in the United States having a population of 10,000 or more, and in such places conditions permitted an increasing number of stores to give primary attention to pharmacy. An apprentice's service with a druggist of 1820 was described later by Edward Parrish: "The apprentice then enjoyed a wholesome development of muscle through wielding the ponderous pestle,

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21 - Krout and Fox, The Completion of Independence, 281.

22 - Daniel Drake, Practical Essays on Medical Education, and the Medical Profession in the United States (Cincinnati, 1832), 20 f.

handling the sieves and working the screwpress. He learned how to make pills by the wholesale, to prepare great jars of extracts and cerates, to bottle castor oil, Turlington's Balsam and opodeldoc by the gross, and what he lacked in the number and variety of articles he dealt in, was made up by a greater extent of his operations and the completeness with which, in a single establishment, all the then known processes were practiced. Very many physicians then dispensed their own prescriptions, drawing the supplies from the druggists, but gradually the separate prescription counter was added to the drug stores, and the dispensing stores, as we now call them, became numerous, and the whdosale druggists gradually ceased to supply the public directly."[23]

This experience undoubtedly was supplemented by a certain amount of pharmaceutical study. There were no American texts, and those of Europe were beyond the apprentice's intellectual reach. A "Course of Study for the Apprentices" outlined by Boston druggists in 1829 probably reflects what was considered the goal earlier in the century likewise. This document reads as follows:

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23 - Edward Parrish, "On the Relations of the Several Classes of Druggists and Pharmacists to the Colleges of Pharmacy," American Journal of Pharmacy, 43: 481, 1871.

I

Latin Grammar and easy lessons in parsing,

Thacher's Dispensatory

Names of articles in Latin and in English

Tables of Weights and Measures

Materia Medica

II

Thacher's Dispensatory, continued,

Table of Synonims,

Table of Doses,

Exercises in reading and writing prescriptions,

National Pharmacopia and Bigelow's Sequel.

III

Chemistry,---especially as applied to Pharmacy,

Pharmaceutical Preparations and Compositions,

Selection and Preservation of Medicinal Articles.

Detection of Adulterations.[24]

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24 - "Facsimile of the 1829 Catalogue of the Massachusetts College of Pharmacy," Bulletin of the Massachusetts College of Pharmacy, December, 1934 (reprint), 7. The spelling follows that of the original.

The main text, James Thacher's American New Dispensatory (first published in 1810) had become very popular. The reasons given by the Massachusetts Medical Society for a warm commendation of the volume are significant. The author had tried "to adapt the work to American practice," using the Massachusetts Pharmacopoeia as the basis and following its arrangement and nomenclature; he had introduced indigenous drugs and omitted ancient articles of little or no value; and exhibited "in a familiar language, and a concentrated form, the principles of modern pharmacy, chemistry and materia medica."[25]

"Bigelow's Sequel," which apprentices were to use in connection with the Pharmacopoeia was "a humble attempt," as the author put it, "to extend the usefulness of the Pharmacopoeia, by a commentary on the design, character and application to use, of its various contents."[26] This study outline undoubtedly represented an ideal rather than an attainable goal for most apprentices in the first part of the century.

From observations made later on, we may infer that the legal indenture was by no means regular practice in pharmacy;

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25 - Testimonial of October 14, 1809 in James Thacher, The American New Dispensatory (Boston, 1821), 3. The first issue of the United States Pharmacopoeia appeared in 1820, and beginning with the 4th edition (1821) Thacher's Dispensatory followed the nomenclature and general principles of this work.

26 - Jacob Bigelow, A Treatise on the Materia Medica, intended as a sequel to the Pharmacopoeia of the United States (Boston, 1822), 15.

that terms were irregular, often only a year or two; and that employers made the best bargain they could get, knowing that a boy probably would either soon demand clerk's wages or set up shop on his own.[27] A survey at mid-century disclosed "it rarely happens that a lad is legally indentured; the idea of such an instrument being exceedingly repulsive to most boys who aim at the apothecary business. The lack of any honor-bound obligation has "deluged us with incompetent clerks... whose claim to the important position they hold or apply for is based on a year or two's service in the shop..." Then they become owners and train others, and "ignorance multiplied by ignorance will produce neither knowledge or skill."[28]

The underlying assumption by the 19th century thus was one of a minimum knowledge that would permit financial success for enterprising youth in pharmacy as a trade. The social consequences of this attitude in a field affecting health were not of primary concern when the rights of self-improvement and free enterprise were at stake. Preceptors here and there, especially among those who had practiced pharmacy abroad or who were well-educated physicians, undoubtedly inculcated their apprentices with knowledge and goals that went beyond self-centered necessities. But they could cause no more than an eddy in the strong socio-economic currents that swept through pioneering America.

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27 - [William Procter, Jr., et al.], "Address to the Pharmaceutists of the United States," Proc. Amer. Pharm. Assoc., 2: 14-17, 1853.

28 - Ibid., 14 f.

The "druggists" of Eastern cities, previously mentioned, must have felt the need for more, rather than less, knowledge of the science and art of real pharmaceutical service. Their interests could be served by formal education. But before the 19th century they were isolated individuals, not a professionalized group, and without organization as a basis for action. Outside of this scattered group, the minimum functional needs required for material success did not include theoretical knowledge or instruction, hence it was not easy for the idea of scientific study to take root.

Pharmacy Taught for Physicians. Unlike pharmacy, medicine had begun to evolve a professional structure and educational system in the latter part of the 18th century. A number of medical societies were actively functioning, quite a few young Americans journeyed to European medical centers such as Edinburgh and Paris for study, and ten collegiate institutions in the United States founded medical instruction.[29]

Within this context it seemed natural that medical students, most of whom would dispense their own medicines, should study pharmacy as part of the curriculum.[30]

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29 - Norwood, Medical Education, 31 and 61.

30 - La Wall states that at the close of the American Revolution there were reportedly "only three medical practitioners in Philadelphia who confined their practice to prescription writing." (Charles H. La Wall, "The Founding of the Philadelphia College of Pharmacy and Science," Amer. J. Pharm., 93: 167-183, 1921.)

The first medical school, which was connected with the College of Philadelphia, gave special attention to pharmacy from the beginning in 1765. An announcement in the Pennsylvania Gazette stated that "In order to render these courses the more extensively useful, we intend to introduce into them as much of the Theory and Practice, of Pharmacy, Chemistry, and Surgery as can be conveniently admitted."[31] Moreover, it was required that the student "shall have served a sufficient apprenticeship with some respectable practitioner in Physic, and to make it appear that he has a general knowledge in Pharmacy."[32] Dr. John Morgan, an early and ardent advocate of the separation of medicine and pharmacy, was to teach the course in materia medica. His announcement said in part: "The Manner of preparing and combining them [the medicines] will be shown by some instructive Lessons upon Pharmaceutic Chemistry: This will open to students a general Idea both of Chemistry and Pharmacy." But he was careful to point out that all this was to prepare the students "more effectually for understanding the art of prescribing with Elegance and Propriety."[33] In 1789 pharmacy was added to the title of this chair in materia medica.[34]

It was not only the materia medica course that was valued in medical schools for its relation to pharmacy. A faculty memorial to the trustees of the University of Pennsylvania,

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31 - Norwood, Medical Education, 63.

32 - Ibid., 66.

33 - Ibid., 64.

34 - M. I. Wilbert, "The Beginnings of Pharmacy in America," Amer. J. Pharm., 77: 399-410, 1907. Dr. Samuel Powell Griffitts thereby became the first professor in the United States to have a joint title of this kind.

shortly before 1821, emphasized that "The students of medicine who almost exclusively support the Professorship of Chemistry are induced to do so in consequence of its application to Pharmacy."[35]

It is also of interest that Benjamin Silliman, editor of the American Journal of Science and Arts and a geologist, held the title of "Professor of Chemistry, Pharmacy, Mineralogy and Geology" at Yale University, where he had worked out most of the details for organizing the medical school.[36]

Other medical schools followed the precedent established at Philadelphia by including pharmacy in a joint title of one of the chairs. In 1820 six of the twenty medical schools listed by Thacher included more or less extensive instruction in pharmacy, usually combined with chemistry or materia medica.[37] This practice continued long afterward, for still in 1849 a third of the schools reporting to the American Medical Association on the "branches taught" specifically mentioned pharmacy. The reasons were made clear in a special recommendation on "Practical Pharmacy" included in a notable report by the Committee on Medical Education. "Practical Pharmacy is a subject of the greatest importance," the Committee emphasized, "particularly where many of our physicians practicing in the country are compelled to become their own apothecaries. We believe as a general rule, it is

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35 - C. H. La Wall, "The Founding of the Philadelphia College of Pharmacy," Amer. J. Pharm., 93: 169, 1921.

36 - American Journal of Science and Arts, vol. 50, n.d. (1847?), frontispiece of "General Index of Forty-nine Volumes."

37 - Wilbert, "The Beginnings of Pharmacy in America," Amer. J. Pharm., 77: 399-410, 1907.

taught in the country offices, where the preceptor requires the aid of his pupils in preparing and putting up medicines. It might likewise be easily studied in the cities...and we think it advisable that, prior to receiving his diploma, every candidate should be required to produce evidence of his having been engaged, during a period of at least three months, in compounding medicines..."[38]

Thus it seems clear that pharmacy was not taught in medicine solely to prepare the physician for more intelligent prescribing, but even primarily for the practice of pharmacy. In doing this medicine did not usurp a pharmaceutical function, but rather merely continued in formal instruction a concept and practice that had become traditional under the old exclusively preceptor training.

There appears to be no evidence that "pharmacists" either actively opposed such instruction[39] or attempted to take advantage of it for improving their own knowledge.

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38 - "Report" (of the Committee on Medical Education), Transac. American Medical Association, 2: 257-352, 1849.

39 - Even in the second quarter of the 19th century the editors of the first journal for pharmacists in the United States apparently found nothing incongruous about such courses. At least two introductory lectures to medical courses on pharmacy and materia medica or chemistry were published by the American Journal of Pharmacy in the mid-thirties (George B. Wood, "Lecture Introductory to the Course on Materia Medica and Pharmacy in the University of Pennsylvania," Amer. J. Pharm., 7: 286-300, 1835, and W. R. Fisher, "Introductory Lecture Delivered in the Chemical Hall of the University of Maryland," Amer. J. Pharm., 9: 269-290, 1837). It may be noted that by 1867 the course still given on "Materia Medica and Pharmacy" at the University of Pennsylvania appears to have been almost entirely materia medica, with five lectures on what we now call pharmacology. (See Joseph Carson, Synopsis of the Course of Lectures on Materia Medica and Pharmacy Delivered in the University of Pennsylvania, with five Lectures on the Modus Operandi of Medicines (Philadelphia, 4th ed., 1867.)

General Education. If formal professional education remained outside the scope and ambitions of pharmacy itself until well into the 19th century, pharmacy lay even more remote from the interests of the early general institutions of higher learning. Science teaching already had begun in the eight colleges established in the United States by 1780. But for reasons that were more than adequate, as we have seen, pharmacy made no early connection with applied science here, as it did on the European continent. Even in other American fields, science remained largely an avocation for gentlemen during the 18th century.[36] Few except those entering the clergy and the children of the wealthy could think in terms of collegiate training.

The Colonial pattern had followed English custom in the teaching of reading and religion in the homes and by the master of apprentices, although the pressing conditions of life often severely limited such instruction. The Latin grammar schools in larger towns mainly prepared the more privileged boys for the colony college.[37]

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36 - For discussions of American science and science teaching in the early period see Theodore Hornberger, Scientific Thought in the American Colleges, 1638-1800 (Austin, Texas, 1945), and Dirk J. Struik, Yankee Science in the Making (Boston, 1948).

37 - Ellwood P. Cubberley, Public Education in the United States, A Study and Interpretation of American Educational History (Boston, 1934), 16.

During the first sixty-five years at Harvard, America's first college (f. 1636), there were on the average only about fifty students enrolled annually and about eight graduates per year. About half of these became clergymen, and quite a few returned to England where life was more remunerative as well as more genteel.[38] Early enrollment figures at William and Mary, the second college to be founded (1693), were not much higher.

How far the institutions of higher learning were from the commercial, competitive stream of life in which pharmacy was developing becomes clear from the curriculum, which remained much the same in the colleges until early decades of the 19th century:

"In the first quarter of the 19th century," says Thwing, "all students of all the colleges were pursuing practically the same course. The common branches were Latin, Greek and Mathematics, including, in some colleges on the one side arithmetic, and in some, on the other side, Calculus...In the Senior year philosophy became dominant...In most institutions natural philosophy was required in at least a single year...French, Spanish, Political Economy, Chemistry, Geology and Botany had begun to appear."[39]

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38 - Charles F. Thwing, A History of Higher Education in America (New York, 1906), 45 and 49.

39 - Ibid., 300 f.

The first intrusion of professional instruction came from medicine, starting at Harvard in 1782. This opened the door to chemistry in connection with the study of the materia medica, at Harvard and elsewhere. From 1800 on, chemical studies "grew slowly but firmly."[40]

In the earlier period the colleges probably did not teach pharmacy largely because they were so much oriented toward liberal education; moreover, it was difficult to find in pharmacy any signs of drive toward professionalization that might require theoretical knowledge at the university level. Even later in the 19th century when the old-line colleges became more versatile and curricula more fluid, pharmacy remained for a long time outside their scope. If for no other reason it was because pharmacy's recruits were coming largely from social groups that had little or no preliminary preparation.[41]

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40 - Ibid., 302.

41 - There was not much social concern about such a circumstance. For President Joshua Bates of Middlebury College probably expressed a not uncommon opinion of the upper stratum in 1818 when he advocated only elementary education for common folk, since "a more refined education and a highly cultivated taste, by dividing the attention, might even unfit a man for excellence and energy in everyday pursuits." (Curti, The Social Ideas of American Educators, 78; citing the Academician, 1: 83 (May 19), 1818.)

In any event the test of a man's worth lay primarily in his economic success rather than in his educational achievement. About 1820 anyone who could read, write and cypher was "educated." Despite national land grants for education in new states, provisions of the different state constitutions, early state laws, and important beginnings in a few cities,[42] there had been no vigorous and broad educational development. It was after about 1820 that Americans as a people developed an educational consciousness—although the awakening came earlier in New England and New York; much later in some states, particularly in the South.[43]

This awakening in the second decade, the limited educational opportunity for the middle and lower groups, the lack of common interests between old-line colleges and pharmacy, the continuing importance of an apprenticeship that had lost its underpinning of system and control—all these were to be pivotal factors in the subsequent development of pharmaceutical education.

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42 - Nineteen of every twenty inhabitants were classified as rural.

43 - Cubberley, Public Education, 110 f.

Attempts at Instruction for Pharmacists. Did this socio-economic context block all formal instruction specifically for apothecaries until 1821? Only three abortive efforts are known, and over these has fallen a veil of uncertainties.

The earliest and most unusual proposal was born in Colonial South Carolina. In November 1769 Dr. Lewis Mottet, a talented French physician, recommended to the House of Assembly of South Carolina that a "General Pharmacy" be established, including a chemical and galenical laboratory and a botanical garden, at a cost "between Six and Seven Thousand Pounds Currency." It seems quite clear from a transcript of the proposal, reprinted by Hoch from the South Carolina Gazette, that the establishment was to be first of all a kind of state pharmacy, where the physician "will find Medicines proper and adequate to all Cases, which cannot be had in private Collections...By not having a general Pharmacy, physicians are obliged to conform to the common irregular Methods, having no other Materia Medica than those imported from Great-Britain, in general so adulterated..." Experiments were also to be conducted to discover indigenous drugs "adapted and natural to this climate" that might be especially useful against "vapoural Impressions emanating in particular from this Soil... ." This general pharmacy and botanical garden, Mottet maintained, would be the "most effective Means for regulating the Practice of Physic, and the surest to prevent Partiality."

On the teaching side, he was ready to "read the general System of the Materia Medica...the most essential Part of Physic... ." The students and apprentices would be "any young Men, having an Inclination and sufficient Education... ."[44]

This grandiose scheme was not only costly but out of step with social attitudes of the time, and nothing came of it. If the project had materialized, one cannot help wonder whether this physician might have offered a remarkable dispensary, testing and research agency, and instruction in the "most essential Part of Physic," primarily for physicians without greatly influencing the development of pharmacy as a separate calling in the South. It is much to be hoped that Hoch or other workers will investigate further the remarkable Mottet and the background and fate of his proposal.

We know of no other educational endeavor of special pharmaceutical interest until forty-three years later. In 1812 James Cutbush of Philadelphia, chemist, self-styled apothecary and scientific writer on pharmacy, made the following announcement: "The subscriber, at the solicitation of several medical gentlemen, proposes to give a series of Lectures on the Theory and Practice of Pharmacy, accompanied with the necessary chemical elucidations. Tickets may be had at 25 South Fourth Street, Price 20 dollars. James Cutbush."[45]

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44 - J. Hampton Hoch, "Dr. Lewis Mottet's Projected Institute of Pharmacy (1769)," J. Amer. Pharm. Assoc., 27: 1260-61, 1938; and quoting, South Carolina Gazette (No. 1825), Sept. 27, 1770.

45 - As quoted by H. C. Wolfe, "James Cutbush--Author, Teacher, Apothecary General," Amer. J. Pharm. Edu., 12: 89-125, 1948.

It may be going too far, however, to consider Cutbush "the first teacher of pharmacy from the point of view of professional pharmacy." For we cannot be sure that the course was ever actually given. If it was, we do not know the orientation given to it by a lecturer Wolfe believes had "an utter lack of interest in the medicinal use of drugs." His biographical study suggests that Cutbush may have been thinking more in terms of industrial pharmacy and chemistry than of dispensing pharmacy.[46] There is also the possibility that the course appealed to "medical gentlemen," such as those who solicited it, more than to Philadelphia apothecaries and their apprentices. We do not know. It appears that the course was not commented upon or announced in Poulson's American Daily Advertiser during 1812, and La Wall likewise found no further reference to it.[47]

Four years later James Mease, a Philadelphia physician, applied for and received permission from the Board of Trustees of the University of Pennsylvania to deliver the "Introductory to his Lectures on Pharmacy in the College building."[48]

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46 - Ibid., 97 f.

47 - La Wall, "The Founding of the Philadelphia College of Pharmacy," Amer. J. Pharm., 93: 169 f., 1921.

48 - Joseph Carson, A History of the Medical Department of the University of Pennsylvania (Philadelphia, 1869), 145. The author--who was editor of the American Journal of Pharmacy beginning in 1836--considered Mease's lectures "the first attempt, by private lectures upon the branch, to improve its condition."

In the same year (1816) the University established a faculty of natural sciences, comprised of chairs in botany, natural history (including geology and zoology), mineralogy and chemistry, and comparative anatomy. Wilbert felt that, in effect, the University "offered to pharmaceutical students a very comprehensive course of study along the lines followed in Universities of Continental Europe... ." The difficulty is that the minutes book of the Trustees, or other sources, give no information on where, when, or to whom the course by Mease was given.[49]

The "records of the Board of Trustees show," Wilbert reports, "that Dr. Mease continued his lectures during the year 1816-1817 and that in the fall of 1817 he was again given permission by the Board of Trustees of the University of Pennsylvania to inaugurate the course of lectures on pharmacy in the University of Pennsylvania."[50]

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49 - M. I. Wilbert, "The Pharmaceutical Exhibition in Philadelphia," Amer. J. Pharm., 88: 448, 1916; and Wilbert, "The Beginnings of Pharmacy in America," Amer. J. Pharm., 77: 406, 1907.

50 - Wilbert, "The Pharmaceutical Exhibition in Philadelphia," Amer. J. Pharm., 88: 448, 1916. Mease's second application offers some circumstantial evidence that the course was given at least once, even though La Wall says "it is probable that no applicants appeared to take the course, for no further mention was ever made of it." (La Wall, "The Founding of the Philadelphia College of Pharmacy," Amer. J. Pharm., 93: 171, 1921.) Wilbert goes too far, however, when he says that "A letter from James Mease, printed in Thacher's American New Dispensatory, Boston, 1821, would indicate that Mease was conducting his course of lectures on pharmacy in 1818 and it is quite probable that this course was continued up to and including the time of the proposed granting of the degree of Master of Pharmacy by the University in 1821." (Loc. cit., 448.) The only evidence actually offered by the testimonial letter mentioned, which is dated February 10, 1818, is the printer's heading: "James Mease, M. D., Lecturer on Pharmacy." The assumption that this testifies to anything is tenuous, since it was not a 19th-century custom to be too hesitant about using outmoded or equivocal titles and degrees.

Whatever may have been the success of Mease's course, it was transient and inconsequential as an educational venture. Yet, the probability is fairly high that, indirectly, it had the most far-reaching consequences for American pharmacy—starting a chain of events that Mease could not possibly foresee at the time.

Perhaps while Mease was still on the scene, for certain less than two years after he last applied to the Board of Trustees to give his pharmacy course, the Board decided that the teaching of pharmacy, for presumptive apothecaries, should be part of the duties of the professor of materia medica and pharmacy.

The man chosen to carry out this assignment, apparently the one who developed the idea, was Dr. John Redman Coxe, dean of the medical faculty and former professor of chemistry. It is difficult to assume that the efforts of Mease, and his recent contact with the Board and with his medical colleague John Coxe concerning a pharmacy course, were not significant in bringing the University to offer a pharmaceutical degree in course. But as we shall see later, the Board's decision of 1819 to inaugurate university instruction in pharmacy, on what Dr. Coxe called "the European plan," never bore fruit—except a barrage of verbal brickbats.

III. THE ESTABLISHMENT OF SCHOOLS

Before the Civil War

In 1820 it appeared that pharmaceutical education in the United States was about to be launched as part of university instruction. Following the decision of the Board of Trustees at the University of Pennsylvania in 1819, Dr. John Redman Coxe drew up a plan for consideration by the Board. In it he specifically pointed to the lack of an "incorporated association," such as sponsored pharmaceutical study in Europe. The University's proposed course was the only visible means for filling the gap. Coxe emphasized that it is "of the greatest importance to society that he [the apothecary] should be perfectly grounded both in the theoretical and practical part of the art he professes." For a degree "under some appropriate denomination," he proposed to require a three-year apprenticeship and two courses of lectures on chemistry and materia medica and pharmacy.

This followed the pattern of requirements for medical students, who likewise had a three-year apprenticeship and attended lecture courses that were to be repeated for a second year. The medical curriculum, which of course was broader, included courses in chemistry and in materia medica and pharmacy; it might well be that pharmacy students were to attend these courses together with medical students.[1]

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1 - For the medical school requirements see W. F. Norwood, Medical Education in the United States Before the Civil War, (Philadelphia, 1944), 78 ff.

To avoid any "unfair tendency," Coxe proposed granting an honorary degree of the same nature to those "apothecaries of standing in Philadelphia who may sanction the proposed plan, as it is believed that there are few, if any, who will not view it as tending to render their profession more honorable and deserving of that estimation in which it ought to be unquestionably held."[2]

Coxe took the precaution of consulting with a group of the most prominent apothecaries of Philadelphia. And the statement bears the names of sixteen who "do approve of the general outlines of the plan above suggested, and do not hesitate to recommend it to the consideration of the trustees of the University of Pennsylvania."[3] Coming to the Trustees with the best possible recommendations, the plan received quick approval—as Joseph Carson puts it, "to meet the urgent want presented."[4]

When apothecaries and druggists of the city opened their "Daily Advertiser" on February 19, 1821, they were confronted with the University's official blueprint for awarding the "Master of Pharmacy," both as an honorary degree and in course. Many

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2 - The full text of this "Statement" is printed in England, The First Century, 45 f.

3 - Poulson's American Daily Advertiser, March 24, 1821, p. 2 (originally cited by England).

4 - Carson, A History of the Medical Department, 145 f. The full text of the resolutions appears here, and also in England, op. cit., 46 f. The Board acted on February 6, 1821; not February 21 as stated by Wilbert.

felt quite differently about it than the group of leading apothecaries who did "not hesitate to recommend it...." There were heated discussions, and letters to the editor began to appear. The far-reaching implications of such an innovation by outsiders now crystallized isolated apothecaries in a heterogeneous business community into a cooperative group with more or less common interests. Joseph W. England has given an extensive account of the opposition to the University's proposal and of the founding of the Philadelphia College of Apothecaries, based on newspaper reports and College records to which I have not had access. There seems to be room, however, for a more searching investigation of this material and an interpretation giving more attention to the social dynamics of the situation that produced American pharmacy's first organization and school.

Stress has often been placed on the desire shown by Philadelphia apothecaries for professional and education independence from medicine. However, it appears that the public opposition to the University's proposal was not so much grounded in the professional implications as it was in the incompatibility with a businessman's scheme of values. Those who authored newspaper protests envisioned fewer apothecaries, which would "lessen the competition among the vendors of medicines"; they saw a threat to freedom of trade in the drug business, which had been as free as any other and should be kept that way; the costs of education, even if only $10 or $15, would still be more than most apothecaries could afford; and apprentices would be taken away from their work at unseasonable hours to hear lectures. There was also an undercurrent of feeling, however, that it would be degrading and show a lack of independence if apothecaries

should submit to the proposal. Moreover, if any courses were to be given, they might better be conducted by men who knew the practical side of the business, not medical professors who knew only theory.[5]

It thus appears probable that at least one vocal segment of the opposition was thinking more in terms of the threat that professionalization and education might offer to the status quo, than in terms of the independence of the profession and of education.

If this be correct, it seems surprising, at first, to note that the resultant counter-action by apothecaries did not stress these concerns, but recognized—even emphasized—the common "abuses" and "irregularities" in the business. The report adopted at the second protest meeting said the University had "roused them to a sense of the propriety of placing their business on the respectable footing it ought to possess as a branch of the science of medicine." This could best be achieved by "the establishment of a College of Apothecaries, the attention of which will be constantly directed to the qualities of articles brought into the drug market, in which subjects relating to their business and its objects can be discussed, and information beneficial and interesting to the trade communicated"; and there ought to be a school "in which lectures designed especially for the instruction of druggists and

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5 - Summarized from England, The First Century, 47 ff.

apothecaries should be delivered."[6]

This vigorous but constructive counter-action is something of which the profession has since been proud. It was the fruit of understanding basic needs that had not been met, with a consequent reshaping of the University's basic plan as part of an independent organization, of a voluntary association like that to which Americans have always given ready allegiance. This understanding could hardly be expected of a group that merely feared change, or resented the inconvenience, cost and stratifying tendency of education.

An explanation probably lies with the group of sixteen apothecaries who had been willing to accept the disadvantages to gain the advantages of the University's proposal. They were representative of the group of "druggists" that had developed in urban centers since the late 18th century. In their shops pharmaceutical knowledge and applied science found daily use. Indigenous and foreign drugs were purchased, tested and stored in considerable quantity. Pharmaceutical and chemical manufacturing often was conducted on a small scale. Wholesale distribution to physicians and country storekeepers on the one hand and a thriving retail practice on the other made such men specialists in their field. Among them and their apprentices arose professional ambitions and a felt need for more knowledge than could readily be obtained, even in Philadelphia.

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6 - As quoted by England, The First Century, 54 f.

Most of the sixteen men who recommended Coxe's plan to the Trustees were such "druggists," men like Daniel B. Smith, Samuel P. Wetherill, the sons of Charles Marshall, Stephen North, Robert Milnor and Charles Allen.[7]

At the protest meetings these druggists were in an uncomfortable position, but they maintained their position of leadership. The Committee on Plan, which was responsible for the frank statement and constructive proposal finally adopted, drew its majority from the group of sixteen.[8]

About half (68) of those identified with the drug trade in Philadelphia joined the new College, and within a month plans for a school had been adopted as one of the main projects.[9]

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7 - See England, The First Century, and C. H. LaWall, "The Founding of the Philadelphia College of Pharmacy," Amer. J. Pharm., 93: 167-183, 1921, for biographical notes.

8 - Compare the lists of names in England, The First Century, 54 and 60. Six of the trustees and two of the officers for the new College also came from this group. The key leaders of the opposition movement--the prosperous druggists Peter K. Lehman and Henry Troth--were both outside this group, however. According to an often quoted anecdote, Lehman is supposed to have approached Troth for support with the statement: "Henry, this won't do, the University have no right to be taking our boys away at noon to make them M. P.'s." (Edward Parrish, "Historical Memoirs of the Philadelphia College of Pharmacy," Amer. J. Pharm., 97-108, 1869.)

9 - "Introduction," J. Phila. Coll. Pharm., 1: 2, 1825. At least part of those who did not join the College were opposed to a pharmacist-controlled school just as they were opposed to the University's plan. One of the founders, Daniel B. Smith said--some years later: "...we were told by many who refused to join us, that we were raising up a set of young men to take the business out of our hands." (Daniel B. Smith, "Address to the Graduates...," Amer. J. Pharm., 9: 89-98, 1837). This offers additional circumstantial evidence that a segment of the opposition group had been motivated largely by business interests rather than a spirit of professional independence.

Philadelphians read in the "Daily Advertiser" of October 31 a frank but at the same time reassuring statement by the College. "In this country," it said in part, "Pharmacy has been entirely neglected as a science. Previous instruction has not been considered indispensable, in order to capacitate an Apothecary for pursuing his profession, while very few practitioners of Medicine possessed more than a superficial acquaintance with the principles and details of Pharmaceutic knowledge. From this state of things, many evils, some of a serious and aggravated nature, have flowed, urgently requiring correction.

"Many apothecaries of this city have long been sensible of the necessity of taking some efficient measures, by which the irregularities and abuses that have crept into their business should be abolished; and that their profession should be placed on that respectable footing to which it is entitled."[10] Two lecture courses—one on pharmaceutic chemistry, the other on materia medica and pharmacy—opened early in November.

Meanwhile, the University of Pennsylvania granted the honorary degree of Master of Pharmacy to 16 apothecaries, then quietly dropped its plan to educate pharmacists. "It is to me indifferent (so that these ends are accomplished)," said Dr. Coxe, "whether it be through the agency of an apothecaries' company, or of the resolutions of the Trustees...Had the

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10 - Peter Williamson, "by order of the Board of Trustees," advertisement in Poulson's American Daily Advertiser, October 31, 1821, p. 4; repeated November 2 and 5 (originally cited by La Wall).

apothecaries pursued the measures they are now adopting before I had actually engaged in the business, I should not have considered any steps on my part necessary..."[11] It is noteworthy that Dr. Coxe was included among such international authorities as Silliman, Pelletier, Faraday and Döbereiner, upon whom the College of Pharmacy promptly conferred honorary membership.[12]

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The College, which was essentially an association, embarked on a number of activities that were helpful to its members and the good repute of the calling. "College" in this sense may be traced back to the "collegium" in Roman law, signifying associated persons having common functions.[13] But the apothecaries had contemporary precedents immediately at hand. The most obvious one was the Philadelphia College of Physicians, which in turn had a model in the Royal College of Physicians of London. The British "college" often referred to corporations with scientific aims, as well as to educational institutions. The term had a like meaning in France, where the Collège de Pharmacie had been established in 1777 as a corporation of Parisian apothecaries, which included educational courses among its functions. When after a year the Philadelphia College

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11 - Quoted by England, The First Century, 61, from the National Gazette, March 24, 1821. There is also a statement by Coxe in Poulson's American Daily Advertiser for the same day in which he says there had been a "misunderstanding, real or assumed." Expressing surprise as to the outcome of his plan, he said, "No one with whom I conversed, for an instant doubted of the utility of such a measure."

12 - La Wall, "The Founding of the Philadelphia College of Pharmacy," Amer. J. Pharm., 93: 181, 1921.

13 - For a summary of the evolution of this term, see Edward Kremers, "The Teaching of Pharmacy During the Past Fifty Years," Druggists Circular, 51: 61-79, 1907.

of Apothecaries incorporated as the "Philadelphia College of Pharmacy" it seemed to be following the French precedent,[14] which offered the advantage of clearly embracing prospective members of whatever designation: apothecary, druggist, or pharmaceutist.

Philadelphia set a pattern both in title and functions for other "Colleges of Pharmacy" that sprang up later. A school was almost invariably given a primary importance among their professed goals,[15] although it sometimes took second place in practice and was never easy to make a reality. Other associative functions closer to immediate business interests also often lacked widespread support in the early period of a college.

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14 - In France the term apothecary had acquired an undesirable connotation, while in England the connotation was misleading. See Kremers and Urdang, History of Pharmacy, 84 f. for a discussion of the change from apothicaire to pharmacien, in France, and the same work (243 f.) for an illuminating discussion of the title adopted by the Philadelphia College.

15 - Constitution, By-Laws and Code of Ethics of the Philadelphia College of Pharmacy... (Philadelphia, 1869), 5; Ed. Dept., "Pharmacy in California," Amer. J. Pharm., 41: 574, 1869; "Act of Incorporation of the Maryland College of Pharmacy," J. and Transac. Md. Coll. Pharm., 1: 61, 1858; Wimmer, The College of Pharmacy, 19; W. B. Day, "The School of Pharmacy," in the Alumni Record of the University of Illinois (Chicago, 1921), xxv; Harold C. Freking, "Gleanings from the Early History of the Cincinnati College of Pharmacy," Amer. J. Pharm. Edu., 12: 412, 1948; G. L. Curry and F. D. Stoll, "A History of the Louisville College of Pharmacy," Amer. J. Pharm. Edu., 8: 77, 1944; Ed. Dept., (Louisville College of Pharmacy), Amer. J. Pharm., 42: 475, 1870; Edward Kremers, "The College of Pharmacy," Pharmaceutical Review, 24: 135, 1906. A school does not appear to have been a primary objective of the Richmond (Va.) association, and in the District of Columbia it was part of the "ultimate design" rather than an immediate objective. ("Pharmacy in Richmond," Amer. J. Pharm., 24: 292, 1852; "The Apothecaries Association of the District of Columbia," Amer. J. Pharm., 28: 285, 1856.)

Activities that received varying emphasis, depending on local circumstances, included efforts to prevent or to expose the adulteration of drugs, the printing of adequate bottle labels for common use by members, the publication or exchange of information concerning drug formulations and the composition of secret remedies, the issuance of a journal, discussion groups (on business, professional and scientific topics), and persuasive attempts to limit unethical practices and excessive competition.

Some writers, notably Urdang and Kremers, have carefully pointed out the nature of the "colleges" and the uncertain beginnings of their educational endeavors; yet there is probably a popular misconception of the extent of pharmaceutical education and its influence on pharmaceutical practice before the Civil War.

Although there were six pioneer colleges of pharmacy established during this period, only four were able to establish systematic instruction: Philadelphia, New York, Chicago and Maryland (Baltimore).[16] And only the two schools at the populous cultural centers of the Middle Atlantic States, Philadelphia and New York, became firmly rooted and showed any vigor.

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16 - Massachusetts (Boston) and Cincinnati are sometimes erroneously included in the list of ante-bellum schools. The statement by Kremers and Urdang, History of Pharmacy, 287, that there were "seven such association schools" before 1864 apparently is a misprint.

Among more than 31 million people in the United States in 1860 there were approximately 11,000 who served as apothecaries or druggists, and of these not more than 514 had graduated from a pharmacy course in the United States. Outside of Philadelphia the combined graduation rolls up to the Civil War total 122, or less.[17]

No graduates were contributed to American pharmacy before the Civil War by Boston, although it was the first city to follow the lead of Philadelphia in establishing a college. And as in Philadelphia the Boston apothecaries associated themselves in response to an effort by physicians to establish some control and qualifications for the completely unregulated business of preparing and dispensing drugs. After obtaining advice from the Philadelphia College, the apothecaries and druggists succeeded in their determination to "oppose any interference of the Medical Society" and established the independent Massachusetts

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17 - The Philadelphia College alone graduated 392 (tabulated from England, The First Century, 461 ff.); Maryland, 22 or less graduates (in The Maryland College of Pharmacy, 1841-1894, MS, Kremers Reference Collection) Charles Schmidt reports eight graduates for the period through 1856-57; in 1859-60 there was a class of six, "larger than at any former period"; the preceding class, 1857-58 has therefore been counted as five or less); Chicago had two graduates in 1861 (W. B. Day, The Alumni Record, University of Illinois, xxvi); and the Medical College of Louisiana totaled 16 pharmacy graduates 1838-60 inclusive (Catalogue of the Alumni from 1834 to 1901, Inclusive, of the Medical Department of the Tulane University of Louisiana (New Orleans, 1901), 41). It should be noted that there was a far larger number of students who entered the schools but never completed the course; see p.282ff The number of apothecaries given for 1860 is from the U. S. Census of 1860 as cited by H. L. Taylor, "Schools and Colleges of Pharmacy," Pharmaceu. Era, 45: 336, 1912.

College of Pharmacy in 1823.[18] The constitution of the College stressed the same points as its Philadelphia model, but no school was established until forty-four years later. This early association receives mention here because of its ineffectual attempts to bring some pharmaceutical instruction to the educationally barren scene.

Brewer tells in his reminiscences of the "Social Circle" that was formed sometime after the founding. This "was composed of the more aspiring members of the college," he recalls, "who wished to become adepts in science. Our meetings were to a considerable extent conversational; but voluntary papers were occasionally read which were of practical value."[19]

This was supplemented occasionally by a series of chemistry lectures for druggists and their clerks. There were at least five such attempts, ranging from six lectures to a lecture course that lasted several months. But attendance was so small that plans for other courses always were abandoned.[20]

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18 - For further information and references concerning the founding, see Kremers and Urdang, History of Pharmacy, 248 f.; also Edward Kremers, "The Teaching of Pharmacy During the Past Fifty Years," Drugg. Circ., 51: 61-79, 1907.

19 - William A. Brewer, "Reminiscences of an Old Pharmacist, No. 12," Pharmaceu. Record, 4: 475, 1884.

20 - The known lecture series were given in 1826, 1830, 1853, 1854, and 1858. See "The Colleges of Pharmacy in the United States," Western Druggist, 15: 51 ("Extra"), 1893.

Samuel M. Colcord of Massachusetts gave a revealing account of some of the early frustrations in trying to establish a Boston school. "It was difficult to get competent instructors, and more difficult to get classes, as there was no demand for educated assistants, because there were no educated proprietors. In Boston the proprietors became the first students, and applied to the Legislature of Massachusetts for a College of Pharmacy, which was opposed by some of the wholesale druggists, and defeated chiefly by the influence of John and David Henshaw, David about that time being one of the secretaries of the United States Cabinet."21

Under such conditions in pharmacy accidental poisonings were of course not unknown.[22] One particularly flagrant mistake in mid-century led to the prosecution of an unfortunate "apothecary" by the name of Wakefield. This had a tonic effect on the College at a time when it was moribund, and awakened "both professions [medicine and pharmacy] to the necessity of giving a more thorough education to the persons in whose hands the practice of pharmacy is, and will in future be placed."23

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21 - Samuel M. Colcord, "The History of American Pharmacy," Proc. Amer. Pharm. Assoc., 41: 223-231, 1893. Although this probably reflects conditions under which association leaders labored, I have not been able to confirm the role of the Henshaws in the incident recounted.

22 - "Massachusetts College of Pharmacy," Amer. J. Pharm., 26: 92, 1854.

23 - Ed. Dept., "College of Pharmacy at Boston," Amer. J. Pharm., 23: 91, 1851.

Physicians of Boston (home of the third oldest medical school: Harvard, f. 1783) once more called for action. At a meeting of the city's apothecaries called at the suggestion of the editor of the Boston Medical and Surgical Journal, it was agreed "that protection to the community, to the physician and to the legitimate apothecary, all demanded that pharmaceutical education should be raised to some fixed and higher standard."[24]

It was apparently at this time that "A committee in the Massachusetts College of Pharmacy was raised, to draw up a new code of ethics, by-laws and constitution for the college by way of reorganization." One member of the committee visited every known apothecary in the city. His findings were not encouraging. There were "five that were ready and willing to do anything in their power to create and maintain a college, to elevate the standard of pharmacy in Boston; five more that would be willing to accomodate and aid, but did not care to take an active part; and ten more that wanted to know how it would benefit them, and would be willing to be enrolled as members."[25] Although this scattering of support was far from promising, the old Board of Trustees had the courage to reorganize. Within three years the Massachusetts College was able to sponsor two series of chemistry lectures, to the delight of the Boston Medical and Surgical Journal, which had periodically agitated for education of apothecaries.[26]

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24 - Boston Medical and Surgical Journal, August 7, 1850, (as quoted in Amer. J. Pharm., 23: 91, 1851).

25 - Samuel M. Colcord, "The History of American Pharmacy," Proc. Amer. Pharm. Assoc., 41: 226, 1893. This account of the reorganization represents recollections, perhaps second-hand, which have not been confirmed in detail.

26 - Ed. Dept., Amer. J. Pharm., 22: 378, 1850 and 25: 187, 1853.

Then the Board reported: "The past winter the Board made arrangements for a course of Lectures on Chemistry, by a professor every way qualified to take rank in any institution of the kind. The course was prepared expressly for this college, with reference to this branch of our profession, and was intended as a trial, to be followed by other courses, on Pharmacy, Materia Medica, and Botany, if successful. The lectures were everything that could be desired, but the attendance was too small, and the idea of the other courses was abandoned."[27]

After this frustrated attempt, the College apparently rested, educationally, for another thirteen years--except for a series of six lectures given in 1838 by one of the apothecary-members, Charles T. Carney.

The College of Pharmacy of the City and County of New York went through no such prolonged period of labor in bringing forth, in 1829, the second course of regular instruction in the United States. Moreover, it apparently did not require the prodding from medicine that characterized the beginnings in Philadelphia and Boston, the other two cultural centers of the East.

Perhaps New York apothecaries reflected on what had happened in recent years elsewhere as they discussed pharmaceutical affairs over a glass of ale at the Shakespeare Tavern, a rendezvous for physicians and apothecaries. They knew that the

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27 - Ed. Dept., "Proceedings of the Massachusetts College of Pharmacy," Amer. J. Pharm., 26: 473-77, 1854.

adulteration of drugs, domestic but especially foreign imports, was common, and that an old New York Druggists Association—about which little is now known—had not functioned effectively. They also recognized the advantage of a more formal pharmaceutical education, especially a few men who had recently returned from attending the Philadelphia College of Pharmacy. One of these, John D. Keese, called some of the leading apothecaries of the city together for convivial meetings at the Shakespeare Tavern during the early months of 1829, where they discussed the organization of a College. On the night of March 18 the Tavern was invaded by apothecaries from all over the city to attend a general meeting for discussing a carefully drawn plan and adopting a constitution.

Within three months plans had been completed for a school and professors elected for a fall session. Hopes ran high for a good attendance. But summer passed and September came, and no one had subscribed to the lectures. "It appeared as if the entire enterprise would fail," Wimmer wrote. "Some of the members of the College offered to subscribe to the lectures, but even at the beginning of the very month in which the lectures were to start, there were but few subscriptions... After much discussion, it was decided to appoint two members for each of the fourteen wards in New York City, to visit each and every druggist, to explain to him the purposes of the College and invite him, and especially his apprentices, to subscribe to the lectures. The price for the subscription was fixed at only $3.00 for each ticket." In this way about forty tickets finally were sold and the school was launched, never to

close its doors.[28]

The school remained important among the various activities of the College, although there were only about a fifth as many graduates on the average as at Philadelphia up to the Civil War,[29] and there were three years in which no one graduated.[30] Occasional waverings of the school were to be expected since there were no enforced qualifications for the practice of pharmacy, even though a city statute nominally required either a diploma or an examination of newcomers to the field after 1839.

As in Boston, poisonings were not unknown; and the public seemed hesitant to condone such incidents, even on the ground of free enterprise. At the State Legislative Convention of 1867, the Honorable Stephen J. Colahan trumpeted: "Numerous deaths have occurred in the city of Brooklyn alone from this last cause [lack of knowledge and experience], most of which have been hushed up by influence and money...Impudence and money are the only requisites for an individual to start the business of pharmacy..."[31]

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28 - This account of the founding is based entirely on Wimmer, The College of Pharmacy, 18-29.

29 - See note 17 supra.

30 - Wimmer, The College of Pharmacy, 313.

31 - Speech of the Hon. Stephen J. Colahan on the Admission to the Practice of Medicine and the Dispensing of Drugs, Delivered in Convention, November 19, 1867 (Albany, 1867), 11.

The Colahan bill to license druggists failed to pass, however, as had a previous one. But the press was in full cry against the druggists. Wimmer observes that "Some accidents had occurred, not of a serious nature, but made much of by the public press. The Coroner arrested several pharmacists, but they were soon released for lack of evidence. The Trustees of the College saw that something had to be done."32

What was done leads through a legal and legislative snarl, extending over several years, that would carry the present discussion too far. But these circumstances, leading to a city licensing law under jurisdiction of the College, testify eloquently that the lack of educational requirements and qualifications in pharmacy was not without social consequences.

The educational pattern established at Philadelphia, followed at New York, and attempted at Boston, influenced not at all the third school that offered regular instruction for prospective pharmacists. Although it continued to produce graduates in pharmacy for nearly a hundred years, the Medical College of Louisiana receives only brief mention in both contemporary and historical pharmaceutical literature. This finds explanation in the fact that the New Orleans venture was never influential on either pharmaceutical education or practice, and was not a "college of pharmacy" or even a school in the then accepted sense.

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32 - Wimmer, The College of Pharmacy, 210.

The Medical College indeed seems to have used the very plan put forward by its more distinguished counterpart at the University of Pennsylvania, which Philadelphia apothecaries had so vigorously and successfully opposed. In 1838 the "pharmacy course" was instituted by action of the medical faculty; the degree was "Master of Pharmacy"; and the required courses were chemistry and materia medica and therapeutics, presumably those taken by the regular medical students.[33] No wonder then that the course was completely ignored up to 1870 by the American Journal of Pharmacy, the publication of the Philadelphia College.

Throughout the 19th century the pharmacy course remained a subsidiary function of the Medical College, which later became part of Tulane University. Significantly, no pharmaceutical paper identified with the College or its faculty appeared in the literature. Up to 1861 there was never a year when more than one or two students graduated in pharmacy. If this first pharmacy course in the South had any influence it was not on the development of university instruction in pharmacy, as suggested by Rudd,[34] but rather as an example for other medical colleges that began to enter the field in the 1860's.

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33 - Catalogue of the Alumni of the Medical Department of the Tulane University of Louisiana, from 1834 to 1901; the early curriculum is inferred from catalogs of the second half of the 19th century.

34 - W. F. Rudd, Pharmaceutical Education (Washington, D. C., 1921), 5.

The third association school to open during this pioneer period was that of the Maryland College of Pharmacy. We do not know precisely what conditions in 1840 brought Baltimore pharmacists into association, with educational ambitions, at just this time. The so-called "educational revival" was of course in full swing, when education in general was being "urged on civic, economic and ethical grounds."[35] At the meeting of the Medical and Chirurgical Faculty of Medicine, in June, the idea of a college of pharmacy came up for discussion.[36] It is also noteworthy that the first dental school in the United States had been founded in Baltimore only the year before.[36a]

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35 - Frank T. Carlton, "Economic Influences Upon Education Progress in the United States, 1820-1850," Bulletin of the University of Wisconsin, No. 221 (Madison, 1908), 6 f.

36 - George E. Osborne, "David Stewart, Baltimore (1813-1899)," mimeograph, 1952, p. 2.

36a- The Baltimore College of Dental Surgery (f. 1839) was joined by four other dental schools by 1865, thus paralleling in dentistry the pioneer period of pharmaceutical education. (Edwin G. Dexter, A History of Education in the United States (New York, 1904), 339.) The first private lectures on dentistry known in the United States occurred about the same time as similar attempts in pharmacy by Cutbush and Mease. These were offered by a self-styled "dental professor" of questionable merit, Levi S. Parmly (Curt Proskauer, "The Earliest American Advertisement of Private Dental Instruction--(1820)," The Academy Bookman, 5: 2-9 (No. 1), 1952).

Although there had been transient attempts at collegiate instruction in law during the 18th century, it was likewise the second and third decades of the 19th century that brought the first permanent law schools. (Cubberley, Public Education, 276, and Dexter, A History of Education, 316 ff.)

The prologue to the founding of the Maryland College of Pharmacy took place at a meeting in the home of a Baltimore physician, in which both pharmaceutists and physicians participated. After lengthy discussion a committee of apothecaries was appointed to devise a plan for a college of pharmacy. At a subsequent meeting on July 20 the College was founded, and all who signed the constitution were required "to cause their apprentices to serve as such at least four years and to attend at least one course of lectures at the College."[37] The lecture courses, at first given by members of the College, started in the fall of 1841. Students were so few that the College decided not to offer the course in 1842-43. In 1845 and 1846 there were no graduates, and the number of College members declined to six. So after the course of 1846-47 the College and its "school" were "altogether discontinued."[38]

The College began anew in 1856 and immediately resumed regular instruction. The ever-present danger of poisonings that hung over the less competent drug dispensers apparently offered a stimulus to renewed educational efforts in Baltimore, as it had in Boston and New York. "The numerous accidents," an official College Circular bluntly stated, "resulting from the ignorance of those who have the dispensing of medicines in charge have not only stimulated the experienced pharmaceutist to make efforts for the removal of this ignorance, but have

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37 - Charles Schmidt, The Maryland College of Pharmacy, 2.

38 - Ibid., 4.

also created that kind of interest with the people which favors the establishment and support of colleges for its removal."[39]

The revived school gradually gathered momentum. In addressing a graduating class of two students, Professor Steiner said, "The course which has just terminated, has been attended by more students than either of its predecessors..." When pharmaceutists acted to re-establish the course, he explained, "Educational influences were being brought to bear upon all professions and trades, and they felt that such should also be called to aid in their own pursuits, and fit its followers for the duties devolving upon them. The College was opened with a discouragingly small number of students,—and the enterprise viewed in a business light was a failure..."[40]

Undoubtedly the same could have been said of the Cincinnati College of Pharmacy, founded in 1850—both with regard to the stimulus of general educational influences and the obstacle of limited support. The College in fact arose

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39 - Fifth Annual Circular and Catalogue of Matriculants, Maryland College of Pharmacy, 1860-61 (Baltimore), 3. It should not be assumed that the perils of a 19th-century patient lay only at the apothecary's door. Although medicine developed a school system more rapidly, the typical course has been adequately termed "a social disgrace," and legislative support was erratic. Comparable conditions in American medicine and pharmacy produced comparable results in some untimely deaths. Cf. Allan Nevins, The Emergence of Modern America, 1865-1878 (New York, 1927), 276-78.

40 - Lewis H. Steiner, "The Pharmacy of Two Hundred Years Ago, Compared with that of the Present Day" (Valedictory Address), J. and Transac. Md. Coll. of Pharm., 1: 101, 1859.

at the "center of educational propaganda in the then West."[41] Moreover, there were some well-educated apothecaries among the Germans who constituted more than a fourth of the city's population by the 1850's.[42] There were also some educated American apothecaries who had ventured into the old West, men like William B. Chapman who graduated from the Philadelphia College and later helped to found the Cincinnati College of Pharmacy. Another probable influence was the meeting of the American Medical Association at Cincinnati in 1850, which seems "to have stimulated the efforts to place pharmacy on a comparable basis with its allied profession of medicine."[43]

The little group of progressive pharmaceutists had educational objectives,[44] but it was to be another twenty years before regular instruction would become reality. Meanwhile, the Cincinnati College followed a course similar to that at Massachusetts. There were "Round Table" discussions reminding one of the "Social Circle" at Boston. More formal but irregular instruction was given in the homes of the better-educated members.

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41 - Cubberley, Public Education, 169.

42 - Ibid., 483.

43 - Freking, "Gleanings from the Early History of the Cincinnati College of Pharmacy," Amer. J. Pharm. Ed., 12: 413, 1948.

44 - "Schools of Pharmacy," Amer. J. Pharm., 23: 390, 1851.

1848
Stet

As at Massachusetts, support gradually withered even as the leadership group made bold plans for an "annual course of lectures for Students of Pharmacy, in connection with the lectures of the Ohio Medical College."[45] The following year, in 1859, the Secretary of the youthful American Pharmaceutical Association observed, "There is cause to fear that our Cincinnati brethren have become lukewarm and lifeless as regards the advancement of their College of Pharmacy. The attempts hitherto made to get up a school of pharmacy have proved unsuccessful."[46]

With the outbreak of civil war the College disappeared altogether, not to be re-instituted until 1871, when Cincinnati lay at the geographical center of the nation's population, a hub of commercial and cultural activity in the old West.

The sectional conflict likewise put an end to the more promising beginning of pharmaceutical education at Chicago. The act of incorporation was approved at a meeting of druggists in the fall of 1859, and within two months the Chicago College of Pharmacy had a school functioning. True enough, most of the students were apothecary-members, and some said the West was not ready to support such an undertaking. But the school did function—the first west of the Alleghenies, except for the medical enterprise at the Medical College of Louisiana. The

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45 - Proc. Amer. Pharm. Assoc., 7: 88, 1858.

46 - "The Cincinnati College of Pharmacy," Proc. Amer. Pharm. Assoc., 8: 104, 1859.

second course started on schedule in 1860; then, in midstream, course and College both disappeared amid the financial panic and political excitement.

Courses had now been established in four association schools and a medical college, although two temporarily disappeared.[47] The founding of pioneer association schools had differed in detail but had much in common. They shared meager beginnings, more important in establishing a system of instruction rather than in the number of students graduating. Although located in populous centers of commerce and culture, they found an apathetic public, admiring self-advancement and free enterprise except when face to face with accidental poisonings. They relied upon a nucleus of leading druggists and apothecaries, who felt an educational need and saw the possibilities, who surmounted the apathy if not opposition of the mass of tradesmen within the calling. They often knew the encouragement, even the demands, of medicine; and by a typically American zest for voluntary association and independence—and a universal pharmaceutical zest for independence from medicine—they avoided subordination or outside control.

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47 - The private "School of Practical Pharmacy," established at Philadelphia by Edward Parrish sometime after 1843, was intended primarily for medical students, to whom the editors of the American Journal of Pharmacy did not hesitate to "cheerfully recommend" it. (Review of "Announcement and Catalogue of Edward Parrish's School of Practical Pharmacy for Medical Students," Amer. J. Pharm., 25: 373, 1853.) Although not a pharmacy school in the sense here discussed, "some strictly pharmaceutical students" attended to take advantage of the laboratory facilities. See p. .

All of these schools developed as branches of an associative movement, rather than as branches of established institutions of learning. Despite this separateness, the founders could hardly escape subtle but pervasive influences from what was happening in general education. Social rather than accidental circumstances, beginning in the third decade, nourished the growth of schools in dentistry and law, in pharmacy, and the "veritable race in the founding of medical schools."[48] The founding of general institutions of learning likewise quickened, bolstered by denominational effort.[49] Wealth from commercial ventures brought more endowments, although they were usually small.[50] Moreover, by 1860, at least one institution directly under state control had been provided for by almost all of the Southern states and many states west of the Alleghenies.[51] (See map, page 69.)

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48 - It is of interest that more than eighty medical schools had been established in the United States before the Civil War, while in pharmacy there were four association schools and a course in a medical college. (Norwood, Medical Education, 431 and list in table of contents.)

49 - Cubberley, Public Education, 269.

50 - Thwing, A History of Higher Education, 328.

51 - Dexter, A History of Education, 279.

This "educational revival" is reflected in the table below.[52] It will be seen that there were four times as many colleges founded in the third decade as in the second; and the number of colleges founded increased sharply in each subsequent decade.

Decade of founding	Number of universities and colleges founded for men and for both sexes
1801-10	8
1811-20	6
1821-30	22
1831-40	34
1841-50	46
1851-60	80

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52 - Report of the Commissioner of Education for 1903, 1138.

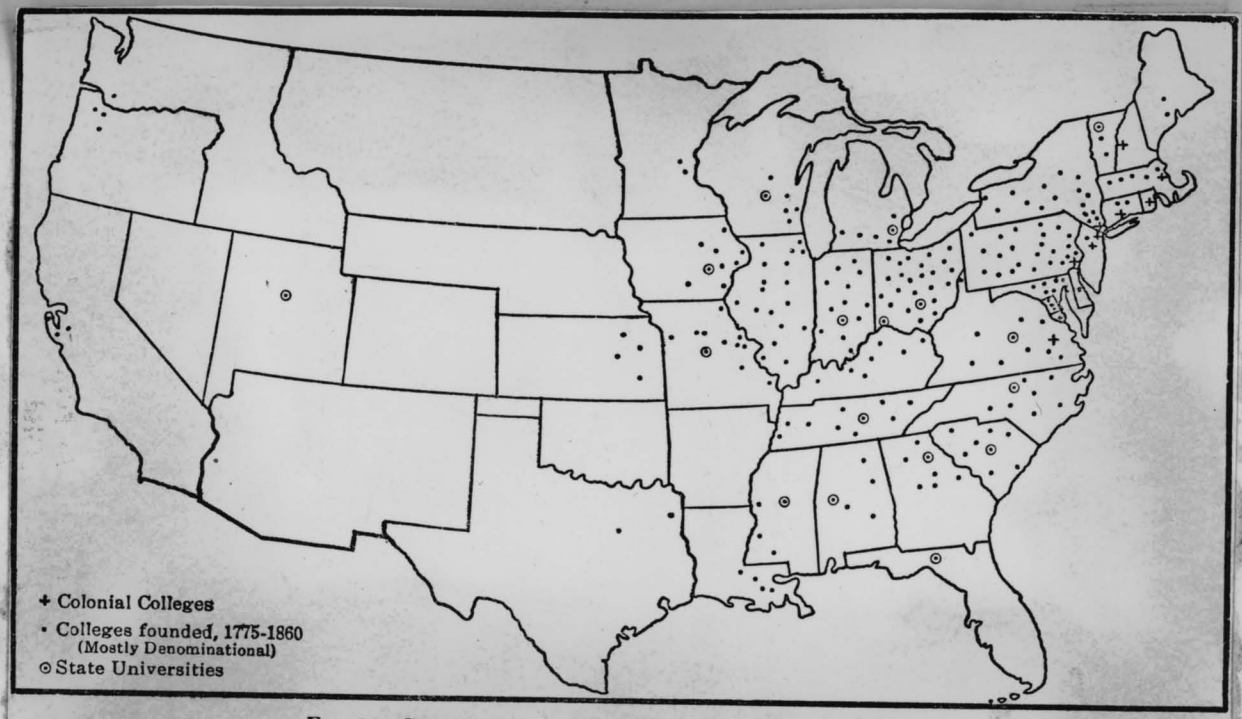

FIG. 36. COLLEGES AND UNIVERSITIES ESTABLISHED BY 1860

Compiled from data given in the *Reports of the United States Commissioner of Education.* Of the 246 colleges shown on the map, but 17 were state institutions, and but two or three others had any state connections.

- From Cubberley, Public Education, 205. (U. W. Neg. No. 7529-B)

About 182 of these 246 colleges were born between 1821 and 1860, the period when the pioneer pharmacy schools were founded. Of the pharmacy courses only the one given in the Medical Department of the University of Louisiana (Medical College of Louisiana before 1847) had any connection with an institution shown on the map. Nearly half of all types of colleges founded in the United States during this period were located in the North Central States. (From data in Dexter, A History of Education, 270. Note that data from all sources is only approximately correct.)

The public interest in education gave rise to, and was fortified by, the lyceum movement, founded in 1826 by Josiah Holbrook. For several decades thereafter the lyceum's meetings, lecture courses, and its propaganda for trained teachers and taxation for education, whetted the American appetite for instruction.[53]

An eagerness for information on science developed, especially in the middle classes, that would hardly leave aspiring apothecaries untouched. Popular science lectures were being delivered in crowded auditoriums by itinerant speakers during the pre-war decades. When Benjamin Silliman spoke "the number of applicants for a single course sometimes rose as high as 8000 or 10,000, so that tickets were distributed by lot..."[54]

The tuition "academy" that had evolved out of the old Latin-grammar school spread rapidly during the first half of the 19th century and remained prominent until after the Civil War. Unlike the Latin-grammar school, the academy built upon the common school education, offering students the more useful studies to prepare them for business life and the rising professions. It was a transition stage to the modern high school.[55]

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53 - Cubberley, Public Education, 168; and Arthur C. Cole, The Irrepressible Conflict, 1850-1865 (New York, 1934), 215 f.

54 - Struik, Yankee Science, 202-216.

55 - Cubberley, Public Education, 246-250.

Already in the 1820's the first high schools appeared. Another indication of the common roots of new educational branches in a maturing society lies in the opening of all pre-war pharmacy courses, except one, within four years of the founding of the first high school in the respective cities.[56]

Who can say how much the general educational awakening stiffened the backbone of dedicated clusters of apothecaries who kept alive the early schools? Some hint that they were not left unmoved may be discerned in the valedictory address of Professor Steiner in 1861: "Learning is no longer confined to the three principal professions," he observed. "Its influence is now more catholic. All classes of society recognize its importance. The merchant feels that he must have his library, and the mechanic his institute, where, by lectures and other modes of instruction, he may fit himself for the thorough comprehension of his business... But the science, as well as the art of Pharmacy, has not been lagging in the rear, while the other arts and sciences have been pressing forwards."[57]

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56 - From high school data in Cubberley, Public Education, 262. The exception was the school of the Philadelphia College of Pharmacy, founded 17 years before the first Philadelphia high school and in the same year that the first high school in the United States was established at Boston.

57 - Lewis H. Steiner, "Valedictory Address...," J. and Transac. Md. Coll. Pharm., 2 (n.s.): 52, 1861.

After the American Pharmaceutical Association was founded in 1852 it gave what encouragement it could to the extension of education. Indeed education was considered requisite to achieving its aims.

At the inaugural meeting a committee to collect information reported that the improvement of practice was the primary object, "and this cannot be effected without extending the present means of education, either by schools or by an increase of facilities offered by proprietors to their apprentices and assistants." It recognized that schools could only be hoped for in the larger cities, and asked that local organizations be founded as outposts for less formal instruction.[58]

Said Edward Parrish of Philadelphia: "The expense to the student residing in a distant locality, of a long journey and residence for two winters in Philadelphia or New York in attendance on lectures, constitutes a great obstacle to the extension of this advantage. Candidates for the drug business are very often in the humble walks of life, and unable to meet so heavy a drain upon their slender resources..."[59]

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58 - Proc. Amer. Pharm. Assoc., 1: 8, 1852.

59 - Edward Parrish, "American Pharmacy," Amer. J. Pharm., 26: 215, 1854.

With the development of organizations and publications by the 1850's, dissatisfaction with the status quo became more vocal if not even more widespread. One pharmaceutist maintained that "19 in 20 of those who deal in medicines never so much as heard of the Pharmacopoeia." Another said he found that some drug dealers "do not know the difference between morphia and strychnia."[60] A Chicago druggist from Scotland reported back to his homelands: "Ten out of twelve that keep drug stores in America have neither served an apprenticeship nor been educated for the business. I have found farmers, plasterers, cloth merchants, grocers and men of other businesses foreign to pharmacy engaged in the sale of medicine, when they did not know one drug from another in their shop unless it was labeled. It is here a matter of trade to start a drugstore. The principal necessary is money and brass, not education."[61]

The American Pharmaceutical Association agreed that "it is of the first importance that those now in the business should adopt a liberal spirit, and aim at making their pupils and assistants better apothecaries and druggists than themselves."[62]

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60 - Proc. Amer. Pharm. Assoc., 2: 28, 1853.

61 - James Rae, "On the Present State of Pharmacy in America," Amer. Drugg. Circ. and Chem. Gaz., 1: 34, 1857.

62 - Ed. Dept., "Circular Address to the Pharmaceutists and Druggists of the United States," Amer. J. Pharm., 26: 378-9, 1854.

At its first meeting the Association resolved "That as schools of Pharmacy are the most effectual aids to the student, this Convention respectfully recommends to Pharmaceutists in all cities where they are numerous to take measures for the establishment of such institutions..."[63]

The upper stratum of pharmaceutists now felt an unquestioned obligation, to themselves and the public, to establish schools. Although their determination could bear little immediate fruit, as we have observed, the rapid development—quantitatively—from 1865 on may be seen in the table below.

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63 - "Proceedings of the National Pharmaceutical Convention... 1852," Amer. J. Pharm., 25: 12, 1853.

A Table of 19th-Century Schools

A comparative investigation of all available sources yields the data given in the table concerning the founding, changes of name, affiliations, mergers, location, and present status or demise of eighty-three schools that offered any regular instruction during the 19th century.[64]

Dating: The first date given in an entry indicates when systematic instruction originally began. This is more meaningful for present purposes than the date of organization often used in previous lists. Dates of "founding" or "organization" in the literature refer somewhat variably to adoption of by-laws, to incorporation or, occasionally, to establishment of a distinct pharmacy department rather than to systematic instruction. In dating systematic instruction we mean the time that an educational program began to function primarily to prepare groups of students for the practice of pharmacy.

The relatively greater accuracy of the present table rests not as much on the correction of certain dates and other data as on the attempt to delineate uncertainties in qualifying notes.

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64 - Schools opened in 1900 are excluded except for the Milwaukee Medical College, whose pharmacy department had earlier beginnings in the private instruction by R. E. W. Sommers.

The second date given in an entry indicates when instruction was "permanently" discontinued. A symbol (*) following the inaugural date indicates a defunct school of unknown date of extinction. A period of suspended instruction is indicated in the explanatory notes. A number of such gaps in the record of more obscure schools probably have not been uncovered here.

Schools and Their Names: The present table is more comprehensive for the 19th century than school lists previously published. For example, twenty-two schools are listed that do not appear in the Kremers-Urdang table,[65] which is the most complete compilation to date but is limited to schools that "gained some importance." A few schools listed below, which may be readily identified, were abortive attempts to establish instruction. They are included to stimulate future local investigations that would clarify their fate and function.

"Pharmaceutical institutions" listed only in the first Report of the Commissioner of Education (1870), and without academic data, are not tabulated, since it is highly improbable

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65 - Kremers and Urdang, History of Pharmacy (2nd ed., 1951), 295-7.

that they sponsored systematic instruction at this time (1870).[66]

Correspondence and "cram" schools in general are not listed, although a few questionable entries may have been included because of sparse information and the lack of a clear-cut dividing line. A few additional schools of uncertain or unknown character are mentioned in explanatory notes in connection with another school.

A course, department, or school of pharmacy that was not administratively independent is listed under the title of the original parent institution (with known change of name, affiliation or location indicated in the explanatory notes). If articles of some historical value have been written about individual schools, references are appended to the respective entries. Relatively few of these represent substantial historical work. There is need for much monographic work on local or state histories of pharmaceutical education.

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66 - These institutions are the California Pharmaceutical Society, Indiana Pharmaceutical Society, East Saginaw Valley Pharmaceutical Association, New Jersey Pharmaceutical Association, Newark Pharmaceutical Association, Rhode Island Pharmaceutical Society, and Washington (D. C.) Pharmaceutical Society. In addition, the Report of the Commissioner for 1871 listed the Mississippi College of Pharmacy at Jackson, which undoubtedly did not conduct courses. (H. H. Faser, former dean of the University of Mississippi School of Pharmacy (f. 1908), letter of July 12, 1952.) By 1873 the College was reported "not in existence" (Report of the Commissioner of Education for 1873, 711.)

Some Sources: Sources cited in the notes provide the basis for data presented, but represent by no means all sources used in checking the table. Several of the best and best-known lists of schools have been especially useful and are cited in abbreviated form. The abbreviations and complete annotated references to these lists follow:

Fischelis: Robert P. Fischelis, "Education in Pharmacy," Amer. Druggist, 88: (Oct.) 149, 154, 156, 160, 162, 1933. A list of existing schools, giving date of organization; also enrollment, tuition and degree granted as of 1933. (Sources not indicated.)

Freericks: Frank H. Freericks, "Report of the Secretary," (of the Section on Education and Legislation), J. Amer. Pharm. Assoc., 4: 24-36, 1915. A list of 56 out of 80 existing schools, giving date of organization, a date for the beginning of regular instruction, usually the method of financing, and the total number of graduates as of 1914. An important feature of this list, not duplicated elsewhere, is the designation of individuals or organizations that were responsible for organization of instruction in pharmacy. Enrollment and the degrees granted (1914) are included. (Based on questionnaire responses from schools.)

Kremers-Urdang: Edward Kremers and George Urdang, History of Pharmacy, (Philadelphia, 1940 and 1951). The list in the first edition (1940, p. 217) is from Fischelis, with six additions. In the second edition (1951, pp. 295-7) the

table has been much augmented and partially corrected. It offers, chronologically, all schools known to the authors that "gained some importance," and is the most complete table previously published. The date of organization, present name (or last title used by defunct schools), location, and often previous names and affiliation dates, are listed.

Reports: Report of the (U.S.) Commissioner of Education, Washington, D. C., annual from 1870 onward. A list of extant schools replying to the annual questionnaire, giving year of opening and/or year of organization or charter. If a school did not respond to repeated questionnaire inquiries, data from the preceding year was published and so identified. If a school did not report in two successive years, its listing was dropped, unless the Commissioner had other evidence that it still existed.[67] Dates sometimes are found to refer to last reorganization or opening if instruction has been interrupted, or to refer to parent institution rather than to pharmacy school. Much other contemporary academic information is given, as discussed elsewhere; the type of information varies somewhat from year to year. Pharmaceutical information also appears occasionally in the educational reports from individual states. A comparative examination of the Reports from 1870 to 1900 was made systematically in preparing the accompanying table.

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67 - Report of the Commissioner of Education for 1889-90, vol. 2, p. 837.

Scoville: Wilbur L. Scoville, American Pharmaceutical Colleges and Schools (American Conference of Pharmaceutical Faculties, n. p., 1905), 17 pp. A list of 94 schools extant in 1905, giving location, "when instituted," length of session, and whether day or night sessions. Considerable other information on degrees, curricula and requirement of shop experience for graduation is included. The dates "when instituted" vary in meaning (i.e., organization of associational College, last reorganization of school, establishment of separate department, etc.).

Taylor: H. L. Taylor, "Schools and Colleges of Pharmacy, V," Pharmaceu. Era, 45: 389-90, 1912. A list of schools established or discontinued between 1887 and 1912, giving the date of organization and location. Appears to be based largely on Reports of the Commissioner of Education.

Other lists of the schools extant at a given time include "Our Pharmaceutical Colleges," The Druggists Circular and Chemical Gazette, 1897, (Aug.) pp. lxxx-lxxxii; "Where Students of the United States Can Obtain Instruction," Meyer Brothers Druggist, 17: 192, 1896; and "American Colleges of Pharmacy," The Pharmaceutical Era, 14: 454, 1895 (also other volumes). Very brief sketches of schools still in existence, including some historical information, were published in a series, "Presenting the Colleges of Pharmacy," in Drug Topics, vols. 90-92 (1946-1948).

Considerable information, which must be used with some caution, appears in an unpublished manuscript by Ernst T. Stuhr, "Pioneers of Pharmaceutical Education in the United States" (in Edward Kremers Reference Collection, University of Wisconsin). For each of 67 existing schools there are one to three paragraphs giving dates, affiliations, location, often the original members of faculty and board of trustees, and sometimes comment on the circumstances of the founding.

Dates, changes of name, affiliations, and interruptions of teaching are reported, for most of the schools extant in 1944, in questionnaires circulated by George Urdang (in Edward Kremers Reference Collection, University of Wisconsin). These were compared with the other sources and helped considerably to clarify and supplement the table.

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* = Became part of a state institution before 1900.

= No longer in existence but discontinuance date unknown (includes schools that disappeared by merger with another pharmacy school).

ALABAMA

1866 Medical College of Alabama, Birmingham and Mobile (University of Alabama).

This school listed by Kremers and Urdang may have suspended, since it does not appear in the Reports. A college of this name located at Mobile appears in the Report for 1896-97 (p. 1804) as: "Medical College of Alabama, School of Pharmacy, University of Alabama." By 1900-01 it was listed as "School of Pharmacy, University of Alabama," with the same dean as in previous years. Whether this same College had located in Birmingham for a time after the war, when its building in Mobile was used as a Negro primary school, has not been confirmed. (Norwood, Medical Education, 376; Polk's Medical and Surgical Register of the United States (Detroit, 1896), 150.) However, Scoville gives the same date of organization (1866) for the Mobile School as Kremers and Urdang give for the one at Birmingham.

•1895 Alabama Polytechnic Institute, Auburn.

Instruction between 1885 and 1895 was confined to alkaloidal assay and toxicology, given by members of the chemistry department. A degree course was instituted in 1895. Originally called Alabama Agricultural and Mechanical College.

CALIFORNIA

1873 California College of Pharmacy, San Francisco (affiliated with the University of California; an integral part of the University since 1934).

Although independently managed and financed, the school was loosely affiliated with the University from the beginning of instruction, first "as a branch of its medical department." (Report for 1877, p. 19) The school was launched in 1873 (George Griffenhagen, The Story of California Pharmacy (Madison, 1950), p. 27; see also the Reports), although the date of organization is 1872.

1898-1916 College of Physicians and Surgeons, San Francisco.

See San Francisco and Pacific Druggist, 4: 2 (No. 8), 1899 and Henry Harris, California's Medical Story (San Francisco, 1932), p. 3, as cited by Griffenhagen in The Story of California Pharmacy, p. 28.

COLORADO

*1884?-ca. 1885? University of Colorado, Boulder.

An abortive attempt at instruction during which "The medical faculty of the State University offer to such as desire to practice pharmacy a two-year course of training." (Report for 1884-85, p. 32) The department of pharmacy was only listed once in the Reports during the 19th century. The present school was not established until 1911. (University of Colorado Bulletin, College of Pharmacy, vol. 38, no. 7, p. 6; also J. Amer. Pharm. Assoc., 4: 32, 1915)

1888-1896 University of Denver, Denver.

Opened with two teachers and 11 students; closed eight years later with four teachers and 27 students. The 1868 "date of charter" appearing in the Reports apparently refers to the University rather than to the pharmacy school. (Reports for 1888-89 (p. 1193), 1894-95, and 1895-96; also H. L. Taylor)

DISTRICT OF COLUMBIA

1868 Howard University, Washington.

"Year of first opening" as 1867 (e.g., Reports for 1888-89 and 1900-01) refers to founding of University; 1868 (e.g., Report for 1899-1900) refers to beginning of pharmaceutical instruction. When Freericks states that regular instruction did not begin until 1870 he refers to a definite differentiation of the medical and pharmacy departments. The first degree granted by the medical department was a "Doctor of Pharmacy" in 1870. (Walter Dyson, Howard University: Studies in History, No. 10, November, 1929.)

1871-1874? Georgetown College, Washington.

The School of Pharmacy (with Johnson Eliot, M.D., as dean and 20 students enrolled) appeared in the Report for 1871 (p. 666) but not thereafter. Instruction began in 1871. Six Bachelor of Pharmacy degrees and three Doctor of Pharmacy degrees were awarded from 1872 through 1873 (term of 1873-74?) but none thereafter. (Anne D. McLaughlin, Director of Central Records, Georgetown University, letter of June 30, 1952)

1871-1872/3 Columbian College, Washington.

The pharmacy course was part of the Columbian "National Medical College." The parent Columbian College was founded in Philadelphia, 1814; moved to Washington, D. C., 1821 (Report for 1871, pp. 390 and 666); and became George Washington University in 1904. But the school of pharmacy was absorbed by the National College of Pharmacy (q.v.) about the time it began instruction (1872-73). (Charles W. Bliven, Dean of the School of Pharmacy, George Washington University, letter of June 27, 1952)

1872 National College of Pharmacy, Washington (affiliated with George Washington University in 1906; became integral part in 1920).

Instruction started in November, 1872. The College absorbed the school of the Columbian College in the first year. (Charles W. Bliven, loc. cit., and his article in Tile and Till, publication pending)

GEORGIA

1891-1926 Atlanta Medical College, Atlanta (school became independent as Atlanta College of Pharmacy about 1905).

When the Atlanta Medical College and the Southern Medical College amalgamated in 1898 to form the Atlanta College of Physicians and Surgeons, the pharmacy school (31 students) was continued as a department of the new institution. About 1905 Dr. George Payne bought the department of pharmacy and operated it independently as the Atlanta College of

Pharmacy until 1926. Not connected with the Atlanta Medical College, this old title having been adopted in 1913 for a consolidation of the College of Physicians and Surgeons and the Atlanta School of Medicine. (Frank K. Boland, "Medical Schools which Eventually Became Emory," J. Med. Assoc. of Georgia, 40: No. 9, 1951, as quoted by Minnie M. Meyer, Acting Dean, Southern College of Pharmacy, letter of June 30, 1952; cf. Report for 1894-95, p. 2190.) The Pharmaceutical Era (16: 858, 1896) gave the founding date as 1890 but other sources agree on 1891.

ILLINOIS

1859 Chicago College of Pharmacy, Chicago (affiliated in 1896 with the University of Illinois, q.v.)

The school was suspended in the second year (1860) because of financial panic and war, although special lecture courses were offered in the winter of 1861-62. There was no regular teaching from 1860 to 1870. Only a year after instruction was resumed in 1870 the Great Fire destroyed all facilities, but within a few months the school began anew in temporary quarters (1872). See W. B. Day, "The School of Pharmacy," The Alumni Record of the University of Illinois, Chicago Departments, 1921, pp. xxv-xxx. Dissension over policy and faculty salaries about 1886 brought an organizational split, leading to establishment of a competing school (see Northwestern University).

1886-1917 Northwestern University, Chicago. (The College of Pharmacy was absorbed by the University of Illinois College of Pharmacy in 1917.)

Dissension within the Chicago College of Pharmacy (q.v.) led to a split of faculty and of administration. The school organized by the splinter group promptly affiliated with Northwestern University. (W. B. Day, op. cit., xxviii f.) Known as the "Illinois College of Pharmacy," this school is not to be confused with the University of Illinois College of Pharmacy (q.v.) Following secession from Northwestern, the pharmacy college was consolidated with the School of the University of Illinois (q.v.)

•1893 University of Illinois, Chicago.

A department of pharmacy was established in the College of Science at Urbana in 1893 ("University of Illinois School of Pharmacy," Western Druggist, 17: 267-71, 1895), but never attracted more than a few students. (Edward Kremers, The Old Northwest Territory and Pharmaceutical Education (Lafayette, 1934), 13 f.) The University acquired the Chicago College of Pharmacy (q.v.) in 1896 (W. B. Day, "The School of Pharmacy" [historical sketch], The Alumni Record of the University of Illinois, Chicago Departments, 1921, pp. xxv-xxx), and apparently at this time discontinued offering courses in the College of Science at Urbana (unpublished manuscript by E. N. Gathercoal, cited by Dean E. R. Serles, letter of August 5, 1952). Most sources (such as current College Bulletins and the Kremers-Urdang table) indicate that the present College started as the Chicago College of Pharmacy.

While this may be considered correct, the University's course in pharmacy antedates by three years the affiliation of the old Chicago College. The College remained in Chicago, moving to the West Side in 1916, to became part of the University's Medical Center. (Kremers, op. cit., 13 f.) In 1917 it absorbed the Illinois College of Pharmacy, which had been an affiliate of Northwestern University (q.v.).

INDIANA

*1884 Purdue University, Lafayette.

First instruction given September, 1884, according to A Brief Account of the First Fifty Years of Pharmacy Education at Purdue (Purdue University, 1934); see also C. O. Lee and Sister Clara Frances, "The First Decade of the School of Pharmacy at Purdue University," Purdue Pharmacist, 25: 44-50 (No. 3), 1948. Reports of opening in 1886 are erroneous.

1892-1940 Northern Indiana Normal School and College, Valparaiso (called Valparaiso University since 1906).

The first graduating class (1893) may not have been enrolled in a separate department (Fischelis). University records show there was a Department of Pharmacy 1893-1905; a College of Pharmacy 1906-1910; a Department of Pharmacy 1911-1916; and a School of Pharmacy 1917-1940. Between 1893 and 1906 the parent institution was called Valparaiso College and Northern Indiana Normal School (Albert F. Scribner,

Registrar of Valparaiso University, letter of July 2, 1952). It seems quite certain that instruction started in 1892, although other dates also appear in the literature.

1898 - ? University of Notre Dame, Notre Dame.

The opening was in 1898, according to the Report for 1899-1900 and 1900-01 (p. 1780) and Taylor.

IOWA

1871 - ca. 1879 Iowa Wesleyan University, Mount Pleasant.

In omitting the listing of the pharmacy school for the first time, the Report for 1879 (p. 598) noted that it was then "not a distinct department."

*1885 State University of Iowa, Iowa City.

See "Iowa University School of Pharmacy," Western Druggist, 16: 285-290, 1894.

1887?-1906 Iowa College of Pharmacy, Des Moines (affiliated with Drake University in 1902).

The Report for 1900-01 gives 1883 as the year of opening; Kremers and Urdang give 1882 as the date of organization; and Scoville gives 1886. But the records of the Registrar at Drake University indicate that the Iowa College of Pharmacy did not begin instruction until 1887 and was affiliated 1902-1906. (Byrl E. Benton, Dean, letter of June 30, 1952) It was not this school (defunct 1906—Taylor) but rather the Des Moines College of Pharmacy (f. 1927) from which the present pharmacy college at Drake grew, becoming

affiliated in 1939. (Cf. Kremers-Urdang)

1890-1927 Highland Park College, Des Moines (called Des Moines University from 1920).

The Catalogue of the Highland Park College of Pharmacy and Chemistry (n.d., ca. 1916) states that the "doors were opened for students" in September 1890. The Reports (e.g., 1897-98), Scoville and Taylor also give 1890 as the date of opening of the pharmacy school, but Freericks indicated that regular instruction did not start until 1891.

KANSAS

1869 - ca. 1872 Kansas College of Pharmacy, Leavenworth.

*1885 University of Kansas, Lawrence.

The Report for 1884-85 (p. 92) notes that "A chair of Pharmacy has also been established by the Regents of the university in accordance with a law passed at a recent session of the state legislature." See "Kansas School of Pharmacy," Western Druggist, 15: 220-224, 1893. The department became a school in 1891 (Fischelis).

? - ca. 1896 Kansas Medical College, Topeka.

Listed as "suspended" in Meyer Brothers Druggist, 1896, p. 192.

KENTUCKY

1871 Louisville College of Pharmacy, Louisville (became part of the University of Kentucky in 1947).

The first listing of the College gives 1870 as the "date of organization" and 1871 as "date of charter" (Report for 1872, p. 819). That instruction had been given in 1871 is indicated by the 18 second-year students mentioned in the Report for 1872. See Gordon L. Curry and Ferdinand D. Stoll, "A History of the Louisville College of Pharmacy," Amer. J. Pharm. Ed., 8: 73-81, 1944. The opening date is erroneously given as 1873 in the Report for 1900-01 (p. 1780).

1883-1896 Louisville College of Pharmacy for Women, Louisville.

The school opened in March 1883, reportedly offering a course of "3 years of 36 weeks each year." The last listing was in the Report for 1895-96 (p. 205); and Taylor gives 1896 as the date of discontinuance. See also Emma Gary Wallace, "II. Women in Pharmacy," Pharmaceutical Era, 45: 103, 1912. (In the Kremers-Urdang table the 1892 date of organization is probably a misprint for 1882.)

LOUISIANA

1838-1934 Medical College of Louisiana, New Orleans (became part of University of Louisiana in 1847; called Tulane University of Louisiana since 1884).

The instruction that had begun October 20, 1838 came to an end nearly a century later, at the close of the 1933-34 session, "because of lack of funds to properly maintain it." (Susan B. Keane, Reference

Secretary of Tulane University, letter of June 30, 1952.) After affiliation with the University the Medical College got some state aid, but during the 19th century it apparently relied mostly on student fees and on benefactions. During the 19th century pharmacy was given as a course in the Medical Department; instruction was suspended 1862-1865, and there were eleven other years when no pharmacy degrees were granted. (Catalogue of the Alumni from 1834 to 1901, Inclusive of the Medical Department of the Tulane University of Louisiana (New Orleans, 1901), 41.) In 1908 a separate Department of Pharmacy was established, which in 1914 became a School of Pharmacy within the reconstituted College of Medicine. (Bulletin of the Tulane University of Louisiana, Series 15, No. 9, College of Medicine School of Pharmacy, Announcement for 1914-1915 (New Orleans, 1914). In 1931 the School was reorganized under its own dean. (Fischelis) See Catalogue for 1899-1900, Medical Department of the Tulane University of Louisiana (New Orleans, 1900).

1865? - ? New Orleans College of Pharmacy, New Orleans.
The Report for 1871 (p. 666) states that the dean was S. Logan and indicates the fees and the date lectures began but not the number of students. The school was not listed again during the 19th century. The New Orleans College of Pharmacy that affiliated with Loyola University in 1913 was not opened until 1900. The Flint School of Pharmacy (absorbed by Dillard University) was a transitory venture for the education of Negroes located at New Orleans; dates are unknown.

MAINE

*1895 - 1919 Maine State College, Orono (called University of Maine since 1897-98).

At the end of the century the school listed 12 professors and 10 students (Report for 1900-01, p. 1780). Dates reported by Arthur A. Hauck, president of the University of Maine, letter of July 21, 1952.

MARYLAND

1841 Maryland College of Pharmacy, Baltimore (affiliated with the University of Maryland in 1904, became integral part in 1920).

1841 was both the date of "organization," i.e., incorporation (Report for 1870) and of "first opening" (Report for 1900-01; Freericks). The College, as an association, actually came into existence the previous year (as in Kremers-Urdang table) at a meeting of apothecaries in July, 1840. The school was suspended from the spring of 1847 to the fall of 1856. For a good historical account, see Charles Schmidt, "The Maryland College of Pharmacy (1841-1894)," MS, Edward Kremers Reference Collection, University of Wisconsin; also Annual Catalogue of the Maryland College of Pharmacy, Session of 1891-92. Semi-Centennial Edition.

MASSACHUSETTS

1867 Massachusetts College of Pharmacy, Boston (founded 1823, but no regular course given until 1867).

1867 has been reported by the College itself as the "first opening" of a school (see, e.g., Report for 1900-01, p. 1780). Between the founding date 1823 (given in the Fischelis and Kremers-Urdang tables) and 1867, there were several short lecture courses in chemistry but the results discouraged regular instruction. See "Massachusetts College of Pharmacy," Western Druggist, 15: 308-312, 1893.

MICHIGAN

•1868 University of Michigan, Ann Arbor.

Charles H. Stocking (Amer. J. Pharm. Ed., 12: 388-9, 1948), Freericks and the Report for 1870 (p. 524) all agree in considering 1868 (rather than 1867) as the date when the Course in Pharmacy was officially instituted and the regular course of instruction was begun. See, however, the clarifying discussion, "History of Pharmacy in the University of Michigan, From the Regents' Proceedings," by Charles H. Stocking (Amer. J. Pharm. Ed., 12: 388-9, 1948). The petition for making the course a separate school of pharmacy was submitted to the Board of Regents December 22, 1876. See also, "The School of Pharmacy of the University of Michigan," Western Druggist, 15: 130-37, 1893.

1890 Detroit College of Medicine and Surgery, Detroit (became independent as the Detroit College of Pharmacy in 1905, part of the Detroit Institute of Technology in 1907).

Instruction apparently began in 1890 (C. H. Waldon, Dean, letter of July 8, 1952), although 1889 and 1891 also have been mentioned (Cf. Reports for 1895-96, 1899-1900, 1900-1901, and Taylor). A discontinuance date of 1905, given by Taylor, refers only to the secession from the Detroit College of Medicine.

1893 Ferris Institute, Big Rapids.

The pharmacy school was not listed in 19th-century Reports, but later on (e.g., Reports of 1912 and 1916) the year of first opening is given as 1894. The date 1884 in the Kremers-Urdang table was the year of the opening of the Institute itself. In a personal communication to George Urdang in 1944, the School indicated that pharmacy instruction started with the year 1893-94.

MINNESOTA

1885 - ca. 1894 Minnesota Institute of Pharmacy, Minneapolis.

1885 is given as the "date of organization" in the Report for 1885-86 (p. 559) and as the "year of first opening" in the Report for 1887-88. It was always listed in the Reports as "Minnesota College of Pharmacy" (rather than "Institute"). The College appeared for the last time in the Report for 1893-94.

*1892 University of Minnesota, Minneapolis.

See Frederick J. Wulling, "The College of Pharmacy of the University of Minnesota--Then and Now," J. Amer. Pharm. Assoc., 17: 994-999, 1928; also "Minnesota College of Pharmacy," Western Druggist, 15: 84-86, 1893.

MISSOURI

1865 St. Louis College of Pharmacy, St. Louis.

1865 is given as the "year of first opening" in the Report for 1900-01 (p. 1780), while 1863 appears as the "date of organization" in the Report for 1870 (p. 524). Charles C. Rabe confirms that teaching actually began in 1865, and has been continuous with the exception of the winter of 1869-70. ("The St. Louis College of Pharmacy and Allied Sciences," Tile and Till, 38: 34-36, 1952.) See also, "The St. Louis College of Pharmacy," Western Druggist, 16: 246-250, 1894.

1885? Kansas City College of Pharmacy, Kansas City (part of the University of Kansas City since 1943).

The school was organized in 1884 and instruction undoubtedly began in 1885 (Theodore T. Dittrich, Dean, letter of July 3, 1952; and Fischelis). But the opening also has been reported as 1886 (Report for 1887-88, p. 799) and the first regular course as 1887-88 (Freericks). The College began as a department of the University of Kansas City, but it was a university "in name only" (Dittrich, loc. cit). In

1889 the College incorporated as the Kansas City College of Pharmacy (Fischelis), but the name had been used from the beginning (see Reports). In 1898 it was reorganized as the Kansas City College of Pharmacy and Natural Science; in 1927 it affiliated with Lincoln and Lee University; and in 1943 affiliated with the present University of Kansas City (founded 1929).

NEW JERSEY

1892 New Jersey College of Pharmacy, Newark (became a part of Rutgers University in 1927).

See David L. Cowen, "Notes on Pharmaceutical Training in New Jersey Before 1900," Amer. J. Pharm. Ed., 112: 302-314, 1948.

NEW YORK

1829 College of Pharmacy of the City and County of New York, New York (affiliated with Columbia University in 1904).

See Curt P. Wimmer, The College of Pharmacy of the City of New York--A History (New York, 1929); and Henry H. Rusby, The College of Pharmacy of the City of New York (New York, n.d.); also "College of Pharmacy of the City of New York," Western Druggist, 18: 348-49, 1896.

1881 Union University, Albany College of Pharmacy, Albany.

1886 Buffalo College of Pharmacy, Buffalo (integral part of the University of Buffalo since 1923).

Until about 1886 the University of Buffalo consisted only of the Buffalo Medical College, which sponsored an affiliated Buffalo College of Pharmacy. (Personal communication to George Urdang from College, 1944.) The actual organization took place under the auspices of the Erie County Pharmaceutical Association. (Ernst T. Stuhr, Pioneers of Pharmaceutical Education in the United States, 30.) Although some catalogs refer to the early College as an "integral part" of the University, Hallberg considered it primarily an association school (Proc. Amer. Pharm. Assoc., 41: 274, 1893). Since 1923 it has been a School of Pharmacy fully integrated with the University.

1887-1890 Cornell University, Ithaca.

The Report for 1888-89 showed a two-year course, with a faculty of 10 and student body of nine. The school last appeared in the Report for 1889-90. Taylor also gives the date of discontinuance as 1890.

1891 Brooklyn College of Pharmacy, Brooklyn (since 1929 affiliated with Long Island University).

NORTH CAROLINA

1891-1918 Leonard School of Pharmacy (absorbed by Shaw University), Raleigh.

Instruction started in November 1891; the School was organized in 1890, primarily for Negroes. (Report for 1895-96 and Freericks.)

*1897 University of North Carolina, Chapel Hill.

There was undoubtedly pharmacy instruction, and perhaps degrees granted, before 1897, and the University even publicized a "School of Pharmacy." This instruction (1880-86, and after 1890) appears to have been only tutorial and so intertwined with similar instruction for students intending to be physicians that no assessment of the supposed course or number of pharmaceutical students has been possible. The variable datings of the Reports, of Freericks, and others, should be viewed in the light of "A Historical Sketch of the School of Pharmacy," prepared by J. G. Beard (MS, Edward Kremers Reference Collection, University of Wisconsin). A regular course and faculty established in 1897 developed into the present school.

OHIO

1865-1876 Baldwin University, Berea.

The dates are given by F. Roehm, Dean of Baldwin-Wallace College, in a letter of December 24, 1931, to Edward Kremers (in Edward Kremers Reference Collection, University of Wisconsin).

1871 Cincinnati College of Pharmacy, Cincinnati (first affiliated with University of Cincinnati in 1877; present affiliation, 1951).

The College (i.e., association) was organized in 1850, and it was reported in 1851 that the members "intend opening their School this session" (Amer. J. Pharm., 23: 391, 1851); yet up to 1870 no mention

of actual instruction was made in the American Journal of Pharmacy or Proceedings of the American Pharmaceutical Association. By the early sixties, and possibly before, there was "personal and indirect" instruction by some of the members, consisting of meetings in private homes and monthly round-table discussions. (Charles T. P. Fennel in Annual of the Cincinnati College of Pharmacy for 1925, as quoted by Dean J. F. Kowalewski in a letter of July 7, 1952.) The association itself was defunct 1861-1871. When revived, regular instruction was instituted in December, 1871, and in 1873 the College "granted its first degree of Graduate in Pharmacy..." The College obtained the first affiliation of its school with the University of Cincinnati in 1877. In 1886 the school became a "department" of the University, but the College retained the old name and administrative control as before (Amer. J. Pharm., 58: 526 f., 1886). See Harold C. Freking, "Gleanings from the Early History of the Cincinnati College of Pharmacy," Amer. J. Pharm. Ed., 12: 412-424, 1948. See also, S. M. Colcord's comment in Proc. Amer. Pharm. Assoc., 41: 225, 1893.

1882-1949 Cleveland School of Pharmacy, Cleveland (affiliated with Western Reserve University in 1908; became an integral part in 1918).

The School started in October 1882 with a single series of 20 lectures, gradually expanding to 90 lectures on standard subjects, in two terms, preparing students for a final year at Buffalo or Cincinnati to obtain a degree. (Personal communication from School, 1944, in Edward Kremers Reference Collection, University of Wisconsin.) Taylor states that the first class of the Cleveland School did not graduate until 1886.

*1885 Ohio State University, Columbus.

See "Ohio State University College of Pharmacy: Historical Sketch," MS submitted by College, 1944, in Edward Kremers Reference Collection, University of Wisconsin. The College absorbed the pharmacy department of the Starling-Ohio Medical College in 1914. See "Ohio Medical University" below.

1885 Ohio Normal University, Ada (since 1904 Ohio Northern University).

The program for "Ohio Northern University College of Pharmacy...Fiftieth Anniversary 1885-1935" (n.p.) states that the catalogue for 1885-86 first announced a "distinct course" in pharmacy, which is the date of first instruction given by Freericks. Some pharmacy instruction had been given prior to that in the Department of Science and Medicine (see the Anniversary program, and Fischelis). About the same time that a regular pharmacy course was instituted (1885), the name of the parent institution changed from Northwestern Ohio Normal School to Ohio Normal University, which in 1904 became Ohio Northern University (see Ohio Northern University Bulletin 1947-48).

1888-1908 Scio College, Scio (amalgamated with Pittsburgh College of Pharmacy in 1908).

Taylor gives the year of opening as 1888, as does Scoville; 1890 is given erroneously as the "year of first opening" in the Report for 1899-1900.

1892-1913 Ohio Medical University, Columbus (merged with Starling Medical College, 1907).

When the Ohio Medical University merged with Starling Medical College its "college of pharmacy" was continued in the new institution, the Starling-Ohio Medical College, as a department. In 1913 the trustees offered their College of Medicine, Dentistry and Pharmacy to the trustees of Ohio State University, who accepted and the transfer was confirmed by the Ohio legislature that same year. (Linden F. Edwards, "Centenary Anniversary of the Oldest Medical College Hospital in the United States—St. Francis Hospital, Columbus, Ohio," Bull. Hist. Med., 26: 274, 1952.) The pharmacy department was absorbed in 1914 by the existing College of Pharmacy of Ohio State University, q.v. (Freericks, p. 31), and the dental and medical units were set up as separate Colleges of the University. The date of organization for the department in the Ohio Medical University was 1891, according to Kremers and Urdang; some Reports give 1891 (Taylor, 1892) as the beginning of the department of the Starling-Ohio Medical College, which refers to the original department in the Ohio Medical University. (Charles A. Doan, dean of medicine, Ohio State University, letter of July 25, 1952.)

? - ? Ohio School of Pharmacy, Columbia.

Listed in Meyer Brothers Druggist, 1896, p. 192. J. H. Canfield was president of the school, which reported holding a nine-month term.

? - ? Ohio National Normal University, Lebanon.

Listed in Meyer Brothers Druggist, 1896, p. 192; also the following year in Druggists Circular, 1897, p. lxxxii. Prospective students were directed to write to Alfred Holbrook.

OKLAHOMA

•1893 State University of Oklahoma, Norman.

OREGON

1888-1895 Willamette University, Portland.

Also known as "Oregon College of Pharmacy." George Griffenhagen states that the pharmacy school was active from 1888 to 1895. ("The Oregon Trail of Pharmacy," Pacific Drug Review, 64: (No. 4) 28, 1952.) Meyer Brother Druggist indicated in 1896 (p. 192) that instruction had been suspended. Thereafter, several short-lived educational ventures were undertaken in Oregon: G. H. Gray's private pharmacy classes, a Y. M. C. A. College of Pharmacy, and M. A. Lane's "Preparatory School." (See Griffenhagen, loc. cit.)

*1899 Oregon State Agricultural College, Corvallis (now Oregon State College).

The Oregon State College Bulletin, School of Pharmacy, 1938-39, p. 5, gives the date of establishment as 1898. However, the school reported in 1944 that teaching began in September 1899, which is also the date given by Freericks. The Department became the School of Pharmacy in 1917.

PENNSYLVANIA

1821 Philadelphia College of Pharmacy, Philadelphia.

The title "College of Apothecaries" was used for a single year (1821-22). The name has been "Philadelphia College of Pharmacy and Science" since 1933. See Joseph W. England, The First Century of the Philadelphia College of Pharmacy (Philadelphia, 1922); also "Philadelphia College of Pharmacy," Western Druggist, 15: 174-79, 1893.

1878 Pittsburgh College of Pharmacy, Pittsburgh (affiliated in 1896 with Western University of Pennsylvania, called University of Pittsburgh since 1908). Absorbed pharmacy school of Soio College, q.v., in 1908.

1898-1916 Medico Chirurgical College of Philadelphia, Philadelphia.

The opening date of 1899 in the Report for 1900-01 appears to have been a misprint; listed as 1898 in other years and in Freericks' report. When the College merged with the University of Pennsylvania in 1916, the department of pharmacy and chemistry of the College merged with the Philadelphia College of Pharmacy.

? - ✱ Pennsylvania College of Pharmacy, Philadelphia.

Listed in Meyer Brothers Druggist, 1896, p. 192. Prospective students were directed to address Martin Roche, M. D., 1137 Spring Garden Street.

SOUTH CAROLINA

•1884 University of South Carolina, Columbia.

After 1866 some pharmacy was taught as part of a "School of Chemistry, Pharmacy, Mineralogy, and Geology," but was probably discontinued in 1877, when the University suspended operations due to "failure of legislative support" (Report for 1878, p. 224). Perhaps pharmacy was taught only as part of the medical curriculum; at least there were no pharmacy graduates. When the institution resumed as the College of Agriculture and Mechanic Arts (1880-82) pharmacy instruction was not revived and still remained dormant after 1882 when the parent institution became the South Carolina College. But in 1884 a School of Medicine and Pharmacy was opened, offering certificates rather than diplomas. J. Hampton Hoch states that a few men graduated from 1886 to 1888. From 1888 to 1891, when the institution again was known as the University of South Carolina, a separate College of Pharmacy graduated 14 men (Ph. G.) from a two-year course. In the Report for 1888-89 the College reported 10 instructors and 23 students enrolled. Note that the charter date 1801 there mentioned refers to the parent institution and not to a school of pharmacy. Instruction resumed in

September 1924 with the establishment of the present School of Pharmacy. (E. T. Motley, "Pharmaceutical Education, University of South Carolina," South Carolina Magazine, 14: 9, 29-31, 1951; Robert W. Morrison, Acting Dean, letter of August 5, 1952; E. L. Green, A History of the University of South Carolina (Columbia, S. C., 1916, excerpted by Morrison); J. Hampton Hoch, History of Pharmacy in South Carolina (Charleston, 1951, p. 43); Bulletin of the University of South Carolina, 1946-47, Vol. 308, No. 1; and a manuscript statement of 1944 from the School of Pharmacy in the Kremers Reference Collection)

*1866 Medical College of the State of South Carolina, Charleston. Kremers and Urdang give 1894 as the date of organization, meaning the time of last reorganization. A decision to grant degrees was made as early as December, 1865; in 1867 the first two students were graduated, and a few more in the 1870's. In 1882 a separate pharmacy department was organized. About 1885 the department "as such no longer existed but instruction continued available to students of pharmacy who applied for it," and some did apply. (J. Hampton Hoch, History of Pharmacy in South Carolina, (Charleston, 1951), pp. 49, 51-2) The school of pharmacy was reorganized and students enrolled in 1894. (1896 as the "year of opening" in the Report for 1899-1900, p. 2010, is in error; cf. Freericks, J. Amer. Pharm. Assoc., 4: 36, 1915.) See, J. Hampton Hoch, "Pharmaceutical Education, The Medical College of South Carolina," South Carolina Magazine, 14: 8, 24-28, 1951.

SOUTH DAKOTA

•1887 South Dakota Agricultural College, Brookings, (since 1907 called South Dakota State College of Agriculture and Mechanic Arts).

The year of opening is variously given (1888, 1889, 1895) in the Reports. The uncertainties are explained by E. R. Serles in an essay, "History of the Division of Pharmacy," (MS, Edward Kremers Reference Collection, University of Wisconsin). It seems certain from "rather authentic sources" that some students took work under the pharmacy course authorized in 1887. However, the class of 1889 was the first to be specifically classified as pharmacy students. The first Ph. G. degrees were granted to graduates of 1893, but the degree may have been granted to part of the class of 1891 "by common consent" later. See also F. J. LeBlanc, "South Dakota State College," Northwestern Druggist, 51: 56 (No. 2), 1943.

? - # Dakota Normal College, Sioux Falls.

The Department of Pharmacy was active in 1897 (Druggists Circular and Chemical Gazette, August 1897, p. lxxxii) and was still functioning in 1905 when Scoville published his tabulation.

TENNESSEE

1873 - ca. 1879 Tennessee College of Pharmacy, Nashville.

Report for 1880 (p. 305) stated that the College "has temporarily suspended." No information had been supplied either for the previous year's Report (1879).

1879-1920 Vanderbilt University, Nashville.

The first regular course began in 1879 (Freericks),

and there were graduates in 1880 (University Catalogue). The Board voted to close the School on June 7, 1920. (Aileen Bishop, Assistant to the Chancellor, letter of July 1, 1952)

1884? - # Memphis School of Pharmacy, Memphis.

First listed in the Report for 1884-85, but without academic data or date of founding. It never reappeared, except under "no information received."

1889-1937 Central Tennessee College, Nashville (later, Walden University, Meharry Pharmaceutical College).

Supported primarily through private philanthropy, for Negroes.

1895? - 1898? U. S. Grant University, Chattanooga.

Listed in The Western Druggist from 1895 (17: 46, adv. sec.) through 1898 (20: 48, adv. sec.).

•1898 University of Tennessee, Knoxville (moved to Memphis 1911).

First listed in Report of 1898-99, but the "year of first opening" was specified as 1888 (p. 1722), undoubtedly a misprint. Freericks confirms the 1898 date and states that the move to Memphis in 1911 involved absorption of the University of Memphis College of Pharmacy. See also University of Tennessee Bulletin, Catalog Number, School of Pharmacy, February, 1938, p. 5. For a brief history, see P. B. Waddell, "The University of Tennessee School of Pharmacy," reprint from The Mask, 1932(?).

1898-1909 University of the South, Sewanee.

Edward Kremers, like Scoville, gives the founding date

as 1898 under "Sewanee Medical College, Department of Pharmacy" (Druggists Circular, 51: 75, 1907). Taylor gives the school's life span as 1898-1909.

TEXAS

•1893 University of Texas, Galveston (moved to Austin 1927).

1897 - ? Southwestern School of Pharmacy, Dallas.

Opened in October 1897 with a faculty of six including E. G. Eberle, later to become prominent as editor of the Journal of the American Pharmaceutical Association (Western Druggist, 1897, p. 481). The School was still being listed at the end of the century.

VIRGINIA

•1887? - 1898? University of Virginia, Charlottesville.

The Report for 1895-96 gives 1884 as the "year of first opening" (p. 2051). There were four professors and three students. Blanton lists the faculty and says the separate course in pharmacy was introduced in 1886. (Wyndham B. Blanton, Medicine in Virginia in the Nineteenth Century (Richmond, 1933), 184). Apparently a separate school of pharmacy existed only from 1887-88 through 1897-98, when the degree was discontinued because of the inadequate caliber and number of students. However, the faculty stated that thereafter "students may still study all these classes as before 1886, when the degree was established." (Francis L. Berkeley, Jr., Curator of Manuscripts, University of Virginia, letter of August 4, 1952 and documented memorandum.)

1893-1913 University College of Medicine, Richmond.

Amalgamated in 1913 with the Virginia School of Pharmacy at the Medical College of Virginia (q.v.) after competing in Richmond for 16 years. A separate department and faculty of pharmacy were listed from the beginning. The faculty of three included two Graduates in Pharmacy (Ph. G.) (Blanton, Medicine in Virginia, 66 and 184).

•1897 Virginia School of Pharmacy, Richmond (Medical College of Virginia).

The date 1893 in the Kremers-Urdang table stems from a belief that the pharmacy school "started as a department of the University College of Medicine" (q.v.). The facts are that the Medical College of Virginia opened the Virginia School of Pharmacy in 1897 as a separate department, competing as a day school with the afternoon-evening sessions of the pharmacy course operated by the University College of Medicine. Finally, in 1913, the two medical colleges were amalgamated, and a single School of Pharmacy emerged as an integral part of the Medical College of Virginia. (See Blanton, Medicine in Virginia, 64 and 184, Reports for 1899-1900, p. 2011, Scoville, Freericks, and personal communication from School, 1944.) Although a separate school of pharmacy opened only in the last decade of the century, pharmacy instruction apparently had a gradual development. Pharmacy as well as medicine is said to have been taught "from the first" (1838?) at the Medical College of Virginia, but it was probably a supplementary study for prospective physicians. From about 1880 medical students with certain pharmaceutical training were graduated in pharmacy (cf. Bulletin, Medical College of Virginia, Catalog Issue 1950-51, p. 39, and Fischelis),

and at least some of these became pharmacists (Blanton, Medicine in Virginia, 184).

WASHINGTON

*1894 University of Washington, Seattle.

See "History of the University of Washington College of Pharmacy," MS from material of Dean-Emeritus C. W. Johnson, in Edward Kremers Reference Collection, University of Wisconsin; also Report for 1894-95 (p. 2191) and Froericks. (Opening dates of 1896 and 1899 are also given in subsequent reports. The latter date refers to the organization of a School of Pharmacy separate from the College of Chemistry.)

*1896 Washington Agricultural College, Pullman (now State College of Washington).

The pharmacy course was organized within the Chemistry Department in 1892 but no work in pharmacy was given until 1896. The Kremers-Urdang table lists separate schools at the "State College of Washington" (f. 1892) and "Washington Agricultural College" (f. 1896 and now defunct). Actually a single institution has continued up to the present, with a change in name after the turn of the century. (The new name appeared in the Report for 1906, p. 642, with the same dean, requirements and founding date as in previous years.) Pharmacy became a separate school in 1898, a department in 1906, and a School of Pharmacy as one of nine main divisions in a reorganization of the parent college in 1917 (Catalog of the School of Pharmacy, State College of Washington, 1945-46).

*1883 University of Wisconsin, Madison.

See The Badger Pharmacist, 1900, pp. 93-142; Frederick Hoffmann, Pharmaceutische Rundschau, 8: 175, 1890; "University of Wisconsin School of Pharmacy," Western Druggist, 17: 11-16, 1895; Glenn Sonnedecker, "The School of Pharmacy at the University of Wisconsin," Wisconsin Druggist, 18: 9-10 (No. 4), 1950.

1900?-1918 Milwaukee Medical College, Milwaukee (College and pharmacy department affiliated with Marquette University in 1907).

The Reports of the Commissioner give 1900 as the "year of first opening," as does Sol R. Bear, in The History of the School of Pharmacy at the Marquette University School of Pharmacy (B. Sc. Pharmacy thesis, University of Wisconsin, 1950, p. 5). Bear indicates that the school actually started two years earlier in Colby, Wis., as a private school of Dr. R. E. W. Sommers, who was a graduate of the University of Heidelberg. Freericks places the beginning of Sommers' venture as early as 1893; it seems to have been largely tutorial before affiliation. (Cf. Badger Pharmacist, 1900, p. 97) In 1900 Sommers and his school moved to Milwaukee, gaining better facilities through affiliation with the Milwaukee Medical College.

After the Civil War

From a paucity of schools readily available to apprentices in only a few large cities, each passing decade after 1860 put formal education within easier reach and brought keener competition for students. This was especially true of certain states. The preceding table suggests areas for study concerning the evolution of instruction in the various states in relation to respective associations, pharmacy laws, general educational structure, local population trends and other social conditions.

The following table shows the approximate number of schools opened in each decade, with an indication of the national population trend:

Decade	Pharmacy Courses Established	U. S. Population at Start of Decade	Number Living in Cities
1820-29	2	9,638,453	1 of 14
1830-39	1		
1840-49	1	17,069,453	1 of 9.5
1850-59	1		
1860-69	10	31,443,321	1 of 6
1870-79	10		
1880-89	23	50,155,783	1 of 4
1890-99[68]	34		

68 - By 1900 the population had reached nearly 76 million, and 2 of every 5 persons were living in urban areas. (Population data from, or based on, U. S. Bureau of Census, Historical Statistics of the United States, 1789-1945.) The numbers of schools are derived from the preceding table, where it will be noted that in a few instances the decade when a course began to function is not entirely certain.

The 1860's. No pharmacy courses were established from 1860 through 1864. Education generally was hard hit by the war, which resulted in suspension "of almost every college south of Mason and Dixon's line" and strongly checked the development of schools in the North.[69]

At the 1866 meeting of the American Pharmaceutical Association Edward Parrish observed that in the fourteen years since the Association's founding "we ought to notice a much greater improvement in or extension of pharmaceutical education than has occurred."[70] Although the improvement in instruction and enrollment would lag, the extension of schools was not long in coming.

At the end of hostilities the pharmacy course was resumed in the medical department of the University of Louisiana.[71] Finally, in 1867, the long-nurtured ambitions of the Massachusetts College bore fruit in a regular school.[72] In the following year the re-constituted Chicago College announced that "Two lecturers have been obtained for the school if finally decided on";[73] and in 1870 instruction was resumed.

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69 - Thwing, A History of Higher Education, 361 f.; cf., Cubberley, Public Education, 427.

70 - The Philadelphia pharmacist chided New Yorkers by stating that "they ought to have three hundred students...to constitute the class in the College of Pharmacy, and yet there are but thirty-five." ("Minutes of the 14th Annual Meeting," Proc. Amer. Pharm. Assoc., 14: 39, 1866.)

71 - Before affiliation called Medical College of Louisiana.

72 - A year before the opening, the Secretary of the American Pharmaceutical Association observed, "The meeting of the Association in Boston last year has given a healthy impulse to the College." (Proc. Amer. Pharm. Assoc., 14: 199, 1866.)

73 - "Chicago College of Pharmacy," Amer. J. Pharm., 40: 283, 1868.

This seventh decade brought four new association schools, but only two became firmly established: those of the Massachusetts and St. Louis Colleges of Pharmacy. Little is known about the short-lived endeavors of the Kansas College of Pharmacy at Leavenworth and the New Orleans College of Pharmacy.

The founding of independent pharmacy schools barely kept pace with the opening of pharmacy courses by colleges and universities already in the 1860's. Baldwin University, a small institution in Berea, Ohio, became, in 1865, the first place where pharmacy instruction began within a general college program.

The first state-supported institution to produce graduates in pharmacy (1867) was the Medical College of the State of South Carolina in Charleston, although instruction had a precarious existence until the reorganization of 1894. Not to be outdone, the University of South Carolina gave some attention to pharmacy beginning about 1866, but the pharmacy course had a feeble and stunted development through the remainder of the 19th century, reflecting in part the severe impact of the reconstruction period on the parent institution (see p. 105).

Unlike the two state schools of the South, the University of Michigan was to have the most far-reaching effect on 19th-century pharmaceutical education through its pharmacy course launched in 1868. That same year the first pharmacy course

particularly for Negroes was established at Howard University in Washington, D. C.

The instruction begun at the Medical College of Alabama a year after the pharmacy course opened at the Medical College of the State of South Carolina foreshadows a 19th-century development that could not be blocked by the insistence of organized pharmacy on educational independence from medicine.[73a]

The 1870's. The eighth decade opened with the founding of five schools in the single year 1871, and it is symptomatic that apparently only two of these lived to see the end of the decade. Of the ten schools tallied in the decade as a whole, four may be credited to private institutions and six to associations of pharmacists.[74] Of the pharmacist-controlled schools, that of the California College of Pharmacy was loosely affiliated with the University of California from the beginning.

73a - Ed. Dept., "Pharmaceutical Degrees by Medical Colleges," Amer. J. Pharm., 44: 189, 1872.

74 - Those counted as pharmacist-controlled schools are the Louisville College of Pharmacy (1871), Cincinnati College of Pharmacy (1871), National College of Pharmacy (1872), Tennessee College of Pharmacy (1873), California College of Pharmacy (1873), and Pittsburgh College of Pharmacy (1878). The private institutions were: Georgetown College (1871), Columbian College (1871), Iowa Wesleyan University (1871), and Vanderbilt University (1879).

Thus begins a historical problem, for even considerable investigation often fails to clarify the extent to which schools claiming university titles actually participated in the advantages that presumes. It will have been noted in the table that many schools gradually amalgamated with universities in several steps.

The 1880's. The 1880's brought a flurry of pharmaceutical activity in legislative halls, meeting houses and academic institutions. In the tabulation on page 113 it was seen that more than twice as many schools were founded in this ninth decade as in any comparable previous period. University and collegiate institutions now brought into being nearly twice as many schools as other types combined. State and private universities shared equally in this endeavor; but the stability of the two types of schools offers a complete contrast: only one of the private institutions has continued instruction up to the present day, while only one of the state institutions does not still have a school of pharmacy.[75]

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75 - Schools counted as part of a private university or college are Union University (1881), Northwestern University (1886), Cornell University (1887), University of Denver (1888), Willamette University (1888), Scio College (1888), and Central Tennessee College (1889). In addition, in a somewhat special category, is the Ohio Normal University, which began regular instruction in 1885. The state-supported institutions were: University of Wisconsin (1883), University of Virginia (1884), University of Colorado (1884?), Purdue University (1884), State University of Iowa (1885), University of Kansas (1885), Ohio State University (1885), South Dakota Agricultural College (1887).

Only about a sixth of the schools established are clearly an offspring of colleges of pharmacy. Several schools of the 1890's had nominal affiliations that make them difficult to classify without qualifications. One of the proprietary ventures (Louisville, 1883) was the first and only school specifically for women.[76]

The 1890's. In the decade closing the century there were three or four schools established every year, on the average. From 1881 to 1900 not a year passed without at least one new school appearing on the pharmaceutical scene.

The private collegiate institutions, the state institutions, and the unaffiliated medical colleges each shared almost equally in the development of the 1890's, from a merely numerical point of view.[77] Testimony that the generative period of association-colleges was largely past lies in the fact that only two schools appeared under such auspices.

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76 - Institutions counted as association schools are the Cleveland School of Pharmacy (1892), Kansas City College of Pharmacy (1885), Buffalo College of Pharmacy (1886), and Iowa College of Pharmacy (1887?); schools that probably may be considered proprietary (in the sense of entrepreneur ventures) are the Louisville College of Pharmacy for Women (1883), Memphis School of Pharmacy (1884?), and Minnesota Institute of Pharmacy (1885).

77 - Normal schools are here counted with other private university and collegiate institutions.

An additional three schools appear to have been proprietary ventures.[78]

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78 - The state-supported schools were the University of Minnesota (1892), University of Illinois (1893), State University of Oklahoma (1893), University of Texas (1893), University of Maine (1894), University of Washington (1894), Alabama Polytechnic Institute (1895), Washington Agricultural College (1896), University of North Carolina (1897), University of Tennessee (1898), and Oregon State Agricultural College (1899).

The private universities and collegiate institutions were: Highland Park College (1890), Shaw University (1891), Ferris Institute (1893), U. S. Grant University (1895), University of the South (1898), University of Notre Dame (1898). In addition, at least three normal schools instituted instruction: Northern Indiana School of Pharmacy (1892), Ohio National Normal University (?), and Dakota Normal College (?).

The unaffiliated medical colleges were: Detroit College of Medicine and Surgery (1890), Atlanta Medical College (1891), Ohio Medical University (1891), University College of Medicine (1893), Kansas Medical College (?), Medical College of Virginia (1897), College of Physicians and Surgeons (1898), Medico Chirurgical College of Philadelphia (1898), and Milwaukee Medical College (1900).

The association schools were the Brooklyn College of Pharmacy (1891) and New Jersey College of Pharmacy (1892). Three schools presumed to be proprietary are the Pennsylvania College of Pharmacy (?), Ohio School of Pharmacy(?), and Southwestern School of Pharmacy (1897).

Types of Schools. The classification of schools[79] has been risked to show the relative numbers of different types, as of the date of opening. A specific designation assigned may be equivocal, occasionally, because a given instance stands somewhere between two conceptual types (e.g., there are degrees of state support, and degrees of university affiliation); or a designation may be tentative because of sparse information. Moreover, as previously mentioned, a few schools may still be missing from the tabulation, and it is open to discussion whether some now listed should have a place in the tabulation.

These qualifications, applying to the previous discussion in general, are emphasized in connection with the following summary for the period 1860 to 1900, which is best considered as showing approximate magnitudes rather than exact figures:

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79 - The term "schools" in this chapter is often used loosely to indicate regular courses of systematic instruction in a variety of administrative structures.

State university or college	22
Private university or college	19
Normal school or university	4
Association school	16
Unaffiliated medical college	11
Proprietary pharmacy school	6

A brief longitudinal view of the 40-year period, with regard to these different types of schools, may supplement the previous discussion of ten-year cross-sections.

Colleges of pharmacy gave rise to four to six schools each decade between 1860 and 1890. In origins and objectives these closely followed the association schools founded before the Civil War.

The purely proprietary school never held the same place in pharmaceutical education as it did in 19th-century medicine.[80] As previously indicated, a few appeared in the ninth and in the tenth decades, but little is known about them.

The rather sudden intrusion of unaffiliated medical colleges--most of them proprietary ventures--into pharmaceutical education after 1890 undoubtedly may be traced in part to an over-supply of colleges and severe competition. For example,

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80 - Cf. Norwood, Medical Education, 431.

in 1880 there were at least 90 medical schools, by 1890 there were 129, and during the next five years there were at least four new schools founded each year.[81] By subsequent secessions and affiliations at least half of the pharmacy departments started by medical colleges during the decade eventually either became independent or merged with distinct schools of pharmacy in other institutions. There was a somewhat similar evolution in quite a number of universities and colleges, the pharmacy schools or courses developing out of special instruction in either the medical department or chemistry department.[82] Some of these medical departments were quite as loosely affiliated with the parent institution of learning as some pharmacy departments. Hence in a few instances, the origins of pharmacy departments that grew out of medical departments, into full and separate university status, are not too different from some originating in unaffiliated medical colleges.

Another perplexing element is the pharmacy course, given in certain (usually unspecified) medical colleges, referred to in the contemporary literature as a "feeder" to the medical courses. That is, students took the pharmacy course on the way to a medical degree, without ever intending to practice pharmacy as a separate calling. No historian has yet attempted to evaluate these medical-college departments

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81 - Report of the Commissioner of Education, 1896-97, 1780.

82 - E. g., Michigan, Ohio State, North Carolina, Illinois, Howard, Ohio Northern, Alabama Polytechnic, and others.

and perhaps show which should not be considered as operating a bona fide pharmacy course. It would be no easy task.

The rise of pharmacy courses in private institutions of learning followed the same chronologic pattern as the state institutions, but varied much more widely in standards and objectives and were much less consequential in changing the direction and content of American pharmaceutical education. As a group such schools have commanded relatively little attention in the literature.

The character and resources of the private collegiate institutions varied over a wider range than any other type of institution teaching pharmacy. There were the church institutions—such as Northwestern, Drake, Notre Dame and Scio College—which as a group were representative of a remarkable denominational endeavor in general education. There were the normal schools—several including pharmacy in their programs—which developed in the West out of a rather desperate need for teachers that could not be met by the regular colleges as the nation expanded. Of the substantially endowed universities only a few opened pharmacy departments, notably Vanderbilt and Cornell. Many small institutions were hardly more than glorified high-schools. Operating on a "shoestring" and a hopeful ambition reflected in the title "university," their sights were set, by the force of circumstances, more on additional students and income than on raising the standards of pharmaceutical education.

Normal schools or "universities" in Ohio, for example, as late as the 1890's boasted four consecutive terms that permitted matriculation and graduation in a single year.[83] On the other hand, at Cornell the trustees set up their pharmacy course on the assumption that they "merely followed an example already offered in the leading countries of Europe, where the necessity of thorough scientific training as a preparation for the practice of pharmacy has long been recognized."[84] The trustees apparently overlooked the fact that they were not in Europe, and the pharmacy department soon collapsed, as it did in many another institution.

Without the support of state funds, a legal requirement of pharmaceutical education to bolster enrollment, or the backing of an association of apothecary-preceptors, the pharmacy departments in private collegiate institutions usually lacked stability. Of nineteen such courses, thirteen survived to 1900, but all but five discontinued thereafter.

In contrast, only two of the twenty-two state universities launching pharmacy instruction in the 19th century do not still have schools.[85] Except for tentative beginnings in two state-supported institutions of the South and the bold and vigorous beginning at the University of Michigan, the development of

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83 - C. S. N. Hallberg, "The Requirements for Graduation in American Colleges of Pharmacy," Proc. Amer. Pharm. Assoc., 41: 274 f., 1893.

84 - Quoted in "Universitäts-Pharmacieschulen," Pharmaceutische Rundschau, 5: 127, 1887.

85 - A third (Colorado) made only an abortive beginning and did not resume until after the turn of the century.

state-university schools came entirely within the final two decades of the century. The reasons for this lie not only in pharmaceutical developments. The real flowering of state universities came only after mid-century and the great period of expansion began about 1865.[86] Thus in 1884 and 1885 we find no less than six state universities opening schools of pharmacy.

A primary stimulus for expansion of the state universities came from grants of vast tracts of public domain, as had the stimulus for the founding of a state university system in the first half of the century.[87] Through the Morrill Act of 1862 about ten million acres were distributed among 45 states during the 19th century to aid higher education. Primarily intended to encourage agricultural and mechanical colleges, the land grant nevertheless often became part of the endowment of

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86 - Cubberley, Public Education, 273.

87 - Although some Southern states had laid the foundation for universities before 1825 without the aid of Federal land grants, provisions of the North West Territory Ordinance of 1787 were of first-rate importance. Cubberley says: "The grant of two or more whole townships of land 'for a seminary of learning,' or 'state university,' begun by Congress as a land selling proposition in the case of Ohio, was continued with the admission of each new State afterward, and these township grants for a seminary of learning formed the beginning of the state universities which were created in all the new Western and Southern states." (Cubberley, Public Education, 115 f., 267.)

universities in states concerned.[88] The primary purpose of the land grants explains the seeming incongruity of pharmacy as part of "agricultural and mechanical" colleges in such states as Oregon and South Dakota.

The state universities were quick to take their cue in meeting the practical needs of the citizenry and in staffing the expanding professions, and gave avid attention to applied science. Within this scope it was not difficult to find a place for pharmacy. The initiative for taking advantage of this opportunity for pharmacy came under diverse circumstances.

The state pharmacy laws, adopted mainly after 1880, usually recognized that pharmacists should have certain qualifications, although evidence of formal education was not required until after 1900. They undoubtedly left a certain implication, however, that "it was the duty of the state to provide such education."[89] Yet, it would be a mistake to make a generalization. For example, in seven states we find that instruction in a state school started some years before the passage of a pharmacy law.

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88 - Charles F. Thwing, "American Universities," in Report of the Commissioner of Education for the Year 1903, (Washington, 1904), 301; see also George W. Knight, "Higher Education in the North-West Territory," in Report of the Commissioner of Education for the Year 1887-88 (Washington, 1888), 1039-1047.

89 - B. V. Christensen, "A Century of Progress in Pharmaceutical Education," J. Amer. Pharm. Assoc., 20: 1094-1098, 1931.

However, for about half the state-supported pharmacy schools of the 19th century the opening came within five years (plus or minus) of the first legislation.[90]

At the first state university to establish a separate and vigorous course in pharmacy, the University of Michigan, there was neither the suggestive influence of pharmacy legislation nor the support of the profession. Instead the course grew out of pharmacy's connection with medical instruction through the intermediary of an outstanding chemical laboratory, backed by an administration noted for its pioneering bent.

"Michigan was one of the first state universities," says Cubberley, "to free itself from the hampering influences of state politics on the one hand and sectarian influences on the other; to open its doors to women on the same terms as men (1870); to begin the development of instruction in history (1857); education (1879); and government (1881) with a view to serving the state; and to examine and accredit the high schools (1871)..."[91] —and to this list may be added pharmacy (1868).

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90 - The dates of adoption of the first state or territory pharmacy laws, upon which this statement is based, are those given by Kremers and Urdang, History of Pharmacy, 276.

91 - Cubberley, Public Education, 651.

Pharmacy began there, as in many universities, as supplementary material for medical students. As early as 1839 Dr. Douglass Houghton, professor of geology and mineralogy, was "also charged with the subjects of Chemistry and Pharmacy..," but he never did any regular teaching. In 1845 his assistant, Silas H. Douglas, took over the instruction in chemistry, probably becoming the first professor of chemistry at a state university. He developed instruction during the next thirty-two years under various titles, including "Professor of Chemistry, Mineralogy, Pharmacy, and Toxicology" (1855-1870). One of his firm goals was to establish an outstanding laboratory in chemistry and its principal applications.[92]

As one of these applications Professor Douglas offered a laboratory course in pharmaceutical preparations as early as 1860. It was mainly designed for medical students, for general training in applied science for others, and even partly for students looking forward to the practice of pharmacy.[93]

The idea of having a special course to prepare students for pharmaceutical laboratory work and for practice had come up now and again for discussion, with Professor Albert B. Prescott, physician-chemist, taking the leading role.[94] The men concerned were no doubt aware in 1868 that instruction in pharmacy had

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92 - Charles H. Stocking, "History of Pharmacy in the University of Michigan, From the Regents Proceedings," Amer. J. Pharm. Edu., 12: 388-9, 1948; and Edward Kremers, "The Teaching of Pharmacy...", Drugg. Circ., 5: 76, 1907.

93 - Albert B. Prescott, "Silas H. Douglas as Professor of Chemistry and Pharmacy," Pharmaceu. Review, 21: 359-63, 1903.

94 - Stocking, "History of Pharmacy in the University of Michigan..," Amer. J. Pharm. Educ., 12: 388-9, 1948.

begun in several types of institutions in the United States, and they were probably even more aware of the research and instruction in pharmacy on the European continent. Indeed the University of Michigan has been used as an illustration of the dominance of German ideas in American education, and in its earlier period the University was under French influence.[95]

Out of this milieu the course in pharmacy was born on December 22, 1868, when the President asked the Regents to approve a full course of study in pharmacy and of the granting of a graduation certificate in pharmacy.[96]

The second state to provide pharmaceutical instruction offers the first example of the initiative coming from a state pharmaceutical association. In Wisconsin, at the third annual meeting of the state association, the President observed that "the State University already embraces a good chemical laboratory and that its instructional force includes a chemist and a botanist..," so with the addition of a chair of pharmacy and materia medica Wisconsin druggists could have educational advantages "equal to those of any other State."[97] When the regents were subsequently approached, "All members of that honorable body seemed to be impressed with the propriety of connecting a department of Pharmacy with the University..."[98]

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95 - Charles F. Thwing, The American and the German University: One Hundred Years of History (New York, 1928), 105 ff.

96 - Stocking, "History of Pharmacy in the University of Michigan...", Amer. J. Pharm. Edu., 12: 389, 1948.

97 - Glenn Sonnedecker, "The School of Pharmacy at the University of Wisconsin," Wisconsin Druggist, 18: (no. 4) 8, 1950.

98 - Ibid., 8.

Although the origins at Michigan and at Wisconsin represent two types of dominant patterns, the detailed circumstances varied in the states that one after the other added to the list of university schools. At the University of Virginia, the separate course came as an outgrowth from the medical department;[99] at Purdue an educated apothecary, J. H. Hurty, who operated an exemplary pharmacy in Indianapolis is supposed to have been influential in arousing the interest of the University's president;[100] in Iowa the primary influences are reported to have been the state association and pharmacy legislation;[101] in Minnesota the initiative lay with the state association, although a majority of the pharmacists initially were opposed to a college;[102] at Ohio State the persistent recommendations of the first chemistry professor at the University, who knew pharmacy abroad, were finally taken seriously after passage of the state pharmacy act;[103] in the state of Washington an association petition pointed to need created by a state law, and the example of Michigan as pointing the way to what should be done.[104] In 1896 no less than five state associations were considering the question of seeking the establishment of a pharmacy school at their respective state universities.[105]

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99 - Wyndham B. Blanton, Medicine in Virginia in the Nineteenth Century (Richmond, 1933), 184.

100 - A Brief Account of the First Fifty Years of Pharmacy Education at Purdue, 1884-1934 (Purdue University, 1934), 6.

101 - R. A. Kuever, "State University of Iowa College of Pharmacy," Pills and Pill, 38: 42-45, 1952.

102 - Frederick J. Wulling, "The College of Pharmacy of the University of Minnesota--Then and Now," J. Amer. Pharm. Assoc., 17: 994-999, 1928.

103 - "Ohio State University College of Pharmacy," (MS in Kremers Reference Collection), 1.

104 - C. W. Johnson, "History of the University of Washington College of Pharmacy," (MS in Kremers Reference Collection), 2f.

105 - Proc. Amer. Pharm. Assoc., 44: 274, 1896.

If we now look at the schools known to have been founded in the 19th century from a regional point of view the following picture emerges:

Schools Founded by Regions up to 1860

And in Each Decade Thereafter[106]

(With regional population in millions at the beginning of each decade)

Period	Northeastern[107]	North Central	South	West[108]
Up to 1860	2	1	2	0
1860-1869	1 (10.59)	4 (9.09)	5 (11.13)	0 (0.61)
1870-1879	1 (12.29)	2 (12.98)	6 (12.28)	1 (0.99)
1880-1889	3 (14.50)	14 (17.36)	4 (16.51)	3 (1.76)
1890-1899	5 (17.40)	12 (22.41)	12 (20.02)	4 (3.10)
Total schools founded:	12	33	29	8
Schools operating 1899-1900:	10	24	20 or 21	5
Population 1900)	(21.04)	(26.33)	(24.52)	(4.09)

106 - The numbers of schools founded are derived from the basic table on p. 75, and are approximate in the sense of qualifications there indicated under certain schools. The regional subdivisions are those used by the United States Bureau of Census, as follows: Northeastern: Mo., N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna.; North Central: O., Ind., Ill., Mich., Wis., Minn., Ia., Mo., N. D., S. D., Nebr., Kans.; West: Mont., Idaho, Wyo., Colo., N. Mex., Ariz., Utah, Nash., Ore., Calif.; South: Del., Md., D. C., Va., W. Va., N. C., S. C., Fla., Ga., Ky., Tenn., Ala., Miss., Ark., La., Okla., Texas.

107 - In New England only the Massachusetts College of Pharmacy and the University of Maine had pharmacy courses during the 19th century.

108 - All of the Western schools were in coastal states with the exception of Colorado.

By the 1880's the educational problems of American pharmacy lay elsewhere than in the establishment of schools. By the end of the century one respected Philadelphian, William B. Thompson--a retail, wholesale and manufacturing pharmacist--could advocate that "seventy-five per cent of the existing colleges of pharmacy in the United States should be eliminated...The administration of the remainder after this wholesome subtraction should be confined to the exclusive control of retail pharmacists actually engaged in the pursuit of the business."[109]

This statement well illustrates, in an extreme way, the essentially conservative attitude of pharmacists, especially in the East. If Thompson's insistence on pharmacist-controlled schools seemed somewhat out of step with the times, there were real grounds for concern that the number of schools had outstripped the demand for education. For the rank growth of schools by no means reflected mass support among practitioners.

Edgar L. Patch of Boston conceded at the meeting of the American Pharmaceutical Association in 1891 that "there has been a prejudice against schools of pharmacy on the part of many, it is true, who are not correctly informed as to the character of their work."[110]

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109 - William B. Thompson, "Control of Colleges of Pharmacy," Western Druggist, 20: 343, 1898.

110 - "Discussion on Recognition of Diplomas by State Laws," Proc. Amer. Pharm. Assoc., 39: 200, 1891.

But the founding of schools continued at an accelerated pace, with only the tax-supported institutions somewhat protected from the competitive pressure generated.[111] E. S. Bastin warned of the danger "of breeding such quack mills as have so long disgraced the medical profession of this country."[112] And C. T. P. Fennel of the Cincinnati College charged that "Quantity must be the first consideration, quality last and least, again involving the universal sentiment, 'Knowledge gained rapidly, easily and at little cost.'"[113]

Yet the number of schools was not exceptional compared with the development in other professions; nor was there anything atypical about the regional distribution. (For graphic demonstration, see next page.)

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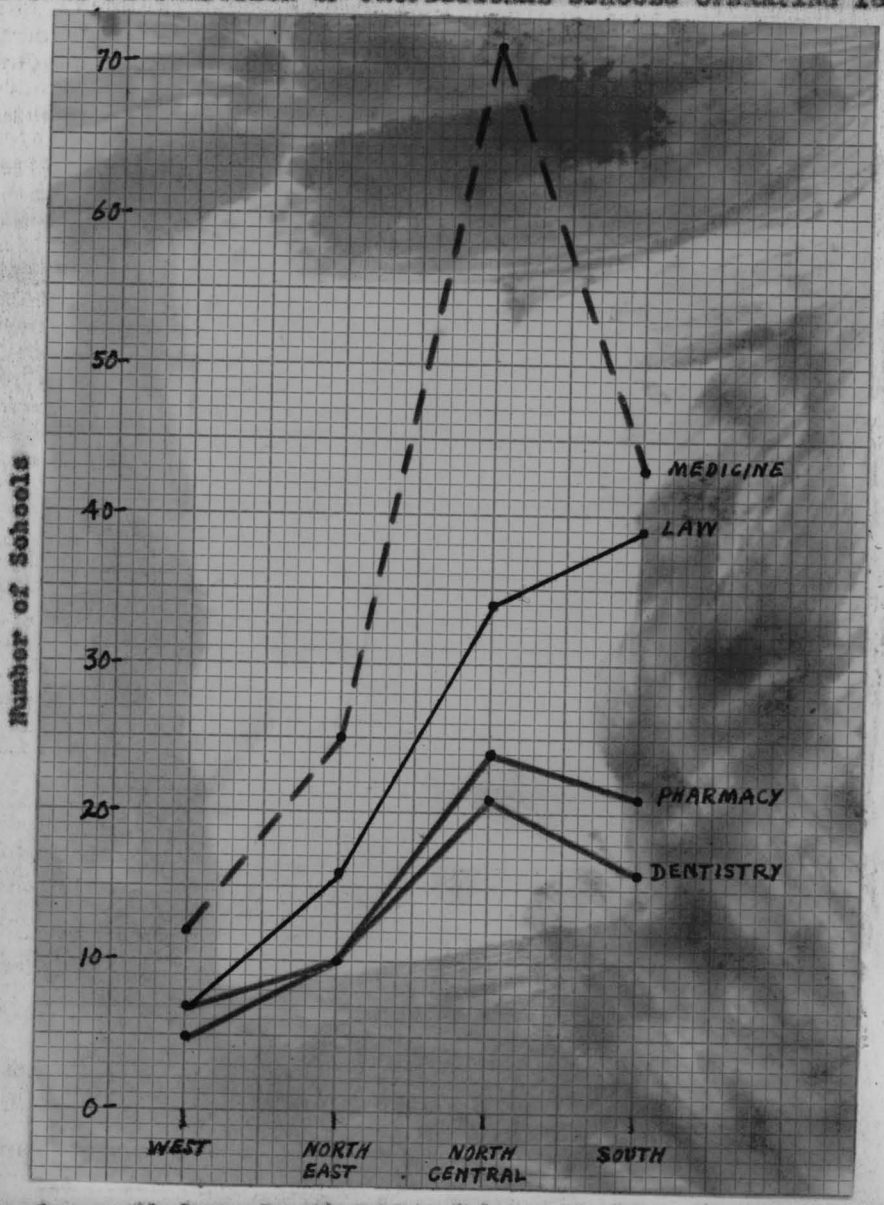
111 - The founding of schools had not reached the crest at the end of the century. Twenty-one schools were to be opened between 1900 and 1905 (Scoville, American Pharmaceutical Colleges and Schools, 17).

112 - E. S. Bastin, "Pharmaceutical Education," Pharmaceutische Rundschau, 6: 284, 1888.

113 - C. T. P. Fennel, "Pharmaceutical Education in America," Western Druggist, 10: 396, 1888.

REGIONAL DISTRIBUTION OF PROFESSIONAL SCHOOLS OPERATING 1899-1900



Data for medicine, dentistry and law are from the Report of the Commissioner of Education, 1899-1900 (Washington, D.C., 1901), 1968, 1970, 1972; data for pharmacy are derived from the table on page 75 supra, and include seven schools not reporting to the Commissioner. Tables indicating the geographic distribution of schools of medicine and law (1901) according to the decade established may be found in Dexter, A History of Education, 320 and 331. Figures from all sources are approximate.

Total numbers of schools used in the graphic comparison above were:

Medicine	151	(includes 30 sectarian schools)
Law	96	
Pharmacy	60	
Dentistry	54	

IV. ADMINISTRATION

Administrative Patterns and Problems

The dominant administrative pattern in American pharmaceutical education until well into the '80's was that of the association school. Authority to determine policy lay with the pharmacist-trustees, and ultimately with the practicing pharmacists whom they represented. Decisions shaping the character of education mirrored its origin and sponsorship.

This linked the schools closely with the "practical side of the business," if they were not even considered merely an extension of what went on in the shop, offering to apprentices as conveniently as possible what the preceptors did not have the time or ability to give. This close connection was buttressed by the local nature of the sponsoring associations. Association schools were possible only in the larger cities, and even where titles suggest broader scope—such as the Massachusetts College and the Maryland College—the administration and the students both centered in the apothecary shops of the mother city.

As the state associations, state boards of pharmacy and other agencies took over many of the functions of the Colleges—notably after 1880—these local associations were gradually transformed into Colleges in the popular sense of the term. That is, they became predominantly educational institutions, with the immediate management in the hands of professional educators. However, their general outlook and policies were still shaped by the board of trustees.

At least some teachers were restless under this control. As late as 1888, Professor E. S. Bastin of Chicago, himself a former druggist, wrote: "It is, however, unfortunately for pharmaceutical education, too often the case that the courses of study are not dictated either by experienced educators or by well-educated pharmacists, but by men whose sole qualification for managing an educational institution consists solely in the fact that they have made money in the drug business."[1]

The Pharmaceutische Rundschau, never a kindly critic of association schools, heartily shared this view. Pharmacy had best look to the new university schools, "where mercenary side issues are less apt to be incurred and can be effectually repressed, and where local 'rings' and boards of trustees with inadequate knowledge and with private interests, are out of the question in the management of educational matters."[2]

A typical reader of the distinguished German-American journal, using his German homeland as a yardstick, might think the editor spoke with singular frankness and logic. To "right-thinking" American pharmaceutists it probably appeared downright subversive to the profession. After all the schools had been forged out of sacrifice in time and money by those who knew pharmacy best; and they were operated--so it seemed--in their best interests. They were symbolic of an American calling become

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1 - E. S. Bastin, "Pharmaceutical Education," Pharm. Rundschau, 6: 284, 1888.

2 - "Editoriell. State Boards of Pharmacy and College Education and Diplomas," Pharm. Rundschau, 3: 70, 1885.

independent within the memory of men still living. There was a symbiotic connection between these men, the schools, and their apprentices, that nourished pride and purse. Why, the so-called school at the University of Michigan did not even require an apprenticeship for graduation; indeed it had no real connection with the profession! It had become increasingly clear that the association founders built wisely.

If the spirit of a crusade burned less brightly than before the Civil War, trustees who sat in the seats of the founders could still share something of their feeling of altruistic service. They were willing to operate the school even at the risk of undermining their own economic position.

Of the school administrators of the Maryland College of Pharmacy late in the century, Charles Schmidt wrote: "When we consider that this body of men conducts and, by voluntary contributions of money, time, and labor, involving often a sacrifice of their own business interests, largely supports an institution which annually sends out into the world young men who may the day after their graduation become the active business competitors of the very members of the college, we have before us in their act an example of philanthropy, true and unalloyed..."[3]

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3 - Schmidt, The Maryland College of Pharmacy (1841-1894), 7 f.

Daniel B. Smith, president of the Philadelphia College, expressed a similar feeling eight years after the founding:

"It cannot be supposed that shrewd and enterprising men, such as first embarked in this undertaking, could be blind to the consequences of making their apprentices better apothecaries than themselves. They did perceive them, and met them with a public spirit and a disinterestedness which make me feel proud of my profession."[4]

At a later time Smith recalled with pride the old struggle to establish the College and school:

"When some of us who are now present, were engaged in founding the College of Pharmacy, we were told by many who refused to join us, that we were raising up a set of young men to take the business out of our hands. I told them that I did not fear the result; that we would educate a race of young men better instructed than ourselves, and that if we should be forced by their competition to reform our own shops and to review our old studies, both we and the community would be the gainers. I am sure that I was right in my opinion, and that a confidence in sound first principles did not on this occasion lead into any error."[5]

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4 - Daniel B. Smith, "Address Delivered by the President, Daniel B. Smith, before the Philadelphia College of Pharmacy, at the Annual Commencement of the College, September 24th, 1829," J. Phila. Coll. Pharm., 1: 243, 1830.

5 - Daniel B. Smith, "Address Delivered to the Graduates of the Philadelphia College of Pharmacy, May 8th, 1837," Amer. J. Pharm., 9: 97, 1837.

This kind of determination was needed among the officers and trustees to keep the schools going. And full power rested in their hands, although decisions could be countermanded by vote of the membership. Committees often were appointed from among the officers or membership at large to explore the advisability of some new school policy; to see that rooms were rented and heated to accomodate the classes and the association's meeting; to establish and maintain a library, cabinet or demonstration apparatus; or to handle some other special task.

The trustees chose the school's lecturers or, as at New York, submitted candidates for election by majority vote of the members. They determined the curriculum, the length of the course, and the hours for lectures—evening hours that would be mutually convenient for apprentices and their preceptors. They set the rules for examining students and for granting diplomas, for which an apprenticeship was a prerequisite. Indeed, the trustees often examined the candidates themselves, or formed a joint examining committee ofapothecaries and professors.[6]

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6 - Some preceptors attended the early courses along with apprentices. At New York the trustees obligated themselves to attend the lectures; and in 1832 "after examining the candidates for the diploma, the Trustees proceeded to examine each other, awarding diplomas among themselves." As late as the 1880's it was the duty of the trustees, rather than of the lecturers, to grade examination papers and theses. (Wimmer, The College of Pharmacy, 96, and 138.) On the function of trustees in relation to the schools, see "Act of Incorporation of the Maryland College of Pharmacy," J. and Transac. Maryland Coll. Pharm., 1: 60-62, 1858; "Charter and Laws of the Philadelphia College of Pharmacy (1822)," Amer. J. Pharm., 28: 278 f., 1856; Constitution, By-Laws and Code of Ethics of the Philadelphia College of Pharmacy (Philadelphia, 1869); Wimmer, The College of Pharmacy, 96 ff.; England, The First Century, passim; Schmidt, The Maryland College of Pharmacy (1841-1894), 7; also the condensed proceedings of the Colleges of Pharmacy published periodically in the American Journal of Pharmacy.

In medical colleges physicians controlled and regulated pharmacy instruction. In some institutions, the administrative function seems to have ended with the selection of certain existent courses to constitute a pharmaceutical curriculum and the designing of a distinctive diploma. Other medical colleges, either initially or later on, had a special but subsidiary department of pharmacy operating as a separate unit. Occasionally a teacher with pharmaceutical background would be designated director of the school or department of pharmacy.

Pharmacy departments integrated with university or college naturally followed the administrative pattern of such institutions. As noted in the chapter on the establishment of schools, pharmacy sometimes started as a department under science, or letters and science, growing into a more autonomous status as schools and colleges with the passing decades. But schools only nominally affiliated with universities, a group that became larger after the turn of the century,[7] were administered primarily as association-schools rather than as part of a university. In typical form this involved policy differences from matriculation to graduation.

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7 - Examples of such schools were the California College of Pharmacy, Buffalo College of Pharmacy and the Chicago College of Pharmacy.

James H. Beal said at the end of the century: "Several of those which are reported as department schools are only nominally such, since they have their own boards of trustees and conduct their business affairs independently, except at graduation day, when the degrees and diplomas are conferred by the head of the university or college of which they are rated as departments."[8]

It would be misleading to consider "affiliated" schools only as a type, for the animal may be neither fish nor fowl. In one school the students might never see the campus of their supposed alma mater, except at graduation time, if then. At another time or another school, the students would take some general work in the parent institution, and the policies of the pharmacy school itself would hew to the university line as closely as finances permitted. The financial qualification should not be minimized, for if "affiliated" schools had a common denominator it was their exclusion from the regular budgetary provisions of the parent institution, remaining self-reliant on student fees and infrequent gifts.[9] The table on the establishment of schools (p. 75) shows that affiliates not infrequently had a different status in different decades—changing affiliation, moving more closely into the structure of the parent institution, or splitting off as an independent venture.

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8 - James H. Beal, "Report on American Colleges of Pharmacy," Proc. Amer. Pharm. Assoc., 46: 513-16, 1898.

9 - For comments on the general nature of loosely affiliated schools see E. S. Bastin, "Pharmaceutical Education," Western Druggist, 10: 403, 1888; "Colleges of Pharmacy or Medicine as Appendices to 'Universities'," Pharm. Rundschau, 6: 256-58, 1888; and E. Kremers, "The Teaching of Pharmacy...," Drugg. Circ., 51: 72, 1907.

While the state universities led the field in maintaining standards, laboratory facilities and the like, it sometimes required strong willed adminstrators to keep pharmacy from becoming an academic step-child. The first dean of pharmacy at the University of Minnesota, for example, writes poignantly of the beginnings in the 1890's. "I believe," he says, "had it not been for the encouragement, passive though it was at first, of these two foremost men in the University administration [President Northrop and Regent John Pillsbury], the College would not have survived... It was through their aid that a room was provided for the College, but a small one, and which had to serve all purposes, including lecture and laboratory, for the several subjects of the curriculum except chemistry, materia medica and botany. Those who created the College had no real conception of what a college of pharmacy should be... I literally went begging of unfriendly and unwilling departments [to get a curriculum together]... Such office and stenographic assistance as I needed I paid for myself."

Nor did Dean Wulling find apathy only in the University, for pharmaceutical support came mainly from progressive practitioners and the State Board of Pharmacy.

"The fact then existed," he continues, "that most of the registered pharmacists were not pharmacists at all and had no pharmaceutical training nor any sympathy for a real training in pharmacy... It was a fact that the graduates of the first years had the greatest difficulty in finding positions because of the general prejudice against them."[10]

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10 - Frederick J. Wulling, "The College of Pharmacy of the University of Minnesota--Then and Now," J. Amer. Pharm. Assoc., 17: 994 f., 1928.

Dedicated administrators who believed in pharmacy as a "cause" played a role in universities reminiscent of the early association schools, although the fight was carried on at a different level and within a different academic concept. At the university it was not intrusion from related fields that had to be fought, but cooperation that had to be sought. Within pharmacy itself, on whatever ground administrators forged a school, usually they found the same enthusiastic support from the minority, the same apathy or hostile suspicion from the uneducated and unaspiring majority.

Significantly, Wulling's article quoted above bears the subtitle: "How a College of Pharmacy Acquired a Scholastic, Financial and Administrative Rank on a Par with that of Other Schools and Colleges of the University." The editor felt sure it would be "inspiring and helpful to those who have not yet secured similar recognition."[11]

Although recognition gradually came, the administrator's ambitions were necessarily restricted by the few students he represented. Many students found more attractive the institutions that opened the door to a pharmacist's license through "knowledge gained rapidly, easily and at little cost." But the very existence of a state university department did not hinge on student enrollment, as it did in most private institutions.

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11 - Wulling, "The College of Pharmacy of the University of Minnesota--Then and Now," J. Amer. Pharm. Assoc., 17: 994 f., 1928.

True enough, the Board of Trustees at Purdue had warned that they would maintain a school only if "sufficient encouragement be given in form of application for admission." Yet they decided in 1884 that the first class of seven students was "sufficient encouragement."[12]

Administrators in private universities were more vulnerable to the law of supply and demand. At both Cornell and Vanderbilt the pharmacy department was eventually crushed between two pressures: a draining off of students by low-standard schools on the one side, and a tendency to bring every department into the general framework of the university's standards on the other. Chancellor Kirkland reviewed the chronic problem before the Board of Trust when Vanderbilt University finally discontinued its school in 1920:

"The attempt of the University during a long term of years to treat pharmacy as a profession seems to have met with failure. The state laws are so lax that druggists find an easy entrance to the profession through practical work in a drug store. One year in the School of Pharmacy gives better preparation than many of them have... Step by step and with great difficulty we have elevated it until it is now on the same plane with the College of Arts and Science..."

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12 - A Brief Account of the First Fifty Years of Pharmacy Education at Purdue, 1884-1934 (Lafayette, 1934), 6.

"One reason [for closing the school] is that the College of Arts and Science has been revising its own admission requirements and is announcing somewhat more rigid demands to go into effect in September 1921. It was natural that consideration should be given at the same time to the more lax requirements of the School of Pharmacy both for admission and graduation. The general sentiment growing out of this investigation is that if Vanderbilt University is to maintain at all a School of Pharmacy its entrance requirements ought to be made strictly coordinate with those of the College of Arts and Science... It would seem, therefore, almost a comedy to outline a department to have a dean, and operate a curriculum for the benefit of half a dozen students."[13]

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13 - From the minutes of the Board of Trust, June 7, 1920, as quoted by the Assistant to the Chancellor, Aileen Bishop, letter of July 1, 1952.

Finances

The dollar sign haunted most administrators outside of the state universities. Few schools were without financial worries at any time during the 19th century. The older schools gained a firm footing, but in the later period "business rivalry" among the schools became intensified.[14]

The estimated annual budget for the Philadelphia College of Pharmacy, presented to the members in September 1846, appeared as follows:

Expense:		Income:	
Ground rent	$225	Annual payments of 70 members	$350
Interest on $3000 at 6%	180	Rent of cellar	75
Taxes	65	Rent of 3rd story	75
Lighting, warming the hall, etc.	110	Rent of 4th story	75
Advertising lectures...	20	Temporary rental of rooms.....	70
Serving notices.....	40	Diplomas	30
		Matriculating tickets.....	15
		Tax on professors.....	75
	$640		$765

This was considered an unusually favorable outlook in contrast to the gloomy financial picture presented just the year before. The crisis had been met by collecting dues in arrears, by asking the lecturers to contribute 12½% of the proceeds from sale of lecture tickets, by transferring funds from the

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14 - For a rather extreme comment, see W. B. Thompson, "The Training of the Shop," Western Druggist, 15: 473, 1893.

American Journal of Pharmacy to the general college treasury, and by a number of members each relinquishing a $100 share of a loan made to the College. Otherwise the "interest on this debt would soon have rendered the college bankrupt..."[15]

At the New York College of Pharmacy the cash balance was $1.01 for the same year covered by the Philadelphia budget above (1846). In 1865 the balance for the year, before payment of taxes and insurance, was $175.93. The income had been $125 from membership dues, $765 from student fees, and $717.16 income from property,—totaling $1607.16.[16]

Other association schools operated on a more modest basis. Most of them depended almost entirely on membership dues and student fees, and there was no clear-cut administrative or financial separation of the school and College.[17]

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15 - "Minutes of the Philadelphia College of Pharmacy," (meeting of September 29, 1845), Amer. J. Pharm., 18: 144-47, 1846, and (meeting of September 28, 1846) Amer. J. Pharm., 19: 154 f., 1847.

16 - Wimmer, The College of Pharmacy, 47, 110 and 123.

17 - Schmidt reported, for example, that throughout the century the Maryland College depended entirely on dues and student fees; Kremers found that at the St. Louis College the student classes were too small to pay the running expenses of the school. (C. Schmidt, The Maryland College of Pharmacy (1841-1894), 7; E. Kremers, "The Teaching of Pharmacy...," Drugg. Circ., 51: 68, 1907.)

The financial stresses created by competition are illustrated by the Chicago College. The "adjustment of the salaries of the faculty" was one reason for friction that led part of the members and faculty of the Chicago College to split off and found a competing school, which affiliated with Northwestern University. This generated severe financial pressure in the 1890's. Some members thought the association-school should be reorganized by forming a stock company. But a determined group led by Albert E. Ebert successfully opposed the idea of converting it into a privately-owned institution. Repeated efforts to unite the rival schools failed. To rescue the school, the members turned to the idea of a university affiliation such as its rival had. The faculty wanted to affiliate with Lake Forest University, but the Trustees—led by Ebert—fought the move on the ground that only affiliation with a state university should be considered. An agreement was finally reached with the University of Illinois in 1896.

The administration now passed from the hands of the College trustees; an arrangement was made, however, whereby an advisory board of pharmacists, nominated by the state pharmaceutical association and appointed by the state university, would keep the profession in close touch with the school. Such advisory committees to the state-university schools were not unusual and have been continued up to the present day. It is noteworthy that during the first eight years as part of the University of Illinois the Chicago school "received no support from the University or the state."[18]

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18 - W. B. Day, The Alumni Record of the University of Illinois, xxviii f.

Student Fees and Teacher Compensation. The main support of the pioneer schools came from student fees, although the lecture hall, library and apparatus usually had to be provided through dues and gifts of members. Ordinarily the compensation of lecturers was directly related to the sale of lecture tickets, although occasionally (as at New York) lecturers managed to negotiate a guaranteed minimum fee. However, the main work and income of the teachers lay elsewhere, for they lectured only two or three evenings per week for a few months out of the year.

Before the Civil War the fees for lecture tickets ranged between $4 and $12 for each series of lectures. A matriculation fee of $2 to $5 was charged, and a graduation fee of $5 to $10. A student not apprenticed to a member of the College was likely to find the costs of the course somewhat higher.

It was not unusual for the price of lecture tickets to vary for different courses in the same school, probably depending upon the estimated demand for tickets and upon the total fee the lecturer wished to obtain. At the New York College of Pharmacy in 1849, for example, chemistry tickets were $7; materia medica tickets $4, and botany tickets $3.50. At the Philadelphia College tickets were priced by the trustees in 1821 at $15 for materia medica and pharmacy and $12 for pharmaceutical chemistry. Apparently members thought the fees were excessive, for a week later the courses were announced at the reduced price of $12 and $10. By 1851 lecture tickets at Philadelphia had been

reduced to a standard price of $8 per course.[19]

In England in the 1840's, where pharmaceutical instruction was having similar meager beginnings, members of the new Pharmaceutical Society of Great Britain and their apprentices were charged the equivalent of $2.50 for the lectures, while non-members were charged $10, according to Procter. There were about 27 lectures in each course, as compared with about 40 lectures at the Philadelphia College at this time.[20]

At Philadelphia, where enrollments were highest, the professors in 1846-47 apparently collected about $475 on the average.[21] At the Maryland College the professors received "such a sum as might be derived from the sale of tickets to the course," but students were so few that College members guaranteed the purchase of at least twenty tickets.[22] At New York the first Committee on Lectures reported to the trustees "that the professors be required to furnish a suitable room and defray all expenses incidental to the lecture courses; that the professors

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19 - "Lectures in the Philadelphia College of Pharmacy. Thirty-first Session of the School of Pharmacy, 1851-52" (adv.), Amer. J. Pharm., 23: 196, 1851; "The Chicago College of Pharmacy," Amer. J. Pharm., 32: 89 f., 1860; "Annual Course of Lectures," J. and Transac. Md. Coll. Pharm., 2 (n.s.): 95, 1861; "Maryland College of Pharmacy" (adv.), J. and Transac. Md. Coll. Pharm., 1 (n.s.): 3, 1860; "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 41: 274, 1869; England, The First Century, 58; Wimmer, The College of Pharmacy, 30, 35 and 47.

20 - William Procter, Jr., "Observations on the Present State of Pharmacy in England," Amer. J. Pharm., 22: 13, 1850; "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 18: 155 f., 1846.

21 - A tax of 12½% on the ticket sales of professors, levied by the College, netted $177.84 from three men, indicating a combined income of about $1422. See "Abstract from the Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 21: 186, 1849.

22 - Schmidt, The Maryland College of Pharmacy (1841-1894), 4.

be paid six dollars for each student attending each lecture course; that the professors have the privilege of admitting to their lectures persons who might not be regular students of the College of Pharmacy."[23] It was not long, however, before the trustees had to liberalize their policy, both by providing a lecture room and making more definite arrangements for remunerating the lecturers.

In the 1830's the College paid its lecturers about $200 per session. But in 1840 times were hard and the two professors agreed to lecture for $100 plus any amount over that resulting from ticket sales. Their incomes that year were $107 and $114; two years later, $30 and $110. By this time Professors Rogers and Griscom rebelled and insisted on a $200 guarantee. Confronted with a crisis, the New York trustees considered giving the lectures themselves, but finally found two men who were willing to lecture without charge beyond what they might derive from lecture tickets. At this turn of events the incumbent lecturers quickly came to terms, but they were discharged anyway.

The fate of L. D. Gale, a lecturer in chemistry, offers another indication of the uncertain tenure and the teaching conditions of the time. When the College moved to newly rented rooms Gale insisted that the trustees pay for moving his apparatus. During the ensuing disagreement, Gale was replaced by Dr. H. Griscom, who would not only supply his own apparatus but transport it himself.

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23 - Wimmer, The College of Pharmacy, 23.

The trustees likewise did not hesitate in 1849 when the well known teacher Ogden Doremus agreed to lecture to chemistry students in his own rooms at $7 per student, plus light and heat. Wimmer reports that Professor Reid, who was thereby displaced, expressed considerable displeasure.

It is safe to say that up to the Civil War teachers were rarely well paid; and where they depended on ticket sales there was no assurance until the session opened whether even a modest stipend would be forthcoming. When the New York College employed lecturers on a salary basis, it was the teacher rather than the College that stood to gain. Student fees totaled $254 in 1836, when the College was paying $200 to each of two lecturers. In 1862 the sale of lecture tickets produced an income of $390, but the College had committed itself to $600 in salaries. Wimmer believes that the first revenue the College gained from lecture fees was a surplus of $151.60 in 1867.[24]

Salaries moved upward in the early 1860's to $300-350, except for the lecturer in pharmacy who received $125-150. After the Civil War professors at New York received $500 to $800. When graded courses were introduced in 1877, the average compensation became $1200. The highest salary up to 1882 was $2000, paid in that year to Professor Froebel.[25]

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24 - Wimmer, The College of Pharmacy, 41, 43, 53, and 125.

25 - All figures on New York salaries have been extracted from Wimmer, The College of Pharmacy, 26, 30, 38, 41, 44 f., 47, 50 f., 61 f., 70 f., 76.

The rise in salary levels probably was influenced mainly by the professionalization of teaching as an American vocation, restricted by the fortunes of the school, and modified by the competence or popularity of a particular teacher; the changes in teacher compensation seem to have little correlation with the teacher's living costs in various periods.[26]

Salaries at the new state university schools were not much higher than those at a strong independent school, such as New York. At the University of Michigan in 1870 Albert B. Prescott, assistant professor, received $1300, while Silas H. Douglass, professor and head of the Chemical Laboratory received $2000. A decade later Prescott, who had become professor and dean of pharmacy, received $2200, while assistant professors and lecturers were paid $1200 to $1600.[27] At the University of Wisconsin in the 1890's professors received $1400 to $2200, while at Purdue the professor of pharmacy in 1890 was paid $900. Instructors at Wisconsin and Purdue during this period were paid $200 to $850, with emphasis on the lower part of the salary range.[28]

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26 - Cf. General Price Index, U. S. Bureau of Census, Historical Statistics of the United States, 1789-1945, L 1.

27 - Joint Documents of the State of Michigan for the Year 1870, vol. III, 202 f.; and for 1880, vol. I, 105 ff.

28 - "Report of the Regents of the University of Wisconsin," in Governor's Message and Accompanying Documents of the State of Wisconsin, various years; and A Brief Account of the First Fifty Years of Pharmacy Education at Purdue, 6 and 11 f.

Although post-war prosperity brought some slight increases in student fees,[29] the apprentice found costs of education not much different from earlier years. In 1870 six association schools charged between $30 and $36 for a year's instruction, which would mean $10 or $12 for the lecture series in each subject. Baldwin University got as much as $45, but had barely more than a third as many students as the most poorly attended association school. Fees in medical and dental schools were more than three times as much, with few exceptions.[30]

Matriculation fees were still $2 to $5, as in the earlier period, and about the same as in schools of medicine. Graduation fees likewise remained $5 or $10, about a fourth to one half as much as that demanded in the average medical or dental school.[31]

Colleges such as Maryland, Massachusetts and St. Louis in 1870 probably had roughly $1000 annual income from students on the average; the New York College about twice that much; and the Philadelphia College five or six times as much.[32]

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29 - "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 41: 274, 1869; Wimmer, The College of Pharmacy, 60.

30 - Report of the Commissioner of Education for 1870, 522-25.

31 - Ibid., 522-25.

32 - See the various fees and the enrollment for individual schools in the Report of the Commissioner for 1870, 524 f. The statement above includes a rough estimate of the number of matriculation and graduation fees that might have been collected.

In 1875 the apprentice in most cities was asked for about the same fees as five years earlier, but the total income of the schools had increased considerably. In the strong schools income appears to have doubled and tripled. There was less difference among these schools now in total receipts, although Philadelphia remained by far the most prosperous.

The Philadelphia College appears to have received about $14,000 in matriculation, lecture and graduation fees; New York, upwards of $8000; and Massachusetts $3600 or more. On the other hand, the small department out at Iowa Wesleyan University, with three students and a tuition of $10 would have had less than $50 to put toward operating expenses.[33]

These calculated estimates do not always correspond to the total receipts from "tuition and other fees" reported to the U. S. Commissioner of Education. In some instances, such as the Massachusetts and Cincinnati Colleges of Pharmacy, the reported income in 1875 corresponds closely to the income one would expect on the basis of enrollment and tuition charges. In other instances, such as the New York, National, and Chicago Colleges of Pharmacy, we find that the reported income from "tuition and other fees" may be 20% to 60% higher than any amount that can be conjured up from the visible sources. One logical explanation is that a number of the Colleges included income from dues, return on investments, or other funds not directly related to the operation of the school.

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33 - Report of the Commissioner for 1875, 775 and 779. These estimates are calculated from the current tuition fees, the graduation and matriculation fees reported five years earlier, and the current enrollment figures.

The following figures reported as "receipts last year from tuition and other fees" should therefore be viewed as rough indications of the relative prosperity of the different schools in 1875, bearing in mind that apparently not all of the institutions used the same bases for calculation.[34]

New York College of Pharmacy	$9151
Massachusetts College of Pharmacy	3975
Cincinnati College of Pharmacy	2500
Chicago College of Pharmacy	2000
Louisville College of Pharmacy	1690
St. Louis College of Pharmacy	1500
National College of Pharmacy	1200
California College of Pharmacy	590[35]
Tennessee College of Pharmacy	500
Baldwin University	200

Of the two private collegiate institutions reporting, Baldwin University had receipts of $200 in the pharmacy department, and we estimated that Iowa Wesleyan had less than $50. In contrast, the association schools averaged $2567--although, as noted, this represents no clear-cut separation of income between College and school. The average income from "tuition and other fees" at dental schools and medical schools was slightly more than $4000 and $4500 respectively.[36]

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34 - Fourteen schools reported academic data to the Commissioner, but only the ten listed gave the total receipts. The receipts for "last year" probably refers to the academic year 1874-75.

35 - Includes a subscription to capital stock.

36 - Calculated from the Report of the Commissioner for 1875, 777 ff.

A decade later matriculation fees were still $2 to $5 in the association schools, and about twice that much in the new university schools. Graduation fees likewise remained $5 to $10, with higher fees the exception. Annual tuition fees had not risen much on the average but the range was wider among schools. Fees of $30 to $40 per year were still not uncommon.[37] The lowest tuition was the nominal amount ($0-$8) charged to residents by a few state-supported institutions. The highest tuition was $65.[38]

A few years later (1888-89) tuition fees were noticeably turning upward. Thirteen of the 30 schools reporting tuition had a minimum annual charge of $50 to $75. An optional course in microscopy would cost about $10 extra; optional laboratory work $10 per month (9 hours per week). Matriculation and graduation fees remained fairly stable, with a few upward adjustments in the latter.[39]

By 1895-96 longer terms, more extensive curricula and additional laboratory work were reflected in the tuition. Twenty-eight of 43 schools reporting annual tuition charged more than $50; all but two charged less than $100 (exceptions: the University of Virginia, $120; Northwestern University, $150). Most of those charging less than $50 were state-supported colleges or universities.[40]

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37 - Wisconsin $0-25, Michigan $25-35, Purdue $8. Charges in some association schools were higher (California $50, Iowa College $46, Louisville College $65, Massachusetts $60, New York College $55, etc.).

38 - Besides a basic tuition of $36 at the Philadelphia College there was also listed a charge of $135, possibly for optional laboratory work. (Report of the Commissioner, 1884-85, 666.)

39 - Report of the Commissioner, 1888-89, 1200. "Prospectus, 1889-1890. College of Pharmacy of the City of New York," 22; cf. H. L. Taylor, "Schools and Colleges of Pharmacy II," Pharm. Era, 45: 264, 1912. Some schools may have minimized student expenses in public announcements.

40 - Report of the Commissioner, 1895-96, 2050 f.

Among 51 schools at the end of the century there were 31 charging a tuition of $60 to $100 per year, with six schools collecting the highest figure. The total cost of an education came to twice this amount (except for a few schools that had a three- or four-year course), plus $20 to $50 extra for matriculation and graduation.[41] An "entire course" in dentistry at this time commonly cost $250 to $350, and an education at most regular medical schools cost $300 to $500.[42]

We have only a fragmentary picture of the total income of the schools at the end of the century. Those that reported "total income" to the Commissioner were:

Massachusetts College of Pharmacy	$14,841
Chicago College of Pharmacy	11,000
California College of Pharmacy	9,500
Pittsburgh College of Pharmacy	7,200
Albany College of Pharmacy	4,728
Cincinnati College of Pharmacy	3,500
National College of Pharmacy	3,500
Cleveland School of Pharmacy	3,200
New Jersey College of Pharmacy	3,000
Brooklyn College of Pharmacy	1,500
Shaw University	696
University of Tennessee	500

41 - For the tuition, graduation fee, and cost of the entire course at each of the 51 schools see the Report of the Commissioner for 1899-1900, 2008 ff.

42 - Report of the Commissioner for 1895-96, 2040 ff. and 2048.

For comparison, the probable income of the two leading association schools may be estimated from reported enrollment and tuition of 1899-1900 and by assuming the same graduation fee as in 1895-96:

Philadelphia College of Pharmacy	$45,000
New York College of Pharmacy	32,500

Special Funds. None of the pharmacy schools of the 19th century was well endowed, and most of them in all probability lived a hand-to-mouth existence from current income. Such income varied widely among the schools in all periods, as seen above.

In 1875 four schools are known to have had productive funds totaling $39,550 and yielding an annual return of $3205. Of ten other schools reporting to the Commissioner of Education two said they had no invested reserves and the others left the question unanswered. It seems probable that few of the latter group would hesitate to report such funds if there were any.

The productive funds and the income realized from them were distributed as follows: Louisville College, $1350 ($80 income); Massachusetts College, $2500 ($175); New York College, $19,700 ($1400); and Philadelphia College $16,000 ($1550). Dental schools at this time probably were worse off than pharmacy, and the endowment of medical education was still in its infancy (approximately $160,000).[43]

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43 - Report of the Commissioner for 1875, 779.

What happened during the next decade shows a dramatic difference between pharmacy and medicine. In 1884-85 two pharmacy schools (New York and Massachusetts) reported productive funds of $23,000, while 31 of the medical schools reported endowments totaling $675,870.[44]

Four years later two pharmacy schools reported a total of only $1200 in such funds: $1000 at the University of Buffalo and $200 at the Massachusetts College of Pharmacy. All four schools that had reported productive funds thirteen years earlier, however, were now (1888-89) proud owners of buildings.[45]

By the end of the century "endowment funds" totaling $19,202 were reported by three pharmacy schools, all of them located in the North Atlantic region. In sharp contrast $1,818,000 in endowments were reported by regular medical schools; $105,000 by schools of dentistry.[46]

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44 - The drop in productive funds reported by pharmacy schools is mainly due to the fact that the Philadelphia College had used its money for a building and equipment since 1875, and the Louisville College, which listed $1350 a decade earlier, now declined to answer the question. See Report of the Commissioner for 1884-85, CCXXIII and 666.

45 - Report of the Commissioner, 1888-89, 1200. These were the Massachusetts, Louisville, Philadelphia and New York Colleges.

46 - Report of the Commissioner, 1899-1900, 1970-1973. The total medical endowment, including the "irregulars," was $2,236,087. It is not clear whether or not the change of terms in the Report for 1899-1900 from "productive funds" to "endowments" means a change in the basis upon which schools reported. Ibid., 1965.

The endowments or "productive funds" of course represented by no means all of the gifts that helped the schools through trying times or helped improve facilities. For the year 1888-89 we have fairly complete data showing that 10 of 34 schools were the beneficiaries of contributions ranging from $25 to $6000, and totaling $8868. That year 34 of the medical schools received gifts totaling $87,139.[47]

In medicine at this time special funds supported five chairs, but there were no endowed chairs in any of the schools of pharmacy or dentistry.[48]

There were funds in 1888-89 for six scholarships in pharmacy: three at Philadelphia, two at the New York College, and one at Buffalo. Although medical schools reported 155 scholarships, two-thirds of these were offered by just two schools.[49]

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47 - Report of the Commissioner, 1888-89, 1200. The sums given to individual pharmacy schools were as follows: Louisville College of Pharmacy, $6000; Louisville School of Pharmacy for Women, $500; Massachusetts College of Pharmacy, $1318; Albany College of Pharmacy, $25; University of Buffalo, $200; Cincinnati College of Pharmacy, $700, and Pittsburgh College of Pharmacy, $125.

48 - Report of the Commissioner, 1888-89, 1201.

49 - Ibid., 1201.

Professor Lucius E. Sayre of the University of Kansas said in 1895 that scholarships deserve more attention in pharmacy than they have received, and he argued against the idea that they would degrade the students. "Much has been said, it is true, in objection to aiding individual students," Professor Sayre observed, "on account of the pauperizing tendencies of such practice; this fear, however, in the speaker's opinion, is not well founded as far as students properly selected are concerned... merit, not poverty, is to be the guide in the bestowal of scholarships..."[50]

Fellowships for "advanced pharmaceutical education and research" in pharmacy apparently were inaugurated in the United States under Edward Kremers at the University of Wisconsin. In 1897 Kremers stated that a stipend pledged by a group attending the 1894 meeting of the Wisconsin Pharmaceutical Association "was as far as I can learn, the first fellowship in pharmacy tendered in any school or college by the friends of such a school." A business depression in the 1890's, however, "put an untimely end to this fellowship." A fellowship in pharmaceutical chemistry also was established at Wisconsin in 1895.[51]

Few if any of the schools received aid from a state or municipality besides those indicated as state-supported schools in the table on page 75.[52] The nature of any exceptions may be exemplified by the Medical College of Louisiana. Its first

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50 - L. E. Sayre, "Scholarships," Western Druggist, 17: 426, 1895.

51 - Edward Kremers, "Report on the School of Pharmacy," Proc. Wis. Pharm. Assoc., 1897, 66 f.

52 - See column 8 of table in the Report of the Commissioner, 1888-89, 1200.

public support came in 1843 when the College was permitted to erect a building on state land. Affiliation with the University of Louisiana brought partial but rather substantial state support for a time, but after 1886 the College apparently had to rely almost wholly upon student fees and bequests.[53]

Among the association schools the Maryland College of Pharmacy considered applying to the legislature for an annual appropriation in 1860, but the members voted against the proposal.[54] The New York College of Pharmacy appealed to the legislature for assistance on several occasions without success. The first petition of the College in 1839 pointed to the burden of maintaining the school for the public benefit, to the need shown by "fatal results" from the "ignorance and incapacity of the Apothecaries," and to the example offered by Europe where "similar institutions have been founded and liberally endowed by the States." In reply to the last appeal of the College, made in 1873, the legislature reminded the members that educational funds were reserved entirely for state colleges.[55]

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53 - Catalogue of the Alumni from 1834 to 1901 Inclusive, of the Medical Department of the Tulane University..., 2 f.

54 - "Minutes of the College," J. and Transac. Md. Coll. Pharm., 1 (n. s.): 228, 1859-60.

55 - Wimmer, The College of Pharmacy, 100 f., 103, 113, 126, 128.

Physical Plant

Any expansion in physical plant usually meant a sacrifice in time and funds by members of the early Colleges. All of the association schools started in rented rooms, some remaining there for decades. Sometimes a neighborly collegiate institution, scientific society, or the city fathers provided inexpensive quarters.

Here are some typical beginnings: The Philadelphia College started in rented rooms at the German Society Hall. At New York the College first shared "a dingy room in the Medical College;" then tried unsuccessfully to get space in a public building; at various times rented space from Columbia College, Lyceum of Natural History and the New Dispensary. The early Chicago College of Pharmacy used rooms at the Rush Medical College and elsewhere. In the early 1840's the Maryland College was permitted to give the pharmacy course in a room of the University of Maryland in return for letting the medical students listen to the lectures. The St. Louis College first held classes at the Academy of Science, later in an office building and a lecturer's medical office. The Massachusetts College gave its first chemistry lectures in a room at the Massachusetts Institute of Technology, and utilized various other rented rooms in the early period. The Cleveland School of Pharmacy began in a room provided by the municipal council in City Hall. The one proprietary school whose beginnings are on record, the Louisville School of Pharmacy for Women, was housed in the drugstore of its chief promoter.[56]

56 - England, The First Century, 65; Schmidt, The Maryland College of Pharmacy (1841-1894), 3; Wimmer, The College of Pharmacy, 25 and 96; The Cleveland School of Pharmacy (anonymous essay, MS, Kremers Reference Collection), 1; E. G. Wallace, "Women in Pharmacy II," Pharm. Era, 45: 103, 1912; E. Kremers, "The Teaching of Pharmacy," Drugg. Circ., 51: 70 f., 1907.

The Philadelphia College became the first to have its own building, one of a list of "firsts" that can be credited to it. The members erected the Zane Street Building in 1832 with $6300 raised by subscriptions to a College loan at 6% interest. By the early 1840's the College was stumbling beneath the burden of $7800 indebtedness. A series of shrewd moves by a special Committee on Finances appointed from among the members reduced the debt to $3000 within two years. Members of the College relinquished 26 loan shares ($2600), and in recognition of this generosity they were absolved from any further contribution to the College. Other members contributed $242 in donations.[57]

By 1868 the College was able to break ground for the larger Tenth Street Building, costing $34,650. This was financed by sale of the Zane Street property and by a private subscription, which was "completed by retail druggists of the city."[58] Adjacent lots were eventually purchased, upon which a laboratory building was erected in the rear of the original building in 1881 and a six-story addition was erected in the front in 1893.[59]

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57 - "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 18: 144-47, 1846 and 19: 154 f., 1847; and England, The First Century, 81, 98 f.

58 - England, The First Century, 146.

59 - Ibid., 167.

The road taken by the New York College to a school building of its own was neither so direct nor smooth. A daring administration took the first step in 1834 when, with a total surplus of $56.69, it resolved to issue stock to buy a lot and erect a building costing $12,000. This building was rented out, the income helping to rent a room for the classes of the school and meetings of the College. Shortly thereafter the trustees discovered that the College charter gave them no right to issue stock, own property or mortgage it. After this legal tangle had been straightened out, the charter expired in 1856. In a surprise move James S. Aspinwall, College treasurer and a principal stockholder, called upon the College to pay off its stock, then foreclosed the mortgage, demanding the principal and all accrued interest immediately. There were other able business men in the College, however, who thwarted the scheme by raising money to pay off the mortgage. Even so, Aspinwall brought a lawsuit against the College, which it won after a prolonged legal battle. It may be noted that Mr. Aspinwall was not re-elected treasurer.[60]

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60 - Wimmer, The College of Pharmacy, 98 f, 100, 115 f. During this period the College had a class of "contributing members," who qualified through the purchase of four stock certificates or more, rather than through any connection with pharmacy. These members could vote for officers and trustees but could not hold office.

In 1868 this building, which had brought so much trouble, was sold profitably for $25,000. Classes were now conducted in space rented at New York University for $1700 per year. By 1878 the College was ready to buy a building for its own use, having solicited $10,000 from New York pharmacists. The members of the German Apothecaries Society proved to be especially liberal supporters. Together with the proceeds from the first property, this permitted an investment of $26,000 in the Twenty-Third Street Building.

Three years later another alert treasurer, Starr H. Ambler, one of the school's alumni, was able to make off with all College funds, totaling $6500, which he lost in a business failure. The College lawyer again went into action and managed to retrieve $4400.

Under an able new treasurer, who had contacts with many wealthy men, the College raised funds for building a new and larger home for the College on 68th Street. The building, opened in 1894, cost about $140,000, of which $30,000 was contributed by New York pharmacists. The trustees had reason to be proud of the school, which they modestly termed "the best equipped institution of the kind in the world."[61]

Few schools were as fortunate as those of the Philadelphia and New York Colleges. Apparently the only other school operating in a building of its own by the late 1870's was the Maryland College of Pharmacy, which acquired a grammar-school building from

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61 - Wimmer, The College of Pharmacy, 98,100, 132, 135, 140 ff.

the city of Baltimore in 1876.[62]

At least four other schools acquired buildings during the next decade, making a total of seven, which listed the value of "buildings and grounds" in 1889 as follows:

Philadelphia College of Pharmacy	$110,000
New York College of Pharmacy	70,000
Massachusetts College of Pharmacy	65,000
Maryland College of Pharmacy	35,000
Louisville College of Pharmacy	21,000
Cincinnati College of Pharmacy	20,000
National College of Pharmacy	5,000[63]

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62 - C. Schmidt, The Maryland College of Pharmacy (1841-1894), 13; Report of the Commissioner, 1875, 779; and 1880, CLIV.

63 - Report of the Commissioner, 1888-89, 1200. In addition, the Chicago College of Pharmacy listed a valuation of $50,000 on a building which it undoubtedly did not own. (Cf. Twenty-Sixth Announcement of the Chicago College of Pharmacy (1888-89), 7.) W. B. Day states that during discussions of various schemes to raise money for a building, the College members had an offer from J. H. Clough, who owned a vacant lot, "to erect there a suitable building if the society would lease it for a term of years. The offer was accepted..." (The Alumni Record of the University of Illinois, 1921, xxviii.)

The real estate valuations of the eight pharmacy schools total $376,000, an average of $47,000. Forty-nine of the regular medical schools at this time reported property valuations totaling $2,523,000, an average of $51,489. Only two of 26 dental schools reported buildings, which had a total value of $35,000.

Pharmacy schools that were an integral part of a university or collegiate institution naturally occupied quarters in one or the other building owned by the parent institution or the state. The adequacy of such quarters varied widely, although it may be said that laboratory facilities were more adequate than those of independent schools, on the average. Obtaining first-rate physical facilities especially for pharmacy was an uphill fight for administrators on many campuses; and the day of fine university buildings devoted exclusively or mainly to pharmacy was still in the future at the close of the century. The facilities offered by the university at large, however, gave both school and students an important advantage. Buildings and grounds owned by 14 of the pharmacy schools at the end of the academic year 1899-1900 were valued at $791,042. Regular medical schools reported $10,226,997 in such property; dental schools, $1,276,500.

Significantly, the region having the fewest pharmacy schools in relation to population had the schools that were strongest financially. Just three schools in the North Atlantic states held more than half the total dollar-value of property reported in the United States. Here is the regional distribution of the reported dollar-value of buildings and grounds:

North Atlantic	$468,542
North Central	145,000
Western	120,000
South Atlantic	73,500
South Central	20,000

The 14 schools represented are:[64]

New York College of Pharmacy	$204,242
Philadelphia College of Pharmacy	175,000
Northwestern University	75,000
Massachusetts College of Pharmacy	69,300
California College of Pharmacy	60,000
College of Physicians and Surgeons	60,000
Cincinnati College of Pharmacy	35,000
Louisville College of Pharmacy	20,000
Maryland College of Pharmacy	20,000
Pittsburgh College of Pharmacy	20,000
National College of Pharmacy	15,000
Albany College of Pharmacy	3,487
Shaw University	2,500
Brooklyn College of Pharmacy	1,500

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64 - Report of the Commissioner for 1899-1900, 1970-1973 and 2008 ff.

A visitor to a typical association school, before the 1870's, found a rather modest array of equipment. The room, or rooms, had been fitted out with benches to seat the apprentices on lecture nights and the members at business and conversational meetings. One or two pot-bellied stoves fought off the chill of winter. Book-laden shelves along one wall held the College library, by the 1870's often consisting of several hundred volumes, or in the most prosperous schools even one or two thousand volumes housed in a special room. Here, too, was the "cabinet," containing specimens of crude and prepared drugs. In cupboards and closets one found a jumble of demonstration apparatus, belonging to the College or the lecturers--or to both.[65] As early as 1830 the Philadelphia College had raised a loan of $1000 for such demonstration apparatus, because "the interests of the college are inseparably connected with the respectability of the school of pharmacy..."[66] But in this, too, the Philadelphia College was exceptional. At New York in 1869-70 E. R. Squibb, who was lecturing in pharmacy, "came with his horse and wagon, accompanied at times by his assistant, Mr. William G. Rothe, but invariably he brought boxes containing apparatus, chemicals and galenicals which he used for illustrating his lectures and making experiments before the student body."[67] All of the "movables" owned by the New York College in 1875 were appraised at $3166; about thirty years earlier the appraisal had been $1000.[68]

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65 - Concerning the libraries, museums, and laboratories, see the chapter on "Teaching Tools," p. .

66 - "Minutes of the College," J. Phila. Coll. Pharm., 1: 22, 1830.

67 - Wimmer, The College of Pharmacy, 62.

68 - Ibid., 106 and 130.

By the end of the ninth decade a few schools reportedly had as much as $20,000 invested in scientific apparatus alone; others only a few hundred dollars. The average for fourteen of the schools was $7382, representing a total of $103,350.[69] The average of 49 medical schools from which data are available is $4780, representing a total of $215,100.[70]

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69 - For more detailed information on scientific facilities, see the chapter on "Teaching Tools," p. 325.

70 - Based on data given in the Report of the Commissioner, 1888-89, 1200. The state university schools made it a policy not to report such data, since they used the apparatus and facilities of various departments.

Degrees and Licensure

An uneasy concern about the degrees to be granted bothered administrators throughout the century. Before the 1870's it was a matter of some pride--perhaps not unrelated to the lack of degrees among administrators--that the schools were not creating a separate class in pharmacy with "aristocratic titles." After competition became keener and pharmaceutical education was less of a family affair, the old simplicity gave way to degrees that were both more diverse and imposing.

When the first school began in Philadelphia, the trustees felt that the satisfaction of having attended a course was enough, without the trappings of degree and diploma. This decision might have been dictated in part by the clamorous objections in 1821 to setting some apothecaries and apprentices apart as Masters of Pharmacy, the degree proposed by the University of Pennsylvania. Indeed some of the 16 apothecaries who did receive the degree as an honorary one are said to have taken unfair commercial advantage of it.[71]

Five years after the founding, members of the Philadelphia College finally agreed that students who had served an apprenticeship, attended the courses of lectures twice, and passed an examination, should be known as graduates of the College.[72]

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71 - It is sometimes stated or implied that the University also gave this degree in course. Although that had been the intent, Wilbert conducted "a careful review" of the minutes of the Board of Trustees and of the Medical Faculty and concluded that the only other Master of Pharmacy was conferred in 1823 upon one graduate of the Medical Department, who had graduated in 1820. (M. I. Wilbert, "The Beginnings of Pharmacy in America," Amer. J. Pharm., 77: 408 f., 1907.)

72 - Ibid., 409.

"Our diploma...bestows no title," the College president stated, "for it was the design of the college to avoid any name, which may hereafter acquire a peculiar meaning, and become the designation of a new class analogous to the English apothecary. In attempting to avoid this danger, it has committed what may perhaps be esteemed a blunder, by establishing a distinction without giving it a specific name."73

As other colleges were established they followed the example of Philadelphia up to the 1870's, in furnishing successful students with a simple certificate of graduation. Although the "Graduate in Pharmacy" diploma (Ph. G.) was never intended as an academic degree it became a modest and distinctive equivalent.

In 1866 Edward Parrish, recently secretary of the Philadelphia College and now professor, stressed the lack of pretense and sham vanity in the designation: "Our plain republicanism in America has happily abolished the aristocratic titles in which many Europeans delight," he told the American Pharmaceutical Association, "and it is equally proper that we should confine ourselves in the circles of science and professional learning to those titles which convenience calls for."74

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73 - Daniel B. Smith, "Address Delivered by the President...," Amer. J. Pharm., 1: 257, 1830.

74 - Edward Parrish, "A Discourse on Titles, Etc.," Amer. J. Pharm., 39: 242, 1866.

Parrish had been incensed by a friendly physician who suggested that he get an "M. D." degree, since "it would be very promotive of your reputation." Parrish had the greatest disdain for any such pompous step--although many others would have felt differently--and commented, "As if to cure any undue estimate of this title [of M. D.], it can be had from legally authorized Colleges almost for the asking."[75]

If the "Ph. G." also was not too difficult to obtain, neither did it display false or borrowed elegance. The typical student and what he was taught will be viewed mainly in the chapters on "The Student" (p. 250) and "Instruction and Experiment" (p. 373). It can be said in general, until after the Civil War, that the diploma represented attendance of lecture series in chemistry, pharmacy and materia medica--repeated for a second season (paralleling the ungraded courses in medical education); the writing of a thesis; the passing of an examination; and above all an apprenticeship that was supposed to cover four years.[76]

Since the heart of an association school was the apprenticeship, administrators faced a delicate question. "Graduate in Pharmacy" certified a man, informally, as an able, well-rounded pharmaceutist. Yet, some of the most prominent members of a college were "druggists," whose apprentices may have served in wholesale and manufacturing activities,

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75 - Edward Parrish, "A Discourse on Titles, Etc.," Amer. J. Pharm., 39: 242, 1866.

76 - Daniel B. Smith, "Address Delivered by the President," Amer. J. Pharm., 1: 257, 1830.

rarely seeing a physician's prescription. The Colleges at Baltimore, Boston, and probably also at St. Louis, finally decided that only apprenticeship in a pharmaceutist's shop could lead to graduation in pharmacy. The druggist's apprentice who completed requirements in these schools, at least in the 1860's, merely received a certificate of proficiency.[77]

Probably this became a major issue only as the numbers and the specialization of druggists grew, for the editor of the American Journal of Pharmacy, in 1867, believed that Maryland had become "the first of our Colleges drawing the distinction between Apothecaries and Druggists."[78]

Although the Philadelphia College did not draw a distinction between the apprentices of druggists and pharmaceutists, and its doors were open to all, the granting of a diploma of graduation was quite another matter. Edward Parrish remarked that "No importer, drug broker, drug miller, herbalist, or perfumer, who is not at the same time a practicing druggist or pharmacist, would lay claim to send an apprentice here with a view to obtain a diploma."[79]

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77 - John M. Maisch, Report on Legislation Regulating the Practice of Pharmacy in the United States (Philadelphia, 1868), 14.

78 - Ed. Dept., "The Approaching Lecture Season," Amer. J. Pharm., 39: 476, 1867.

79 - Edward Parrish, "On the Relations of the Several Classes of Druggists and Pharmacists to the Colleges of Pharmacy," Amer. J. Pharm., 43: 484, 1871.

Whether even the druggist's apprentice should receive the regular diploma became a live issue at Philadelphia as it had at Baltimore and Boston, but the trustees finally decided against making a distinction. Perhaps it was partly because a pharmaceutical laboratory opened for students now fulfilled the desire of some members that instruction "include sufficient practice on the part of students from wholesale stores to remove all objections to the issue to them of the same diploma as to those who have had the required practice in a dispensing store."[80]

As conditions changed in retail pharmacy, as laboratory work developed in the schools, and new problems intruded, the issue of discriminating between the apprentices of American druggists and pharmaceutists lost its importance and was forgotten.

A more basic change of policy in the granting of degrees was foreshadowed in late 1870 when trustees of the Maryland College of Pharmacy resurrected the Master of Pharmacy as a degree to be conferred upon graduates in practice at least five years (reduced to three years in 1871) who gave evidence of such advancement in the sciences of their profession "as the body of trustees may require."[81] Here was the pharmaceutical counterpart

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80 - Edward Parrish, "On the Relations of the Several Classes of Druggists and Pharmacists to the Colleges of Pharmacy," Amer. J. Pharm., 43: 534, 1871; Maisch, Report on Legislation Regulating the Practice of Pharmacy, 14.

81 - Schmidt, The Maryland College of Pharmacy (1841-1894), 7; This might be considered the first professional degree offered by an American school of pharmacy, although Maryland did not confer the degree for a prescribed course until 1901 (H. P. Hynson, "Historical Notes on Degrees," Drugg. Circ., 51: 80, 1907).

of a practice followed by nearly all regular collegiate institutions in bestowing the Master of Arts "in course." Until late in the 19th century it "practically allowed every graduate of three years' standing, who made application for it and paid the fees, to receive his master's diploma."[82]

Either because of discriminating trustees, or because of the strength of the opposition, a much more conservative policy was followed at Maryland in granting the Master of Pharmacy than was ordinarily exercised by institutions of higher learning in granting the Master of Arts. While the Maryland College had 550 graduates up to 1894, according to Schmidt only six of these received the Master of Pharmacy and fifteen the Doctor of Pharmacy. To be eligible for the Doctor's degree the graduate had to be in practice at least ten years (instead of three, as required for the "M. P.") and achieve a higher level of scientific attainment and service to the profession.[83]

When these degrees were inaugurated in 1870 the College also abandoned the term "licentiate in pharmacy," by which it had designated graduates, and adopted instead the common appelation "graduate in pharmacy."[84] The modest pattern of merely graduating in pharmacy had always been violated by the aberrant degree of Master of Pharmacy conferred at the Medical College of Louisiana; but pharmacy graduates were few at the remote Southern school and this unwelcome practice had been mostly ignored by the association schools, at least in public print.

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82 - Dexter, A History of Education, 295. The demise of the "A.M." as a degree not representing actual postgraduate work began when Yale abandoned the practice in 1874.

83 - Schmidt, The Maryland College of Pharmacy (1841-1894), 7.

84 - Ibid., 7.

There was real cause for concern, however, when a leading Western university, the University of Michigan, began to graduate students as "Pharmaceutical Chemist" (Ph. C.) in 1869. The editor of the American Journal of Pharmacy, which was published under the aegis of the Philadelphia College, said he would "cheerfully give place" to the list of Michigan graduates and announcement of the course. But he had serious reservations about Michigan's granting a diploma and distinctive title.

"We are not well assured," said the editor, "of the preliminary requirements of this school as regards practical training in the shop, and hence do not know the real value of the diploma granted. In this country the words 'pharmaceutical chemist' have no meaning beyond the other terms used to express the business or profession of a pharmaceutist. But in England they apply only to the members of the Pharmaceutical Society who have complied with the Act of Parliament, and can be used by no others under penalty. If the Michigan students are apothecaries who go there from the shop to get their laboratory education it is all well, but if any one without other training in pharmacy than is obtainable at the University School is pronounced a qualified apothecary, it should be known and appreciated."[85]

In a letter of reply Dr. A. B. Prescott, the assistant of Professor Douglass, wrote: "No requirement of training in the shop is made; either for admission to the course or for graduation.

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85 - Ed. Dept., "University of Michigan School of Pharmacy," Amer. J. Pharm., 41: 472, 1869.

Our school believes it to be quite as well for the young pharmacist, better for his employer, and far better for the public that scientific preparation for the drug business should precede experience in it."

This confirmed the editor's worst suspicions, and he commented: "This is all well enough as regards the preparation of the student for his pharmaceutical duties, but to give a diploma to a student intimating that he is a pharmaceutical chemist, which means an apothecary or pharmaceutist, when he has no practical familiarity with drugs and with shop experience, is not right. The point of the matter is whether the latter classes leave the University and offer themselves as qualified clerks, or whether they enter as beginners? In any case the school authorities should adopt some other title for their diploma..."86

Thus two entirely different concepts of pharmaceutical education clashed, embroiling administrators and educators in controversy for the rest of the century. It eventually changed the entire orientation and scope of American pharmaceutical education.

In this initial sparring it will be noted that the spokesman for the Philadelphia College, leader of the association schools, scored no point against the University of Michigan school because it was not under the control of pharmacists, and even

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86 - Ed. Dept., "University of Michigan School of Pharmacy," Amer. J. Pharm., 41: 575, 1869.

implied a welcome to the extension of pharmaceutical education. The really shocking fact was that a new degree would designate a special class of pharmaceutists who were not necessarily educated as such (i.e., lacked apprenticeship). That the University offered an unheard of range of facilities and courses to American pharmaceutical education could not be considered the pivotal point.

This attitude rested on a firm foundation of traditional circumstances and assumptions. College administrators considered graduation in pharmacy as a warrant for a certain competence in practice that could not be assured by apprenticeship alone---but not as an excuse for setting men apart by special titles that might be misleading or pretentious. With no state licensing laws and practically no effective local regulations, graduation in pharmacy---of whatever designation---testified, in lieu of a license, to a young man's skill and competence. This competence was to be assured by an apprenticeship, whose meaningfulness and usefulness could be extended by didactic instruction. Thus it was easy for administrators to see that designating those who lacked the core of pharmaceutical education---the apprenticeship---as pharmacist of any kind would break down the standards of full qualification that had been erected with so much toil and trouble.

The president of the American Pharmaceutical Association saw the issue clearly. If universities and medical colleges would not yield, then pharmacists were obligated to seek laws in the public interest to maintain standards, as distasteful as that might be to real Americans.

At the 1870 meeting President E. H. Sargent reported that "several of the Universities and Medical Schools of this country are now giving special instruction in Pharmacy, and that in some diplomas are awarded for proficiency in this particular branch of study. A feature complained of, and one likely to create trouble hereafter, is that a student may be graduated as a Master in Pharmacy without having had any experience whatever in the practical work of the shop, thereby unsettling our notions of what constitutes a pharmacist, and also unsettling the value of a diploma...If Universities are to confer degrees in Pharmacy without requiring the necessary qualification, or if they are to be their own judge of what constitutes qualification, the teachers themselves being ignorant of what should be required, then it is time for earnest work on our part, and for the establishment by law of what an Apothecary shall know and be capable of doing.

"Our Colleges of Pharmacy may close their doors," the president maintained, "if Medical Colleges are to be allowed to confer the title of Graduate in Pharmacy upon students who have never studied Pharmacy properly, nor had a pharmacist for a teacher. It is not possible to prevent this by the laws now in force, each College and University in this free land having the right to fix its own standard for any title it may choose to confer. We must therefore defend ourselves if we think defence is needed, until such time as legislation can be obtained to protect us."[87]

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87 - E. H. Sargent, [President's Address], Proc. Amer. Pharm. Assoc., 18: 37 f., 1870.

Other speakers on other occasions spoke out against deviations from the right path. But the interests represented in pharmaceutical education proved too divergent to permit effective enforcement of any unifying standards during the century. In the granting of degrees, as in more basic policies, exceptions from the old pattern were eventually to become the rule.

Perhaps the first American institution to introduce the degrees of Bachelor of Pharmacy and Doctor of Pharmacy in course was the Georgetown College in Washington, D. C., which opened a short-lived pharmacy school under its Medical Department in 1871. Opposing this intrusion, John M. Maisch of the Philadelphia College said that pharmacy should "look upon the conferring of pharmaceutical degrees by strictly medical educational institutions... with the same favor with which we should regard the attempt of a college of pharmacy to confer the degree of Doctor of Medicine, honoris causa or otherwise."[88] In 1872 the delegate from the Georgetown school was denied a seat at the meeting of the American Pharmaceutical Association. Although the Proceedings do not so state, Hynson said "it is known to those still living, who were present, that the objection arose solely on account of the character of the degree, doctor of pharmacy, conferred by the institution Dr. Hickling represented."[89]

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88 - Ed. Dept., "Pharmaceutical Degrees by Medical Colleges," Amer. J. Pharm., 44: 189, 1872; Anne D. McLaughlin, letter of June 30, 1952, quoting the Georgetown College catalog, 1870-73.

89 - H. P. Hynson, "Historical Notes on Degrees," Drugg. Circ., 51: 80, 1907.

Administrators were even more alarmed when the National College of Pharmacy, founded the next year under pharmaceutical auspices, followed the lead of its medical competitor in the same city by also awarding the Doctor of Pharmacy degree in course. Then the Tennessee College of Pharmacy, opened in 1872, followed suit.

Feeling ran high against the policy of the two schools. The Doctor of Pharmacy degree offered by the Maryland College even earlier (see page 178), was viewed in a different light. It was accepted as a kind of honorary degree, for only a Graduate in Pharmacy of superior attainments over a period of years might receive it.[90]

Edward Parrish of Philadelphia spoke for an even less restrictive policy in 1871 when he said: "A degree of Doctor of Pharmacy seems appropriate to place our profession on a par with those of medicine and of dentistry. This has already been granted to a few distinguished pharmacists by the Maryland College of Pharmacy, but would seem well suited to designate all graduates in pharmacy who have devoted themselves creditably to the legitimate practice of their profession for a term of years. A title of this kind would hardly seem pretentious if held in reserve by the Colleges until their graduates had attained a well recognized professional standing."[91]

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90 - H. P. Hynson of Baltimore recalled, however, that the honorary degree was conferred upon some members of the College who had not graduated in pharmacy (H. P. Hynson, "Historical Notes on Degrees," Drugg. Circ., 51: 80, 1907).

91 - Edward Parrish, "On the Relations of the Several Classes of Druggists and Pharmacists to the Colleges of Pharmacy," Amer. J. Pharm., 43: 535, 1871.

Whether Parrish spoke for himself or his trustees we do not know; in any case we hear not even a hollow echo of his ringing cry four years earlier on behalf of "plain republicanism" and against "aristocratic titles."[92]

At the 1872 meeting of the new Conference of the Schools of Pharmacy (f. 1870), the old-line institutions nodded approval to the Master of Pharmacy as a degree awarded to graduates of at least three years' standing who passed a special examination. They likewise approved the Doctor of Pharmacy as a "purely honorary" degree.[93]

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92 - See p.174.

93 - Minutes book of the Conference of the Schools of Pharmacy (MS in Edward Kremers Reference Collection), see proceedings of 1872. The "Conference of the Schools of Pharmacy," as it was always called in the official proceedings, is the same organization commonly referred to as the "Conference of Teaching Colleges of Pharmacy," which Kremers and Urdang State was first used as a title in 1874 (History of Pharmacy, 310). Only a temporary secretary's brief minutes for 1885 are titled Conference of the Teaching Colleges. This 15th and apparently last conference quickly adjourned because of a lack of quorum.

The Doctor of Pharmacy degree in course at the National College brought the members of the Conference into agreement, which was a rare occurrence. They voted unanimously in 1873 to "protest against this as an innovation detrimental to the best interests of pharmacy and respectfully ask the authorities of that college to conform to the usage of the other Colleges[94] of the United States in regard to the title conferred on its graduates."[95] Confronted by another errant member at the next meeting, the Tennessee College of Pharmacy, the members took stronger action, restricting official representation in the Conference to those schools that "confer upon their students the degree of 'Graduate in Pharmacy' on graduating."[96] Conditions in pharmaceutical education being what they were, this naturally had no effect on the policy of the non-conformists.

Still in 1880 all of the association schools except National and Tennessee were granting only the Ph. G. in course.[97] Although the old-line schools thus maintained some uniformity in the graduating degree some wavered on the standards that the "Ph. G." was supposed to represent, which the Pharmaceutische Rundschau unkindly attributed to the "ill-disguised trade spirit" of the Colleges.

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94 - By "Colleges" the members meant organizations operating a school that requires "practical experience in the drug business previous to graduation," the only type of school that could be a part of the Conference. (See constitution in minutes book.)

95 - Minutes book of the Conference of Schools of Pharmacy, 1873 proceedings.

96 - Ibid., proceedings 1874.

97 - Report of the Commissioner, 1880, 734; England, The First Century, 501 ff.

Members of the Conference of Schools of Pharmacy, for example, had agreed to require four years of apprenticeship for graduation. As candidates presented themselves who lacked in the length of apprenticeship, or in age (21), some schools tried to stay within the letter of their pledge by issuing "Certificates of Graduation" and "Minor Certificates," instead of the regular "Graduate in Pharmacy" diploma. Students thereupon presented the certificates to state boards, requesting a pharmacist's license without examination, a privilege extended to graduates under a number of the new state licensing laws. The Illinois Board of Pharmacy refused and brought the issue into the open, threatening not to rate as "satisfactory" the diplomas of any college that persisted in issuing two kinds of certificates. One dean offered the defense that "every American college is doing the same thing."[98]

Such protests went almost unheard as the din of controversy over degrees increased. In the late 1880's additional schools were founded each year; their administrators tended to follow the dictates of their conscience and enrollment book, rather than pharmaceutical tradition. They adopted new degrees and old requirements, old degrees and new requirements.[99]

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98 - "Editoriell. State Boards and College Education and Diplomas," Pharm. Rundschau, 3: 69, 1885.

99 - The editor of the Pharmaceutische Rundschau thought it would be just as well for prospective pharmacists "for the sake of the completion of their professional education, to enter a medical instead of a pharmaceutical college, and secure for a not much larger outlay of time and money the degree of M.D. in place of that of Ph. G." This would offer a choice of careers and higher social prestige. By this comment, however, Editor Hoffman possibly was only baiting a colleague on the Philadelphia Medical Times who had decided it was time to re-unite pharmacy and medicine in the hands of physicians. ("What College Course Offers the Better Chances for Pharmacists, the Pharmaceutical or the Medical College?", Pharm. Rundschau, 5: 274, 1887.)

After the Conference of Schools of Pharmacy collapsed,[100] the effusive discussion of degrees, and standards for them, continued in the new Section on Education and Legislation of the American Pharmaceutical Association.[101] This resulted in what the editor of the Western Druggist termed a "drawn battle," remarking that "The colleges are therefore free, so far as the American Pharmaceutical Association is concerned, to issue whatsoever degrees they please and to whomsoever and under whatsoever conditions.. This question cannot be put out of sight in this summary manner. The colleges will eventually in self-defense find it necessary to agree upon some uniformity in titles and upon the meaning which shall attach to each. 'Ph. C.' has heretofore meant a college graduation without the requirement of experience; 'Ph. G.' has meant college graduation with experience. There is no good reason why this distinction should not be preserved," the editor maintained. "Neither party to the controversy can consistently object to it."[102]

No one objected to the principle; it merely was not observed within the fluid, competitive, loosely organized conditions of American pharmaceutical education. The trend

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100 - See p. 221.

101 - See p. 227.

102 - "Experience Before Graduation" (Editorial), Western Druggist, 17: 364, 1895.

was underscored by The Apothecary, a journal that had counted in 1893 four schools giving degrees without requiring practical experience; in 1895 fourteen schools, as follows:103

University of Illinois	B. S.
University of Wisconsin	B. S. and Ph. G.
Maryland College of Pharmacy	Ph. G.
Ohio State University	Ph. G.
University of Iowa	Ph. G.
Northwestern University	Ph. G. and Ph. C.
Purdue University	Ph. G. and Ph. C.
Scio College	Ph. G. and Ph. C.
Chicago College of Pharmacy	Ph. C. (i.e., "Pharmaceutical Chemist")
University of Michigan	Ph. C.
Vanderbilt University	Ph. C.
University of Kansas	Ph. C.
Philadelphia College of Pharmacy	Ph. C.
University of Minnesota	Phm. D. (i.e., "Doctor of Pharmacy")

Of the old association schools, it will be noted, only the Maryland College of Pharmacy was violating the traditional rule of no Ph. G. without apprenticeship. Some of the university schools were following the lead of Michigan in granting "Pharmaceutical Chemist" as a degree indicative of no practical experience requirement. Others gave "Graduate in Pharmacy," or both degrees without apprenticeship.

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103 - "Editorial," The Apothecary, 5: 55, 1895.

Why certain university schools should adopt "Graduate in Pharmacy" may be traced, at least in some instances, to early years when they required apprenticeship. After apprenticeship dropped out of the picture, the vestigial "Ph. G." still remained.[104]

"Graduate in Pharmacy" retained its popularity as a degree into the 20th century, although it no longer had any definite meaning. Twenty-seven of 39 schools are known to have considered "Graduate in Pharmacy" their standard degree in 1895, although almost a third of the schools believed to have been teaching did not report to the Commissioner of Education in a survey of degrees.[105]

Like the "Ph. G.," the "Ph. C." by no means carried with it standardized requirements, and it is said that Michigan graduates resented the cheapening of the degree in some of the other schools.[106] Only a half dozen schools or so were graduating "Pharmaceutical Chemists" by the mid-90's, but the degree grew quickly in popularity thereafter, being granted by at least 20 schools in 1904.[107]

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104 - In 1887 the Ph. C. at Wisconsin required four years' experience; at Cornell, one year of experience; at Purdue, about 32 months. ("Universitats-Pharmacieschulen," Pharm. Rundschau, 5: 130, 1887; A Brief Account of the First Fifty Years of Pharmacy Education at Purdue, 8.

105 - Report of the Commissioner, 1894-95, 2090 f.

106 - Editorial, "College Degrees," Pharm. Era, 14: 98, 1895.

107 - H. P. Hynson, "Historical Notes on Degrees," Drugg. Circ., 51: 80, 1907. Eight schools are listed as giving the Ph. C. in the tabulation on p. 189; Hynson and other sources give lower figures. C. S. N. Hallberg said in 1897 that 15 schools already were granting the "Pharmaceutical Chemist" degree (Proc. Amer. Pharm. Assoc., 45: 264, 1897).

In 1897 at least seven schools already were bestowing the Doctor of Pharmacy in course, for two or three years' study. A few adopted the logical abbreviation "Ph. D.," which offered obvious advantages to less scrupulous graduates. Others, like the University of Minnesota, used the abbreviation "Phm. D." or "Phar. D."[108] In 1895 the Philadelphia College had adopted the Doctor of Pharmacy degree for a three-year course, followed closely by the New York College; an important difference was that nearly all Philadelphia graduates obtained the "P. D." after the degree became effective (apparently everyone who served an apprenticeship); whereas at New York the Ph. G. was still earned by all but a few in each class.[109] The fledgling Brooklyn College now applied to the legislature for the privilege of granting the Phar. D. for either post-graduate work or as an honorary degree. The New York College and others gave battle at Albany, but the "very exciting contest" terminated in passage of the Brooklyn bill. An interesting postscript appeared in the letters column of the Brooklyn Eagle; said an outraged reader: "In regard to your recent publicity of the conferring of the degree of doctor of pharmacy by Brooklyn College of Pharmacy upon themselves I wish to say that in the opinion of many there never was a more flagrant travesty enacted in the name of education than this..."[110]

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108 - C.S.N. Hallberg, "Chairman's Address," Proc. Amer. Pharm. Assoc., 45: 264, 1897; Report of the Commissioner, 1894-95, 2090 f.

109 - Editorial, "Pharmaceutical Degrees," Amer. Drugg. and Pharm. Record, 28: 146, 1896; England, The First Century, 198 and 563 ff.; Wimmer, The College of Pharmacy, 136; H. P. Hynson, loc. cit., 81.

110 - "Brooklyn Doctors of Pharmacy," Brooklyn Eagle, July 15, 1897, as quoted in Drugg. Circ. and Chem. Gaz., 42: lxxix, 1897; H. P. Hynson, "Historical Notes on Degrees," Drugg. Circ., 51: 81, 1907; Editorial, "Pharmaceutical Degrees," Amer. Drugg. and Pharm. Record, 28: 146, 1896.

Around the turn of the century the trustees of the Maryland College followed the trend and adopted the Doctor of Pharmacy, as its only degree. But the policy was soon modified, according to Henry P. Hynson, then secretary of the College, "owing to the extreme sensitiveness of some members of the faculty and board of trustees." The doctorate was therefore reserved for those "who did more advanced work in botany, assaying and volumetric analysis," until the school affiliated with the University of Maryland after the turn of the century.[111]

Beginning in 1891-92 the University of Wisconsin offered the Master of Pharmacy to "Graduates in Pharmacy" who "satisfactorily complete a course of one full year (three terms) at the University in advanced pharmacy, or in some science or sciences specially allied to pharmacy, and who shall present a satisfactory thesis embodying the results of original investigation."[112] In 1894, a second school, Vanderbilt University, was granting the same degree for one year's advanced work by those holding the degree of Pharmaceutical Chemist (Ph. C.).[113] In 1897 Hallberg counted two other schools that offered the same degree.[114] One undoubtedly was the Philadelphia College, which decided in 1875 to confer the Master of Pharmacy upon graduates

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111 - H. P. Hynson, "Historical Notes on Degrees," Drugg. Circ., 51: 81, 1907.

112 - Catalogue of the University of Wisconsin, 1891-1892 (Madison, 1892), 61.

113 - Report of the Commissioner, 1894-95, 1239.

114 - C. S. N. Hallberg, "Chairman's Address," Proc. Amer. Pharm. Assoc., 45: 264, 1897.

who had practiced pharmacy for at least five years and who presented an original thesis.[115]

The Bachelor of Pharmacy degree (Phar. B.) was a newcomer in the 1890's, perhaps first introduced at the St. Louis College of Pharmacy where it was given to graduates who lacked the apprenticeship.[116] The Cincinnati College of Pharmacy began to confer the same degree in the spring of 1899.[117]

A much more significant development was the introduction of the regular academic degree of Bachelor of Science (in Pharmacy) based on four years of study. This was inaugurated by the University of Wisconsin in 1892, as an optional course to the "Ph. G." curriculum. Four other state schools followed suit in 1895: the University of Michigan, Purdue University, Maine State College and the Alabama Polytechnic Institute, which were joined by the University of Kansas a year later.[118]

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115 - Report of the Commissioner, 1894-95, 2090 f.; "Philadelphia College of Pharmacy," Amer. J. Pharm., 47: 231, 1875. The first "M. P." in course listed by England, however, was not conferred until 1903. The Philadelphia College also conferred the Master of Pharmacy honoris causa since 1887 (England, The First Century, 200).

116 - Report of the Commissioner, 1894-95, 2090 f.

117 - H. C. Freking, "Gleanings from the Early History of the Cincinnati College of Pharmacy," Amer. J. Pharm. Ed., 12: 423, 1948.

118 - George Urdang, "Edward Kremers (1865-1941), Reformer of American Pharmaceutical Education," Amer. J. Pharm. Ed., 11: 648, 1947.

The introduction of a four-year course leading to the B. Sc. by no means met with prompt acclamation either from the average practitioner or from other types of schools. Goals beckoning administrators like Kremers at Wisconsin to take the bold step were the level of pharmaceutical education achieved on the European continent and the opportunity to place pharmacy on a par with other scientific departments of the state university.[119] On the other hand the opposition was somewhat mollified, and the given circumstances in American pharmacy recognized, by still retaining the shorter courses leading to the Ph. C. or Ph. G.

A highly significant by-product of the inauguration of the Bachelor or Science degree was that it opened the door to graduate degrees in pharmacy based on the regular university requirements for the Master of Science and Doctor of Philosophy degrees. The University of Wisconsin scored another "first" by offering the Master of Science degree for pharmaceutical study immediately after the academic degree of B. Sc. in pharmacy was announced.[120] It was granted to "graduates of the Four Years' Course upon fulfillment of similar requirements" to those for the Master of Pharmacy (i.e., a year of advanced work in some science allied to pharmacy and an original thesis satisfactory to the Committee on Higher Degrees).[121] The Doctor of Philosophy, with a pharmaceutical major, was first conferred at Wisconsin soon after the turn of the century.

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119 - G. Urdang, "Edward Kremers, Reformer of American Pharmaceutical Education," Amer. J. Pharm. Ed., 11: 646, 1947; and Edward D. Campbell, History of the Chemical Laboratory of the University of Michigan, 1856-1916 (Ann Arbor, 1916), 12.

120 - See graduate study, p. 457.

121 - Catalogue of the University of Wisconsin for 1894-95, 200.

By 1900 the lack of standardization of undergraduate degrees was becoming worse rather than better, with regard to titles, length of study and content of curricula. One school might require three months of study for the Ph. G.; another, three years. The holder of a B. Sc. might have studied one year or four.[122] The degrees available, to summarize, were: Graduate in Pharmacy, Pharmaceutical Chemist, Doctor of Pharmacy ("Ph. D.," Phm. D., Phar. D., P. D.), Master of Pharmacy (Pharm. M., Ph. M.), Bachelor of Pharmacy, and Bachelor of Science (in Pharmacy). Probably all of these degrees were bestowed as honorary degrees at some places and times.[123]

As schools shifted degree designations, added a second, third or fourth undergraduate degree to their repertoire,[124] and lengthened and shortened the terms, editors began to refer to "degree chaos." The development reflected a keen competition among schools, a wide variation in needs and objectives of the students, and divergent opinion and uncertainty among administrators as to the proper or attainable goal for pharmaceutical education in the United States.

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122 - Scoville, American Pharmaceutical Colleges and Schools, 16.

123 - On Graduate in Pharmacy honoris causa, see Western Druggist, 16: 204, 1894. The pharmaceutical reader occasionally may encounter a curious degree not here discussed, such as the "Pharmacist and Druggist" conferred at the National Normal University in Lebanon, Ohio (Western Druggist, 20: 572, 1898). Note that a given instance of "Master of Pharmacy" may be purely honorary; may represent a year's postgraduate work in residence, with thesis, after a two- or three-year course; or may be "in course" merely by several years of exemplary professional practice by a graduate (cf. 19th-century "A.M."), sometimes also involving a thesis or other special requirement.

124 - In 1897 Hallberg reported that "Eighteen schools grant two degrees, one grants three and one four degrees." (C. S. N. Hallberg, "Chairman's Address," Proc. Amer. Pharm. Assoc., 45: 264, 1897.)

No degree of any kind was needed to obtain a pharmacist's license during the 19th century. Yet, the system of licensure that spread through the states during the last three decades brought a stimulus to education and created new issues for school administrators. The evolution of state regulation and its public and professional significance lies outside the scope of the present study, but the relations of this legal framework to educational policies and problems must be recognized.

While the new state laws failed to recognize any need for formal education, it was of commanding importance for both the profession and its schools that some knowledge of pharmacy now became a prerequisite to practice. How such knowledge was to be demonstrated received widely varying interpretations. By 1880 it became clear that disagreement would center about the question of whether a degree was carte blanche to practice pharmacy. This had been accepted almost universally in medicine before the Civil War, and still in the 1890's only a minority of the states would not issue a medical license upon presentation of a diploma.[125]

Representatives of the pharmacy schools, as customary, were by no means in agreement among themselves. Divided and vocal opinion on the issue prevented action at the Conference of the Schools of Pharmacy in 1880.[126] After the demise of the Conference, debate continued on the platform of the Section on Education and Legislation of the American Pharmaceutical Association.

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125 - Report of the Commissioner, 1892-93, 1620; Norwood, Medical Education, 406.

126 - Minutes of the Conference, 1880 (Kremers Reference Collection).

The influential conservative leader, J. P. Remington, made an eloquent plea in 1891 for licensure by diploma alone. "...It will be a standing reproach," he thundered, "if pharmacy... entirely ignores the diplomas of her institutions of learning." His resolution urging the states to accept diplomas without formal examination met defeat after long and lively debate.

One cogent argument against the plan was that a diploma might mean much or little. Still more importance was attached to the danger in Western states of physicians forcing the legal recognition of medical diplomas in pharmacy, if pharmaceutical diplomas were recognized. C. S. N. Hallberg pointed to the results in Missouri, which "has been over run with doctors working in the drug business."[127]

The American Pharmaceutical Association went on record in favor of examination of all applicants,[128] and although some boards had tightened requirements, about a fourth of all licenses issued in 1897 were without examination. James H. Beal found that at this time only nine states issued licenses solely by examination. The others exempted one or more categories of candidates, mostly hinging on the type of degree or diploma: the diploma representing apprenticeship before graduation; the diploma with experience either before or after graduation; diplomas without relation to experience; and diplomas of medicine. There were also states

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127 - J. P. Remington, "The Recognition of College Diplomas by State Pharmacy Laws," Proc. Amer. Pharm. Assoc., 39: 198, 202 ff., 1891.

128 - Proc. Amer. Pharm. Assoc., 42: 383, 1894.

that accepted apprenticeship alone as the equivalent of a diploma, and this was the sole qualification for a third of all candidates licensed without examination.[129] Three years earlier Hallberg had reported that twenty states recognized the "diplomas of some reputable college of pharmacy" for licensing without examination.[130]

The requirement of apprenticeship prior to graduation for recognition of the diploma gave the association schools at least a nominal "selling point" in some states, although this outmoded discrimination gradually broke down.[131] Competitive advantage rather than educational principle was reflected in the comment of an Eastern educator that since the boards require experience, students "attend institutions which make this provision...To supply what their customers desire," he observed, our colleges "choose to provide drugstore experience."[132]

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129 - James H. Beal, "Pharmacy Laws of the United States—a Comparative Exhibit," Proc. Amer. Pharm. Assoc., 44: 331, 1896; and Proc. Amer. Pharm. Assoc., 45: 269, 1897.

130 - C. S. N. Hallberg, "The Requirements for Graduation in American Colleges of Pharmacy," Proc. Amer. Pharm. Assoc., 41: 276, 1893. In a few states that required examination the testing of pharmacy graduates was said to be "merely a formality." (Minutes of the Conference of Schools of Pharmacy, 1880.) In at least one state, Wisconsin, the graduates were licensed on diploma but a committee was sent by the state association to administer a practical examination before diplomas were conferred. (Catalogue of the University of Wisconsin, 1892-93, 141.)

131 - In Kentucky, for example, the restriction was nullified in 1883 when an angered lady by the name of Bessie White gave the state board a sound legal trouncing when it refused to recognize her "Ph. C." from Michigan, on the ground that it did not presuppose experience. The case was carried through two court battles. (Emma Gary Wallace, "II. Women in Pharmacy," Pharm. Era, 45: 103, 1912.)

132 - Quoted in "Editorial. The Recognition of Diplomas," The Apothecary, 5: 69, 1895.

Some administrators of university schools saw in the state boards, not a tool for bolstering education based on apprenticeship, but a repository for responsibility concerning the adequacy of a candidate's experience, an experience that lay outside their educational program and over which they had little control. In the early 1890's several university schools "deliberately decided that they will no longer assume any responsibility for whatever drugstore experience their students may have had," and dropped apprenticeship from their graduation requirements.[133]

While this interplay of different attitudes and ambitions may well have produced mutual antagonisms among the boards and schools, as Oldberg reported,[134] in some instances the cooperation was all too close. At least interlocking memberships between college boards and state boards and assumed favoritism provided fertile ground for further suspicion and friction.

James H. Beal, one of the best-informed and responsible teachers, wrote to Edward Kremers at Wisconsin that some colleges "might be regarded as appendages to the Boards, or the Boards as appendages to the Colleges." In addition there were quite a few schools that had either a trustee or teacher on the examining board.[135] Another respected teacher, H. H. Rusby, testifies that these were not always innocent relationships:

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133 - "Editorial. The Recognition of Diplomas," The Apothecary, 5: 69, 1895.

134 - Oscar Oldberg, "The Educational Condition of American Pharmacy," Amer. Drugg. and Pharm. Record., 36: 178, 1900.

135 - James H. Beal, letter to Edward Kremers, February 22, 1899 (Kremers Reference Collection).

"In some cases," he maintained, "college faculties captured State boards and tipped off their own graduates in preparation for the examinations. In one notable instance, those graduates who acknowledged their alma mater to be other than that which controlled the board examinations were plucked almost without exception, while those of their classmates who denied any educational relations were as uniformly successful. Many who were sure of handsomely passing one board would not think of venturing to appear before another, notwithstanding that its examinations were on their face easier."136

These were signs that at least one segment of American pharmacy was still more self-reliant than self-respecting. Yet, there were no sweeping charges of corruption and collusion. Probably a more demoralizing influence in education were the cram schools called into being by the state laws.

Registration by diploma and relatively low examination standards both tended to focus the student's attention on "getting by the state board." By the end of the century he had a choice of educational facilities ranging from easy lessons by mail, practically guaranteed to assure a license, up to a four-year course in top-grade universities, with step-wise gradations between the two extremes.137 The competitive pressures generated appear to have more than counter-balanced the increasing number of youths who were led to college doors by the prospect of confronting a licensing board.

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136 - H. H. Rusby, "Fifty Years of Materia Medica," Drugg. Circ., 51: 41, 1907.

137 - On courses of home study, see p. 504.

If the state boards had nailed shut the bottomless well of incompetency in pharmacy they were not in a position to enforce high educational or professional standards. In his address as president of the American Pharmaceutical Association in 1882, Peter W. Bedford assumed the new laws to be "a method only to weed out the utterly incompetent."[138] Near the end of the century Edward Kremers felt that this had been achieved, at the same time putting "the tyro on an equal basis with the better educated and experienced pharmacist."[139]

It was becoming more difficult as examinations stiffened, however, for the mail-order graduate to take his place alongside the holder of a university's Bachelor of Science degree.[140] Compulsory education for licensure would have helped narrow the vast disparity in competence among licensed practitioners, but there were few who could contemplate such compulsion, before the end of the century. Socially-conscious teachers had felt impotent against the "jealous watchfulness over every movement that in the slightest degree really or apparently invades their assumed rights" and the pervasive feeling of danger that lay "in creating a monopoly for the benefit of a favored few."[141]

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138 - P. W. Bedford, President's Address , Proc. Amer. Pharm. Assoc., 30: 590, 1882.

139 - Edward Kremers, "Report of Committee on National Legislation," in Proc. Wis. Pharm. Assoc., 1897, 40.

140 - Wortley F. Rudd, "Pharmaceutical Education," J. Chem. Ed., 9: 275, 1932.

141 -"Editorial Department," Amer. J. Pharm., 21: 191, 1849; William R. Fisher, "Introductory Lecture Delivered in the Chemical Hall of the University of Maryland...," Amer. J. Pharm., 9: 280, 1837.

The United States and England had become notable exceptions among civilized countries, in the 1890's, in not requiring more or less definite courses of pharmaceutical study. Oscar Oldberg, professor at the Northwestern University school, attributed this to the importance attached to unlimited competition in pharmacy, which most peoples did not so highly value.[142]

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142 - Oscar Oldberg, "Can a Minimum Standard of Pharmaceutical Education Be Adopted?", Proc. Amer. Pharm. Assoc., 42: 345, 1894.

V. COOPERATION AND CONFLICT

Trustees of the early colleges at Philadelphia and at New York saw in each other men of like mind and purpose, men to help and be helped in achieving "the same important ends, the advancement of pharmaceutic knowledge, and the improvement of those who may be preparing to commence the business of apothecaries." Early arrangements were made for reciprocal favors in accomodating transfer students.[1] Apothecaries in the 1830's saw with interest in the American Journal of Pharmacy the lively exchange of information and reports between the two colleges.

Later on the pioneer schools at Baltimore and Boston were included in the family circle, and the frequent correspondence between them[2] undoubtedly helped to soften the feeling of isolated struggle and built up a common store of ideas and aspirations. Moreover, graduates of the Philadelphia College, as previously noted, often gained positions of leadership in other cities and felt and expressed the shared educational experience. This circle appears to have been restricted to and held together by common origins, organizational structure, type of membership, and educational ambitions to "round off" the apprenticeship by formal lectures.

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1 - "Minutes of the College," J. Phila. Coll. Pharm., 3: 343, 1832; Wimmer, The College of Pharmacy, 35.

2 - S. M. Colcord, "The History of American Pharmacy," Proc. Amer. Pharm. Assoc., 41: 225, 1893.

After 1852 the leadership groups broadened their intercourse through the annual meetings of the American Pharmaceutical Association. In this formal Association, as in informal association, the main nexus was through the Colleges rather than the educational branch. For the American Pharmaceutical Association never served as an association of schools, as half-assumed by those who overlook the 19th-century meaning of a College of Pharmacy.[3] It was the "Colleges of Pharmacy, or local pharmaceutical organizations" that were entitled to delegates. Among these delegates educational efforts held an important place, since a number of professional problems were rooted largely in the lack of knowledge and competence among dispensers of drugs.

At the conventions not much attention was paid to the several outside groups that made some kind of beginning in pharmacy instruction before 1868, which became a notable year in the history of American pharmaceutical education. None of these institutions tried to register delegates in the American Pharmaceutical Association and quite possibly were not even represented at the meagerly attended meetings. In fact only one, the Medical College of Louisiana, had offered pharmacy instruction before 1865. And it probably won some tolerance by requiring an apprenticeship with an apothecary.[4] The others, as far as pharmacy is concerned, remained isolated, little-known, and either suspended or had few students, until later in the century.

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3 - For example, see H. L. Kendall and C. O. Lee, "College of Pharmacy Associations, 1.," Amer. J. Pharm. Ed., 8: 195-200, 1844, and the clarifying commentary by G. Urdang, "College of Pharmacy Associations," Amer. J. Pharm. Ed., 8: 333-339,1944.

4 - In the 1890's a two-year apprenticeship was still required for graduation, but we cannot be certain about early requirements. (Medical Department of the Tulane University, Catalogue for 1893-94, with Notice of the Course in Pharmacy, 7.)

When the vigorous, innovating University of Michigan opened a pharmacy curriculum, ignoring completely the apprenticeship requirement, the reaction was quite different, as has been noted previously. It caused the greatest uneasiness, resentment, and eventually open hostility. Heretofore there had been no serious challenge from outside the circle of association schools, and comfortably harmonious relations within. Michigan offered a discomfoting display of superior instruction in scope and facilities, simultaneously contradicting a basic tenet of association schools. The threat of change and challenge quite probably helped spark the impulse to form a special organization which would bolster the security and defend the ideals of "true" pharmaceutical education.

The Conference of the Schools of Pharmacy

The call for organization of the Conference of the Schools of Pharmacy issued from the Maryland College of Pharmacy, on April 21, 1870, as the members had directed at a College meeting. The purpose foreseen was "to consult and determine upon the best uniform course of study for those learning the profession of pharmacy, and to recommend the same for adoption in the Schools of the several Associations they represent, to the end that there may be a uniform standard of qualification for all graduating in pharmacy."5

It may not be entirely coincidental that the ground had been laid in Baltimore likewise for the first association of medical colleges just four years before. When the American Medical Association met in Baltimore in 1866, some members of the Maryland College must have been interested observers of the action taken to "earnestly request the medical colleges of the country to hold a convention for thoroughly revising the whole system of medical instruction for the purpose of establishing more uniformity of time and a more systematic course of instruction for the whole."

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5 - The full text of the circular sent out by the Maryland College appears under "Proposed Congress of Colleges of Pharmacy in Relation to Education," Amer. J. Pharm., 42: 281, 1870.

Delegates from seventeen medical colleges met in Cincinnati the following year as the Medical Teachers Association. Several noble resolutions were passed, with the hearty endorsement of the American Medical Association, but received meager support from college administrators. The Association became inactive after only the second meeting, but it got people to thinking about reform in medical education.[6]

Both the nature and the fate of this earliest associative attempt of the medical colleges found a remarkable parallel in the attempt of the pharmacy colleges a few years later. The organizational meeting, "In pursuance to the call of the Maryland College of Pharmacy," was held in the hall of the Maryland College in conjunction with the 1870 meeting of the American Pharmaceutical Association. President Sargent heralded the founding: "A Convention of delegates from the various Colleges of Pharmacy has been called to meet simultaneously with our own," he said, "and I trust this Association will give its encouragement and indorsement to whatever wise measures may be inaugurated for the better education of students in Pharmacy and for the elevation of the standard of qualification necessary to graduation."[7]

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6 - Frederick C. Waite, "The Medical Teachers Association of 1867," J. Assoc. Amer. Med. Colleges, 25: 202 f., 1950. The American Medical College Association (now Association of American Medical Colleges), founded in 1877, was considered a revival of the 1867 Association.

7 - E. H. Sargent, President's Address, Proc. Amer. Pharm. Assoc., 18: 37 f., 1870.

Delegates attended from the Colleges of Maryland, New York, Chicago, California, Philadelphia and Massachusetts, and from the New Jersey Pharmaceutical Association.[8]

The minutes of this first meeting appear in the American Journal of Pharmacy, as well as summaries of most meetings thereafter. Fortunately, however, the official unpublished minutes of the subsequent meetings have been preserved in the Edward Kremers Reference Collection at the University of Wisconsin. These minutes remained unpublished during the lifetime of the Conference as the result of deliberate consideration and decision by members of the Conference on a number of occasions.[9]

The Conference reportedly died at various times prior to 1884.[10] But it actually had a lively, if rather ineffectual, existence up to the 1884 meeting.

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8 - The latter organization had no school and never did take the initiative in founding one. But about this time the Association's president expressed the opinion that "the time will come when New Jersey should have a College of Pharmacy." (David L. Cowen, "Notes on Pharmaceutical Training in New Jersey before 1900," Amer. J. Pharm. Ed., 12: 302, 1948.)

9 - See manuscript minutes in Kremers Reference Collection. A "phonographic reporter" was engaged for at least some of the sessions, but his record is not known to have survived.

10 - See, for example, The Graduate, 2: 35, 1894, and R. P. Fischelis, "Education in Pharmacy," Amer. Drugg., 88: 72, 1933.

At the very first session of the "Conference of the Schools of Pharmacy"[11] in 1870 delegates from the six colleges, and the New Jersey association, acted on a series of questions posed by a committee of the Maryland College of Pharmacy. William Procter, Jr. hastily amended a motion "That there be an educational standard established prior to the admission of any student to attendance on the lectures of Colleges of Pharmacy." The resolution passed reads: "Resolved, That, in the opinion of this Convention, more attention to the preliminary education of those who propose to enter the business of pharmaceutists is needed, and it is earnestly recommended to the Colleges and Societies of Pharmacy to urge their members and the profession of the United States generally to give greater care to this subject in taking apprentices."

This first significant action illuminates key problems and limitations of both the Conference and schools. First of all Procter immediately recognized that it was not within the sphere of the Conference to act upon the establishment of an educational standard for admission to the schools. Instead, it was "the opinion of the Convention," which was to be "recommended to the Colleges," which in turn might "urge their members."

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11 - It will be recalled that "schools" was defined in the constitution as incorporated teaching institutions requiring apprenticeship before graduation. See p. 186 and footnote 94 at that place.

This represents a thoroughly democratic procedure, but one not likely to bring forth many innovations. Notice also the shift of attention from a standard for admission to the school, to the suggestion of greater care in the selection of apprentices. This basic idea, confirmed by the Conference, fundamentally affected all aspects of the association schools during the 19th century. For with primary responsibility for selection resting with the preceptors, rather than with the educators, no effective standard of preliminary education proved possible.[12]

At this first meeting the delegates also recommended that apprentices be at least sixteen years old, and that a diploma not be granted before the age of twenty-one. They also recommended that a four-year apprenticeship be exacted "in a dispensing drugstore," thus specifically excluding service primarily rendered in the wholesale or manufacturing branches.[13]

After much discussion, it was "Resolved, That the branches to be taught in Colleges of Pharmacy should at least include lectures on general chemistry, elementary botany, materia medica, and the general facts and principles of Pharmacy, and when practicable, opportunity should also be provided for instruction in practical and analytical chemistry." After rejecting a motion that "it is inexpedient at this time to recommend any uniformity in conducting examinations for graduation," the Conference voted that "whatever method be adopted" the examinations should be both oral and written and that familiarity with the physical properties of drug specimens be insisted upon.

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12 - See Preliminary Education, p. 250.

13 - Cf., p. 175 ff.

Before adjournment the delegates took their stand on the Michigan course by stating that "diplomas should not be recognized as evidence of sufficient qualification, unless based on four years' practical service in a dispensing shop."14

Of significance for understanding the role of the Conference is the closing resolution "that each College of Pharmacy be requested to take action on the questions presented at this Convention, and report to this body at its next meeting." These delegates---teachers and pharmacists---knew now and would become more keenly aware that their actions could not bind the College trustees. Nor is it recorded that the trustees of the respective schools ever reported back administrative decisions, to reinforce or modify Conference recommendations.

With charming and rather surprising frankness, J. P. Remington recognized, in later years and in another connection, the import of this locus of power: "The colleges themselves will simply have to decide," he said, "so long as they are governed by boards of trustees. These boards will do as they feel in which direction their needs are, and therefore the passage of a resolution of this kind will have no more effect than...opinion..."15

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14 - All actions quoted are from William Wright, Jr., Secretary pro tem, "Minutes of the Convention of Delegates from Colleges and Societies of Pharmacy, Held in Baltimore on the 14th and 15th of September, Relative to Pharmaceutical Education," Amer. J. Pharm., 42: 500-504, 1870.

15 - Section on Pharmaceutical Education and Legislation discussion, Proc. Amer. Pharm. Assoc., 40: 338 ff., 1892.

1871. No new action of special significance to education arose from the second Conference,[16] but the meeting of the American Pharmaceutical Association buzzed with excitement and talk of education. Professor A. B. Prescott of Michigan arrived and expected to participate in the proceedings!

When the session opened on September 12 the Association's members clearly saw that they faced an important issue. The general tenor of the early debate indicated that Prescott would be welcome as a member, but the University of Michigan just was not a "college of Pharmacy" and therefore not entitled to a delegate. Then discussion began to drift away from the question of what was meant in the by-laws by "colleges" that were entitled to delegates. A member of the Kansas College of Pharmacy persisted in raising the question of the status of Michigan graduates in the profession. Others now took issue with the idea that persons like Prescott even had a right to participate in the meetings. The members seemed to sense that the acceptance of Prescott embodied more than a technical point in the by-laws, indeed he symbolized a challenge to the correctness and adequacy of the traditional education represented by organized pharmacists.

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16 - In the summary here given for each year, only Conference actions that seem to offer some insight into the conditions of instruction or the characteristics of this cooperative endeavor are mentioned.

Then Edward Parrish arose, a clear thinker of conceptualizing turn of mind. "Pharmaceutical education in this country," he said in part, "is in its infancy. There are very few schools that teach Pharmacy; there are very few persons who are graduates in Pharmacy. We have heard it said that a graduate of a medical school has no right among us. Let us remember that there are many here who have never even graduated in a medical school or school of pharmacy, and who make no pretensions to it; but we give them the right hand of fellowship and we want them to be associated with us for their good and our good. We are comprehensive. We are not a college elected after great care and research as to the qualifications of each individual; we take everybody in, and if the delegate from the University of Michigan came here as an individual there would not be the slightest question about his admission. Now it is a question, looking to the future, at the shape pharmaceutical education is to take hereafter, what sort of bounds we ought to make in this beginning."

Finally, a special committee was appointed, consisting of one representative of each organization participating, to consider seating Prescott as a delegate. The next day found its members "united in the conclusion that the University is not, within the proper meaning of our Constitution and By-laws, a College of Pharmacy: it being neither an organization controlled by pharmacists, nor an institution of learning which, by its rules and requirements, insures to its graduates the proper practical training, to place them on a par with the graduates of the several colleges of pharmacy represented in this association."17

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17 - The narration of this incident is based on Proc. Amer. Pharm. Assoc., 19: 29-34 and 47, 1871.

The following day Prescott delivered his memorable address on "Pharmaceutical Education." It was forthright and fair. He decried emphasis on an apprenticeship that in a majority of instances had to be under a preceptor who knew little more science than his apprentice, a man "too often unconscious or regardless of his own deficiencies..." He championed the supreme value of a new school of thought: application of science in pharmacy, instruction centering about the laboratory, principles first then application in practical experience.[18]

Prescott's remarks were too true to be comfortably accepted. Colleges could not meet the standards he envisioned for a long time to come, even if they saw the need. Moreover, even if what Prescott said was true, that offered no reason for doubting the validity of revered institutions. The chill thought of change was profoundly disquieting.

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18 - Proc. Amer. Pharm. Assoc., 19: 425-429, 1871. For a transcript of the principal part of Prescott's address, see p. 683 for full text.

1873. At the next Conference, delegates found that organizational bonds bringing them closer together offered not only the basis for cooperation but the opportunity for internal dissension. Every motion except one, after discussion, was laid on the table: on a code of ethics; on a certification of the apprentice's experience; on requiring preceptors, "as soon as practicable," to be graduates; on requiring an entrance examination; on requiring a four-year apprenticeship.[19]

The only significant action taken by the Conference this year was the protest against the granting of the Doctor of Pharmacy degree at the National College of Pharmacy,[20] which represented little more than "common defense against unfair competition."[21]

1874. Conferral of the Doctor of Pharmacy upon graduation from the usual course was condemned again at the fifth Conference, since the Tennessee College of Pharmacy had joined the National College in this practice. The Tennessee College promptly announced that it would withdraw from the Conference. Withdrawal was coupled with ejection when the delegates amended the constitution to restrict constituent members to those schools that conferred the "Graduate in Pharmacy" diploma, as well as requiring apprenticeship.

Before adjournment the delegates beat down a proposal, for the third time since the founding, to publish the minutes of the Conference.

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19 - Since the Conference had enthusiastically recommended the four-year apprenticeship in 1870, it may be that interim discussions with trustees altered thinking on this point considerably.

20 - See p. 184.

21 - Kremers and Urdang, History of Pharmacy, 310.

1875. Delegates were incensed, in 1875, when confronted by documentary evidence that their erstwhile associate, the Tennessee College, had "offered to examine candidates and graduate them without their attending the customary courses just the same as if they had attended all the lectures." The Conference officially communicated this information to the American Pharmaceutical Association.

1876. The seventh Conference of the Schools of Pharmacy at first failed to convene for lack of a quorum. Since the Conferences were held in conjunction with conventions of the American Pharmaceutical Association several delegates arrived later, and the session opened with eight Colleges represented.

An extended discussion of introducing graded courses led to the conclusion that the time was not yet ripe. Even without graded courses it was the consensus that a "first course" examination should be recommended to the Colleges for trial. The delegates nervously shied away from any implication of trying to make it compulsory.

The Chicago College again raised the issue of requiring a preliminary examination of matriculants. It was re-interred with the comment that "the examination as to general education should take place when the apprentice is taken in the store."

The possibility and desirability of pharmaceutical laboratory work--previously relegated, hopefully, to the apprenticeship--now came within the purview of the schools. The Maryland delegate pointed with pride to the obligatory course in

analytical chemistry at his College. Professor Remington, whose school had a pharmaceutical laboratory, "dwelled upon the desirableness and even necessity of organizing such a practical course." Although such prospects were dim at many schools, a goal was set when delegates agreed that it was "advisable" to institute a laboratory "for practical instruction in chemistry and pharmacy."

1877. In the minutes of the eighth Conference we find the first recognition of non-member institutions. In formulating a policy on transfer students, the delegates agreed that credit should be given for one year of lectures at "another recognized College of Pharmacy, or corresponding institution where the same branches are taught, there being no regular college of Pharmacy in the same locality."

This was an unusually fruitful year for passing resolutions, possibly because only five colleges were participating, mostly representing strong schools.[22]

The problem presented by apprentices who completed the courses before reaching the minimum age or before fulfilling the apprenticeship requirement, by now required special attention. The delegates reaffirmed their stand at the first Conference that a four-year apprenticeship should be required for a diploma; permitted the final examination one-half year earlier. For those under 21, they approved the idea of certificates attesting that the final examination had been passed. But the diploma was not to be issued until age and experience requirements were met. That these loopholes were fully taken advantage of is confirmed

22 - Philadelphia, Massachusetts, New York, Louisville and Chicago.

by the vigorous objections raised later by the Illinois Board of Pharmacy.[23]

Another resolution of 1877 gives some idea of the scope of the final examination that educators hoped would be given in the schools. The written or oral examination should include chemistry, botany, pharmacognosy and materia medica, knowledge of the U. S. Pharmacopoeia, weights and measures, posology, antidotes, and translation of Latin prescriptions. The practical examination should include analysis to establish identity and purity of simple medicinal chemicals, the actual compounding of prescriptions requiring skill and judgment, the identification of specimens in the several departments, and the making of chemical and pharmaceutical preparations.

The Conference also went on record for requiring a thesis in English for graduation, a recurring topic of discussion among educators.

1878. At the ninth Conference only four Colleges were represented: Philadelphia, Massachusetts, New York and Louisville.

That there could be no preliminary education required of those studying pharmacy, was a decision that had stood the test of time. At the first, fourth, seventh and now at the ninth annual meeting, the proposal for some entrance standard was firmly rejected. The Conference did express the view that candidates for scholarships should have reached next to the highest grade of public grammar school in

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23 - See p. 187.

their section of the country, or show similar attainment upon examination.

It was decided that the time was not ripe for either graded courses or required laboratory practice. This means, it will be noted, that representatives from some of the strongest association schools did not feel in a position, in 1878, to vote for offering different material in the second term of lectures than that given in the first term, or for any laboratory work that would be part of the regular course.

Although association schools were by no means ready to concede Prescott's contention that experience could follow graduation, the delegates did believe that "apprentices should attend their first course of lectures as early as possible."

1879. At the tenth Conference the main interest was in the case of a student from Michigan who wanted to transfer to an association school. The Conference decided "that students having attended a course of instruction in any chartered institution of learning where the subjects of chemistry, pharmacy and materia medica and botany are taught, may be admitted to the second course of instruction in these Colleges, under such rules as may be in existence for other pharmaceutical students."

The delegates also decided in 1879 that there could be no objection to admitting "female students into all the departments..."

1880. By now the practice by state boards of licensing graduates without examination had become an important issue. As mentioned in another connection,[24] divided opinion blocked any definite action. Opinion was also now divided on the thesis requirement. Some delegates felt the requirement should be dropped, but emphasized that they could not speak for the trustees.

1881.[25] The prolix discussion of the thesis requirement continued the next year. The consensus seemed to be that theses did not amount to much, but the vote was to recommend continuing the requirement for whatever educational value it might have.

1882. The National College of Pharmacy, which had been excluded since 1874 because it conferred the Doctor of Pharmacy, now asked whether its delegate might be reinstated. The reply was that "no school had been excluded" and that all schools of pharmacy were welcome to participate, that is "all schools granting the title of Graduate in Pharmacy..."

Now came an extended discussion of analytical chemistry as an obligatory course, with Professor Remington championing the dominant view that the time was not ripe. Delegates voted six to one "to encourage the study in the regular course of lectures, but it is the sense of this Conference that the course in analytical chemistry should not be made compulsory..."

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24 - See page 196 ff.

25 - This Conference is dated 1882 in the manuscript, but was actually held in 1881.

1883. There always seemed to be one or more delegates who insisted upon introducing the threadbare topic of preliminary education. The fourteenth Conference was no exception; the topic was discussed as it had been "each year since the conference had been held"--and with similar but not the same results. It was proposed that graduation from grammar school, or an equivalent examination, be required, and if "this motion be approved by all of the Colleges of Pharmacy that it go into effect on or before 1885." With the addition of this stipulation that the standard would have to be approved unanimously by all boards of trustees to be effective, the resolution was passed "with enthusiasm."

The question of whether or not the annual course should be extended from four to six months was finally laid on the table.

It is of the greatest interest that Professor A. B. Prescott was present in 1883 by invitation, was asked to participate in the discussion, and was given a vote of thanks for his attendance.

Prescott

As far as we know that was the last meeting of the Conference of the Schools of Pharmacy.[26] The last yellowed page of the minutes book reports in the scrawl of an acting secretary that in 1884 only three college representatives carried credentials

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26 - It is noteworthy that the second association of medical colleges (American Medical College Association, f. 1877) became dormant just the year before the Conference of the Schools of Pharmacy disbanded. Its short existence seems to have been marked likewise by internal disagreements. (F. C. Waite, "Advent of the Graded Curriculum in American Medical Colleges," J. Assoc. Amer. Med. Colleges, 25: 319, 1950.)

as delegates; no meeting could be held for lack of a quorum. Whether the proposal of 1883 to require grammar school graduation for matriculation proved to be the last straw for the boards of trustees, or the Conference just became quiescent from weary ineffectualness, we do not know.

What had been accomplished? The secretary of the American Pharmaceutical Association, John M. Maisch, a German immigrant who had become one of this country's master pharmacists and teachers, keenly felt frustration and failure:

"Ziehen wir das Facit...," he wrote in the Pharmaceutische Rundschau, "so ergiebt sich zwischen blossen Empfehlungen und wirklicher Ausführung ein sehr bedeutendes Deficit, und ist es meistens bei den ersteren geblieben. Sehr viel Zeit ist auf Aeusserlichkeiten und Nebensächliches verschwendet worden. Die Verhandlungen im Jahre 1870 dekten bereits das Notwendigste. Abgesehen von der erforderlichen Schulbildung (preliminary education) bei dem Eintritt in die Lehre, welche damals schon in Vorschlag gebracht wurde, und auch meiner Ansicht nach bei den gegenwärtigen Verhältnissen die einzige Alternative für Abhülfe und Besserung ist, ist höchst wenig was von irgend welchem Belang für pharmaceutische Erziehung ist, verhandelt worden, und von diesem wenigen ist das Meiste so allgemein und unbestimmt gehalten, dass es nur geringen Werth besitzt, so dass jene Verhandlungen so gut wie resultatlos geblieben sind.

"Meine ursprüngliche Hoffnung, dass durch diese jährliche Conferenz Gelegenheit geboten würde, über Methode, Umfang und Details des Unterrichts, über Einführung und Ausdehnung neuer Fächer, über Umfang und Mass der zu verlangenden Kentnisse etc. zu einheitlichen und thatsächlichen Resultaten zu gelangen, ist daher so gut wie völlig unerfüllt geblieben."27

The editor of the Rundschau heartily agreed with this dismal view. The Conference, he said, failed to realize its aim or be of any real use because of masterly inactivity. He claimed that "in recent years, at its annual meetings, the best elements of pharmaceutical talent and character have kept aloof from participation in its proceedings...The Conference, unless re-organized on a sounder basis, and unless its character and standing is raised by strictly eliminating incongruous and commercial elements, and the unjustified fear of losing matriculants or reducing their number, by requiring the future pharmacist to enter the portals of pharmacy and its educational institutions with a fair knowledge of the common English branches, will continue to be rather a dead weight on the educational system of Pharmacy."28

Edward Kremers considered "the failure of united effort by the old line colleges to raise the status of pharmacy" the most striking feature of the period of the Conference.29

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27 - J. M. Maisch, "Die Conference der Fachschulen der 'Colleges of Pharmacy'," Pharm. Rundschau, 1: 182-3, 1883.

28 - "Editoriell. State Boards of Pharmacy and College Education and Diplomas," Pharm. Rundschau, 3: 70, 1885.

29 - E. Kremers, "The Teaching of Pharmacy...," Drugg. Circ., 51: 74, 1907.

Frederick B. Power, first director of the pharmacy course at the University of Wisconsin, spoke disparagingly of the "questionable honor to be represented in the 'Conference of Teaching Colleges'."30

There seemed to be agreement, in this case, to speak ill of the dead or not at all. The results of the ill-fated Conference perhaps were as discouraging to the participants as to onlookers. The minutes seem to indicate, however, that Maisch's bitter disappointment with lack of results colored his judgment when he charged that "there was very little talked about that can be considered of any importance for pharmaceutical education." There was much of importance discussed; delegates saw the problems, grappled with them and failed to solve them.

It is difficult to believe that pharmaceutical education did not benefit eventually by the exchange of views and experiences during those hectic years. There were also discussions of text-books, examination procedures and the like which have not been mentioned. Yet, the primary purpose had not been one of exchanging shop talk on teaching methods, but of arriving at common agreement on fundamental issues and raising standards. In this the conference failed.

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30 - F. B. Power, "The Problems of Pharmacy in the United States," Pharm. Rundschau, 3: 124, 1885.

Urdang diagnoses an important handicap of the Conference as follows: "There was no definite educational requirement making systematic schooling a necessity for the pharmacist to be. For most of the colleges of pharmacy the necessity to use all means possible to attract students in order to keep up the mere existence of the school was stronger than a desire of some of the professors to elevate the general pharmaceutical standards and to agree upon unified requirements as to prerequisites and curricula."31

A correlate and a fundamental characteristic was the focus of power in the boards of trustees, who were tied to traditional forms and the majority opinion of preceptor-members. The delegates lacked authority to make decisions having even the appearance of effective policy. And if they had that authority there was no visible means for penalizing recalcitrant schools. A peculiarity of the Conference---throwing in doubt the resoluteness of the constituent Colleges---is the apparent lack of systematic procedure for reporting back to the Conference the vote or attitude of trustees concerning recommendations made, as a basis for further work and action. It seems safe to assume that ambitions for the Conference never went beyond that of a sounding board and advisory discussion-group. No willingness was expressed to modify in any significant way the patterns established by the pioneer schools; and the mechanism of the Conference, in effect, protected against unwelcome or inconvenient innovations. If we

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31 - G. Urdang, "History of District No. 4 of Boards and Colleges of Pharmacy," Amer. J. Pharm. Ed., 11: 295, 1947.

assume a moderate ossification of this kind, it may help explain why schools like New York and Philadelphia, which were no longer struggling for "mere existence" seem to have made no stronger bid for reform and higher standards than other Conference participants.

The Section on Education and Legislation of the American Pharmaceutical Association

Only three years after the Conference of the Schools of Pharmacy suspended, a new sphere of associative endeavor was opened within the American Pharmaceutical Association. The Association amended its by-laws in 1887, establishing four Sections "to expedite and render more efficient the work of the association...": Sections on Scientific Papers, on Commercial Interests, on Pharmaceutical Education, and on Legislation.

"Heretofore the very important subjects of commercial interests, pharmaceutical education and the labors of Boards of Pharmacy, have received no direct recognition from this Association," said J. P. Remington, chairman of the Committee on Management. "Your Committee feel that in the past this body has suffered loss in this respect, for we believe that a National Association should be so comprehensive in its scope that every important interest should be effectively represented."[32]

There was some discussion on whether education and legislation should really have separate sections. Remington thought there was much to be said for combining the two subdivisions, but the Association decided to operate separate sections experimentally.[33]

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32 - Proc. Amer. Pharm. Assoc., 35: 472 f., 1887.

33 - Ibid., 475.

At the first meeting (1888) following organization, few members appeared in the Section on Legislation, and some of these were seen to slip out the door. "The Section on Education in the other room seemed to be drawing off our members," the Secretary observed. So the Section recessed until after the Section on Education had adjourned. C. S. N. Hallberg of Chicago promised to move amendment of the by-laws to merge the two sections, as originally suggested. This was consummated in 1890, forming the Section on Pharmaceutical Education and Legislation. Only the scope and function of the educational part concerns us at this time. While the Section was not an organization of schools, it did play an important role in continuing part of the associative function of the old Conference and in leading up to the founding of a new association of schools.

The meetings were open to all, regardless of the degree held or granted, or whether or not a participant's school required apprenticeship for graduation. On this basis the Section bridged the gap between the old restrictive Conference, confined to a family circle of association schools, and the future American Conference of Pharmaceutical faculties, open to all that met certain standards.

Instead of finding official delegates of the schools, we meet here a gathering of pharmacists, teachers, and school administrators with common interests. Some sat doggedly through the longest debates, maintaining the highest interest and strongest opinions. Others drifted into the meeting out of curiosity as to what the Section was up to, or for lack of finding something interesting at other Section meetings of the convention.

Like the Conference of the Schools of Pharmacy, the Section provided a sounding board for educational policies and problems, offering an exchange of information and opinion. Mindful of the Conference's experience and sensitive to the fact that it was not a school association, the Section vacillated on taking a firm stand concerning educational affairs. Although not without influence, its actions were recommendatory and invoked no sanctions.

Edson S. Bastin, Northwestern professor, held hope for a higher goal, of which the Conference had fallen short. In a vigorous paper, he argued: "If an agreement could be brought about among six or eight of our leading colleges to adopt requirements for admission and for graduation something like those here outlined and they were to pledge each other that they would stand by them, and, if they were to have the backing of the association, there could be no doubt of the success of the movement..."[34]

A majority were content for the time being with the primary purposes of the Section, as given by Professor William Simon of Maryland, an early chairman: (1) presentation and discussion of papers; (2) careful collection and registering of data on American pharmaceutical education (and legislation).[35]

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34 - E. S. Bastin, "Pharmacal Education," Western Druggist, 10: 404, 1888.

35 - Proc. Amer. Pharm. Assoc., 39: 193, 1891. Only highlights of Section sessions of the 19th century are mentioned below, illustrating the relations among the schools and teachers and what they tried to achieve through the Section.

Gathering and interpreting data to delineate the over-all picture of pharmaceutical education and legislation represents a substantial contribution of subsequent years. Already in 1891 the Association appropriated $50, at the request of the Section, for a national survey of pharmaceutical education.

The Section secretary labored long over his report, comprised of 47 closely typewritten pages. But now, at the 1892 meeting, considerable concern was expressed that the report might be published. Professor Remington expressed confidence, however, that the Committee on Publications would "cut out all matters which reflect upon the pharmaceutical education of any institution in the United States..." The idea of publishing only a summary won quick approval.[36]

Secretary Hogan complained bitterly at the next convention that he had been referred back and forth between the Secretary of the Association and the Chairman of the Committee on Publications, without result or decision. He was now advised, however, that "the report could not be published, that it could not be condensed, and that there was no way of distinguishing between sham colleges and those of recognized standing."[37]

The same year that Hogan brought in his ill-fated report, W. C. Alpers of New Jersey told the Section about a resolution pending before the New Jersey Pharmaceutical Association that would make it necessary for everyone applying for a state license

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36 - Section on Education and Legislation, Proc. Amer. Pharm. Assoc., 40: 298, 1892.

37 - Proc. Amer. Pharm. Assoc., 41: 281, 1893.

to be a college graduate. He recommended the idea to the Section and was "very much surprised and pleased to see that the majority, with but one or two exceptions think as I do"--- or so Alpers thought. At the suggestion of Alpers, C. S. N. Hallberg of Chicago then introduced a resolution "That it is the sense of this Section of the Association that a theoretical education obtained through pharmaceutical education in a college of pharmacy be approved as a requirement for examination and registration for pharmacy in the nearest possible future."

Seeing what the tolerance of their discussions had led to, the members were aghast. Their response showed how far the proposal was ahead of the pharmaceutical times.

W. H. Torbert of Iowa spoke for America's self-made man when he said, "...if a man shall come before a competent Pharmacy Board, and shall show that he has in any way whatsoever acquired the intelligence and ability to be a pharmacist equal to that of any man who has graduated in a pharmaceutical college, I submit to you, gentlemen, do you propose that a man that has such competency as that shall be barred...I hope the Association will do honor to itself by voting negatively."

The "poor boy" and American freedom loom large in discussions of pharmaceutical education both before and after the turn of the century; Mr. Watson now spoke for both: "We often find that a poor boy who has no means of attending a college, has, after years of patient study in the store, and application to business, become, in many respects, just as good and practical a druggist, and as well educated, as one who has graduated at a

college of pharmacy. That such a one should not be allowed to pass the Board of Pharmacy, but be outlawed because he has not had the means to attend a college of pharmacy in the first place, is altogether wrong. It is perfectly apparent," he maintained, "that no such proposition could be entertained by the law, and if it were I shouldn't think that any man would be willing to permit such a law to go into effect without a protest. It is utterly opposed to every principle upon which our government is founded."

Several men now asked for the floor to point out that such a radical proposal would endanger the hesitant progress already being made among pharmacists and state legislators. S. A. D. Sheppard of Boston said, "It seems to me that we could not possibly send out to the pharmacists of the country a more foolish resolution than this would be if it were passed...We would simply, it seems to me, put a stumbling block in the path of our colleges, and merely antagonize these men whom it is our duty to conciliate and help educate up to the right idea of the necessity of college education, which we all so much desire. The idea that none but college graduates should be eligible for examination before our boards of pharmacy would be immediately made a handle of by the politicians of every state. In our own commonwealth we went up to the [Massachusetts] Legislature ten different times, and ten times were sent back before we could get a board of pharmacy..."

The conscientious Chicagoan, Albert E. Ebert took the floor: "I plead so that you will not pass this resolution," he imbored the Section. "I have had experience with legislation, and if this resolution were to go out from this Association, I

am sure that our brethren in Indiana would not be able, this winter, to get pharmaceutical legislation."

George W. Sloan of Indianapolis was quick to confirm the point. "The men who control the majority of those stores would at once say that were such a law enacted, where would they secure help? and their influence would be against the law entirely," he contended. "Largely, the opposition to the pharmacy laws has been from the druggists and not from the politicians."

Mr. Eccles echoed the sentiments of others who spoke, when he said, "I consider the resolution in the right direction, but...the time is not yet ripe..."[38]

After this barrage the resolution was gladly withdrawn. No one had spoken in favor of the proposal, upon which Alpers thought everyone so pleasantly agreed. The preliminary interest in and approval of its consideration by New Jersey, the ambivalent attitudes of several of the speakers, the fears of wrecking more modest advances—all speak for the thought that a number of men in the Section agreed on the idea of required education in pharmacy, and also agreed that any public expression of the idea through the Association could lead only to conflict and retrogression. The opposition from both pharmacists and legislators forecast in the debate reflects a relatively low level of professionalization at this time in American pharmacy, on the one hand, and a public preference for minimum social controls and minimum compulsory standards, on the other, even in a field directly affecting health.

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38 - Section on Education and Legislation (discussion), Proc. Amer. Pharm. Assoc., 40: 329 and 333 ff., 1892.

Professor C. T. P. Fennel of the Cincinnati College, at the same meeting in 1892, introduced a resolution "That we recommend all reputable teaching colleges of pharmacy to adopt a three years' course in their respective institutions, commencing with the session of 1894."

Edgar L. Patch of Boston thought "we are going a little too fast." James M. Good of St. Louis advised, "Let it come naturally, as it will, in the course of a few years." Professor Remington observed, "The colleges themselves will simply have to decide that, so long as they are governed by boards of trustees."

The Section had now picked up where the Conference left off. The motion was passed unanimously, however,--with important substitution of "as soon as practicable" for a specific effective date.[39]

That the Association's voice did not lack influence, or at least could give impulse and focus to a trend, was indicated by the editor of the Western Druggist when he told his readers, "In accordance with the resolution of the American Pharmaceutical Association in 1891, all but one of the well-known colleges have increased their courses to six months, this one school operating two continuous courses during the year."[40]

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39 - Section on Pharmaceutical Education and Legislation, Proc. Amer. Pharm. Assoc., 40: 338 ff., 1892.

40 - "Colleges of Pharmacy of the United States," Western Druggist, 15: 55 ("Extra"), 1893.

This "one school" offering both courses to students in a single year was affiliated with Northwestern University, the bitter competitor of the old Chicago College of Pharmacy. Many felt that Professor C. S. N. Hallberg of the Chicago College merely brought the rivalry into the convention hall when he introduced a resolution in 1893 that a "recognized college" require its graduates to take two terms, of at least six months each, extending over more than one year; be 21 years of age; and have an apprenticeship of four years (including time in school).

It was an explosive issue. The chairman tried to refer the resolution to a committee. The discussion kept going. Some shied away from "the old Chicago fight"; others pointed out that the resolution would give no recognition to the University of Michigan and none to Purdue.

The voluble Hallberg jumped up: "Should their graduates be entitled to recognition as efficient pharmacists," he cried, "unless they have had experience in pharmacy? I defy any man to stand up here and say that they ought to be."41

No one stood up.

But there were hints of change; and Hallberg's resolution went to committee. No longer were the university schools ignored; the weight of numbers prevented that. But neither were they unappreciated now in halls where men debated and sweated to pull American pharmacy up by its bootstraps. That had been foreshadowed at the 1883 Conference, where Michigan's Prescott came as a guest and left with a vote of thanks.

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41 - "Discussion on Requirements for Graduation," Proc. Amer. Pharm. Assoc., 41: 277 ff., 1893.

The trend was melodramatically confirmed now, just a decade later. The convention of the American Pharmaceutical Association remained the scene, but the associative ties had changed. Albert E. Ebert, who had lived through it all, arose:

"I believe it was nearly twenty years ago, although I cannot exactly recall the time,"[42] he said, "when this Association took it upon itself to denounce one of the best institutions in the land. I was one of those who took a prominent part in this action, and who at the time felt that it was necessary to oppose no less an institution than the University of the State of Michigan because its faculty did not agree with us in the matter of curriculum. Time has passed, and now when I look back and see who were the men that gave instruction in that University, and the vast amount of good they have done for the American Pharmaceutical Association, I feel, as do many others, that we ought to get down on our knees and ask pardon for the adverse action that we took, in years gone by."[43]

The next speaker got up, hesitated, then made a prefatory remark: "It is not my intention to criticize the colleges or any set of men. The Michigan lesson taught us very well."

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42 - The 1871 convention when Prescott was denied a seat as delegate.

43 - "Discussion on Requirements for Graduation," Proc. Amer. Pharm. Assoc., 41: 278 f., 1893.

The pioneer mold for American pharmaceutical education lay broken. The association schools strove to fit a new pattern, entangled as they were in the competition for student fees. There was no unity in the fragments of the old system. After the fellowship of pioneering schools, building the beginnings of education for American pharmacy, standing together against wrong ideas of intruders, there came a spreading infection of competitive jealousies and discord. James H. Beal recalled the 1890's when "in the American Pharmaceutical Association there was great rivalry between the various colleges of pharmacy. New York and Baltimore were especially jealous of the Philadelphia College of Pharmacy, and all of them were opposed to the School of Pharmacy which had been established in connection with Scio College at Scio, Ohio," which Dr. Beal headed. "At meetings of the American Pharmaceutical Association," Beal reminisced, "when any member of the faculty of any of these institutions presented a paper, it was sure to be attached by members of the other faculties present."[44]

At least the members were not mute and indifferent. The section on education continued to keep live issues to the fore, minimizing the dissension as best it could. In 1894 the committee sent home the year before to consider Hallberg's controversial resolution, which attempted to define a "recognized college," actually brought back a sobering restatement of the Section's scope and limited function in relation to the schools. This report was read by the committee chairman, S. A. D. Sheppard of Boston, who said, in part:

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44 - James H. Beal, manuscript memoirs, 1945, in Kremers Reference Collection.

"The connection between the Association and the schools and colleges is one entirely of courtesy, and in no sense one of judicial authority. Nevertheless, the connection is a very strong one, and the Association on the one side, or the schools on the other, can, very materially, help or retard the good work that all are doing in the cause of pharmaceutical education. Now, what action can the Association take on this subject [of defining "recognized Colleges"] that will give the most help to pharmaceutical education, as represented in this country to-day? It would seem to be for the best that the Association should be a common meeting-ground for all; that there should be at all times on this common meeting-ground such full and friendly discussion of methods as shall stimulate, benefit and teach, without producing friction or bitterness of feeling.

"It is very plain," he emphasized, "that the Association has no judicial rights to exercise. While most of the active workers in the schools are members of the Association, they are members simply in their personal capacities, and not by virtue of their connection with their schools. Nor, can it be said that the Association is an association of schools. It is simply a body made up of individual members. Therefore, it would seem that the American Pharmaceutical Association has no right to set itself up as a judge of what should be considered a regular, or recognized, or reputable, or good or bad college of pharmacy."45

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45 - "Report of Committee on Resolution Offered by Professor C. S. N. Hallberg, at Chicago, August 17, 1893," Proc. Amer. Pharm. Assoc., 42: 335, 1894.

No objection or question arose concerning this definition of the Association's relationship to education. Since the schools' own Conference had died of inanition, apparently there was to be no association or group that could stand up as arbiter and collective conscience concerning the means for molding American pharmacists.

Before adjournment the members took a firm stand that "Graduates in Pharmacy should be compelled to pass an examination by State Boards."[46]

When the next convention convened in 1895 the Section heard the report of its special committee to study conditions in education and make recommendations. Its members boldly concluded, and offered as a resolution, that the "cause of pharmaceutical education would be advanced" if schools would require preliminary education equivalent to high school entrance, a two-term course requiring the full time of the students "as far as practicable," and offer the Ph. G. without "any regard to practical experience in a drug store."

The chairman could not believe his ears; asked for a confirmation of the last part. Tension was in the air, for the apprenticeship tenet still rated high with old-line colleges.

H. M. Whelpley of the St. Louis College tactfully pointed out that the committee had really covered only the "Graduate in Pharmacy" course, hence had "limited its work to a small portion of what was outlined..." The report was incomplete and had best be tabled. By a rising vote of 28 to 8 "amid applause the motion to table was declared carried."

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46 - Proc. Amer. Pharm. Assoc., 42: 383, 1894.

Professor Remington observed laconically, "I merely wish to say that we are now in exactly the same position that we were a year ago."

Recalling the policy report of the Section a year before, A. E. Ebert said, "I hope that hereafter we will let these schools and colleges take care of themselves." (Applause)[47]

But a compromise resolution was put through at the same meeting, with highly significant and diplomatically astute changes. Instead of addressing a recommendation to the colleges on what should be a "recognized college," it was suggested to state associations and state boards that they set the educational requirements for licensure by seeking to amend the state laws. The Section now was willing to look to legal requirements by the state, rather than to the old idea of voluntary, cooperative action. It asked for laws requiring 600 instruction hours during at least six months, without mentioning laboratory work.[48] Thirty-six months of practical experience (including time at a school having "adequate laboratory courses") was urged, but of more importance--if the members understood the resolution--was the omission of reference to any practical experience being advisable before graduation.[49]

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47 - Section on Education and Legislation, Proc. Amer. Pharm. Assoc., 43: 374 f., 1895.

48 - The original committee report specified a total of 600 laboratory hours alone.

49 - Section on Education and Legislation, Proc. Amer. Pharm. Assoc., 43: 377, 1895.

Inroads were being made on old attitudes, without question; but there were many who still took a firm stand. Hallberg usually took a firm stand, and he did not like what he saw in 1895: "...I want to know," he asked the Section, "if these schools shall be constituted a propaganda for drawing young men into the drug business on the hazy theory of learning pharmacy. I want to ask the State Pharmaceutical Associations of Indiana, of Iowa, of Michigan--we have heard from Kansas--whether the sentiments of these State Associations are represented by the expressions of their teachers...I am satisfied they are not. I know that if the Ohio Pharmaceutical Association, for example, had any voice in this matter, they would not pay the expenses of the institution...Gentlemen in the employ of the State come here for the purpose of extending their non-experience propaganda..."

Said the chairman: "That is out of order."50

Twenty years earlier it is hard to imagine that Hallberg's invective would have been considered out of order in any pharmaceutical gathering. Probably the majority would not yet go so far as Henry P. Hynson of Baltimore, but traditional views were now visibly crumbling under the weight of events of the past two or three decades. It was an officer of an association school speaking when Hynson told the Section in 1898:

"I think we should get at the bottom truth of education, and this Association should take no step which does not look toward the establishment of schools of pharmacy in connection

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50 - "Discussion on Better Education in Pharmacy," Proc. Amer. Pharm. Assoc., 43: 367, 1895.

with our universities, and we should see to it that these colleges are endowed. It seems to me that is the way to secure a better pharmaceutical education. The whole trend of effort in this Association should look toward the establishment of pharmacy as a branch of the great universities, and to see, as far as possible, that these branches are endowed with the funds to support them, independently of whether they get students or not."[51]

This prophetic statement heralded a development that has continued up to the present day. If still not a widely popular view at the time, it at least testified that university schools could be considered legitimate partners in the work of American pharmaceutical education.

The Section on Education and Legislation had provided a common, if not always peaceful, meeting ground for advocates of two different educational concepts. Vivid debates kept attention focussed on the problems, a store of data conscientiously assembled by committees helped show the type and magnitude of the problems, and a host of papers on the method and content of education fostered emulation and upgrading of instruction. Improvements that came depended on individualistic action under the given circumstances of each school. This rejection of standardization hinged primarily on financial rather than academic emulation. If controls were avoided schools lacking tax support remained free to meet exigencies of competition.

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51 - Section on Education and Legislation, Proc. Amer. Pharm. Assoc., 46: 616, 1898.

Professor C. T. P. Fennel reflected a rather general pessimism near the end of the century. "With the exception of one institution," he said, "every college of pharmacy in the old cordon of teaching colleges is dependent upon the revenues derived from students, and consequently they watch each other so closely lest some student might get away, that the bars are thrown down at the expense of the calling...I have lost all faith in the united action of the teaching institutions..."[52]

Apparently sporadic efforts had been made by school representatives in the Section to pull the institutions together but the "community of interest was not strong enough."[53]

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52 - Quoted by James H. Beal, "Report on Preliminary Education Requirement," Proc. Amer. Pharm. Assoc., 46: 551, 1898.

53 - H. H. Rusby, "Fifty Years of Materia Medica," Drugg. Circ., 51: 51, 1907.

Prelude to the American Conference of Pharmaceutical Faculties

The founding of the Association of American Medical Colleges in 1890 [54] did not go unnoticed in the Section and aroused some interest in reviving a special association of pharmacy schools. Pointing to events at the Nashville meeting of the American Medical Association, Professor William Simon of Baltimore told the Section, "this is what we have to do, and what we ought to have done long ago.

"We have first to equalize the standard of our college education among ourselves, and have then to at least equalize it with the best furnished anywhere in the world."

Edgar L. Patch of Boston rose to ask how dental and medical colleges had taken action; he could not see any way it could be done, nor "any way to reach uniformity as to the preliminary education; that must be accomplished by the methods of the college where the clientage will permit of a selection from it."

Professor Simon again asked for the floor. "As to how the medical colleges of the United States are now attempting to effectuate these matters, I will say, as it may not be known to you, that the dental colleges have actually accomplished this for the last three years or more. They recognize no teaching below a minimum standard...The medical colleges have taken the same step at the last meeting in Nashville. They will no longer recognize as a reputable medical college any school, new or old,

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54 - The old American Medical College Association had been dormant since 1882.

which does not come up to the minimum of the requirements, and I think that the pharmaceutical colleges might do the same."

A long and lively discussion followed, but there were none to express ambitions or a proposal to go and do likewise. Some remembered the lack of success in the old Conference of the Schools of Pharmacy. Professor Remington advised caution. "I believe that the old convention of teaching colleges, which used to meet during the annual meetings of the American Pharmaceutical Association failed of its purpose not because the delegates were not in accord individually in many ways, nor because there was a want of harmony...[but] because the delegates could not in any way bind the colleges they represented to their own view; and as Professor Patch says, those colleges, situated as they are in various parts of the country, some in the old well-settled States and others in the newly settled districts of the West have to deal with totally different conditions."[55]

But the astute James H. Beal of the Scio College in Ohio did not let the idea die. Four years later, in 1894, he thought the time had come. He and his neighboring educator, George B. Kauffman of Ohio State University, who became dean of pharmacy the next year, "issued a circular letter inviting a number of colleges to meet in conference at Asheville, N. C."[56] Beal undoubtedly refers to this circular when he recalls in his

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55 - Narrative of discussion based on Proc. Amer. Pharm. Assoc., 38: 243 f., 1890.

56 - W. F. Rudd, Pharmaceutical Education (Washington, D. C., Bureau of Education Bulletin No. 11, 1921), 7; also H. L. Kendall and C. O. Lee, "College of Pharmacy Associations," Amer. J. Pharm. Ed., 8: 200, 1944.

memoirs that "only two responded favorably, Dr. Simon of the Maryland College of Pharmacy and Henry P. Hynson of Hynson, Westcott and Dunning at Baltimore."[57]

Despite this discouraging response, Beal offered the following resolution to the Section when the Association convened in Asheville: "Resolved, That it is the sense of the American Pharmaceutical Association that the cause of pharmaceutical education ought to be advanced, and that all pharmaceutical schools and colleges should form an association for the purpose of regulating such matters as are for their common interest which do not come properly within the scope of the American Pharmaceutical Association."

The chairman, R. G. Eccles of Brooklyn, warned Beal and the members that the American Pharmaceutical Association had nothing to do with such a resolution.

Professor Remington advised caution. This was the session (1894) at which the special committee was named to make a study of American pharmaceutical education, to consist of one representative from each college and school, plus three Association members who were not teachers. Since this committee undoubtedly would bring a good turn-out of semi-official school representatives at the next meeting, Remington suggested that nothing need be done now, and when the Association met in Denver these representatives could resolve themselves into an association.

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57 - J. H. Beal, manuscript memoirs, 1945, in Kremers Reference Collection.

The chairman again warned that "this Association could not force them to do so."[58]

No action was taken; no organization developed. At the Denver meeting the special committee report that recommended abandonment of the apprenticeship requirement for the Ph. G.[59] probably seemed ample warning to reluctant schools of the dangers that lay in organized planning. Beal's proposal remained dormant.

It may be that men like Beal, Simon and Hynson continued to work for a school association behind the scenes.[60] Three years later we find Beal still pushing the idea in his "Report on American Colleges of Pharmacy" for 1898.

"It is much to be regretted," he told the Section, "that the leading pharmaceutical schools and colleges are unable to find a common basis upon which to unite and form an organization, and determine what should constitute a standard course in pharmacy leading to specified degrees. The common interests of the schools are so much in excess of their antagonistic interests that an association of this sort could not fail of beneficial results.

"While such an association could not determine who should not maintain schools of pharmacy," he emphasized, "it could at least determine within reasonable limits what should be the

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58 - Proc. Amer. Pharm. Assoc., 42: 385, 1894.

59 - See p. 239 f.

60 - George D. Beal, son of James Beal and a present-day leader of the Association, recalls that his father told him that preliminary conferences on a school association were held about 1896. (Personal communication, July 3, 1952.)

requirements for a school which should receive the countenance of the organization. I am sure that the American Pharmaceutical Association and the State boards and State associations would cordially indorse such a movement, and thus, by inference, at least set a conspicuous brand upon the institutions which would not consent to conduct their courses in accordance with the laws of decency...

"The colleges of dentistry and medicine have organizations of this sort, and have accomplished an enormous amount of good for themselves and for their professions. Why may not colleges of pharmacy do likewise?"[61]

In the discussion of Beal's report, no one tried to answer his rhetorical question or commented on the proposed association. It will be noted that Beal, like Simon, was alert to current organizational efforts in medicine. The Association of American Medical Colleges (f. 1890) had restricted its membership to schools requiring a graded curriculum of three sessions. Forty-two medical colleges adopted such a program in the two years following the Association's founding. Waite attributes this to the qualification established for membership plus the fact that several states enacted laws requiring attendance at three sessions for the granting of an "M. D." degree.[62]

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61 - J. H. Beal, "Report on American Colleges of Pharmacy," Proc. Amer. Pharm. Assoc., 46: 516, 1898.

62 - F. C. Waite, "Advent of the Graded Curriculum in American Medical Colleges," J. Assoc. Amer. Med. Colleges, 25: 321, 1950.

Beal saw that rivalry among the schools was a serious block to organizational efforts, and now laid stress on a non-binding conference, to make at least a beginning. It is said that the deans of the rival schools in Philadelphia and Baltimore each expressed willingness to participate but was sure that the other would never agree. It was thus something less than an eager and enthusiastic group of men that Beal and Hynson brought together at the turn of the century. Before the convention of 1900 Hynson sent out another call for organization to the schools. The committee appointed to consider the question at the Richmond convention had J. P. Remington as its chairman. Remington advised caution, and was sceptical of success. Beal recalled that in the committee meeting the problem of drawing a report was turned over to him. "...Knowing of the magic in the word 'conference' I used it in recommending a meeting," Beal relates. "Since there seemed to be nothing dangerous in the coming together in the same room, the other members of the committee agreed to the report."[63]

Thus began the American Conference of Pharmaceutical Faculties (since 1925, American Association of Colleges of Pharmacy). Professor Albert B. Prescott of Michigan was marked to become the first president, signifying the temper of a new time.

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63 - J. H. Beal, manuscript memoirs, 1945, in Kremers Reference Collection; George D. Beal, personal communication of July 3, 1952; W. F. Rudd, Pharmaceutical Education, 7.

VI. THE STUDENT

Preliminary Education

Abilities and backgrounds of apprentices in the early lecture courses of American pharmacy, while unknown, could hardly be more than that possessed by the average citizen. This was little enough, since the idea of public responsibility for the common education of all failed to gain wide acceptance in the United States before the Civil War. Moreover, the literacy of matriculants could hardly become a burning issue in schools where administrators and teachers were struggling to keep instruction alive.

The American who had been in school 208 days of his life had his fair share of learning in 1841, when the third teaching college of pharmacy began instruction. A decade hence the total schooling of the average citizen had doubled, however; and by the time of the Civil War reached 434 days per person. This includes instruction in common schools, private schools and colleges.[1] If the average youth entering pharmacy by 1860 had twice as much schooling as the population on the whole, it would have been equivalent in time to four years of common school instruction today.[2]

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1 - Report of the Commissioner of Education for 1899-1900, based on reports of the U. S. Bureau of Census.

2 - Figures for the population as a whole represent averages that of course would not apply in Eastern urban centers where the first association schools were established. Yet when the New York College of Pharmacy began instruction there were about 24,000 children between the ages of five and fifteen in New York City (population ca. 200,000), who were in no school of any kind. (Merle Curti, Social Ideas of American Educators, 26.) New York schools at the time were probably the best of those in any state. (Cubberley, Public Education, 101.)

American educational thought had begun to make substantial contact with European ideas and accomplishments in the 1820's,[3] but like the concepts of European pharmaceutical education these could not be transplanted intact. The preliminary education expected of a German apothecary's apprentice helps measure the distance that separated the new and old worlds. There, in general, the entering Lehrling of the 1840's had to demonstrate before a pharmaceutical commission his knowledge of languages (Greek, Latin, French), elementary mathematics, and general studies such as history and geography.[4]

At this time Americans were pioneering the movement for common schools under public control and support. By mid-century such schools were becoming an actuality in most Northern states,[5] as public-spirited men hammered against conservative ideas that free education would be an entering wedge for socialism, infringe on liberty, or would lead poor children to a life of laziness at the taxpayer's expense.[6] In Southern states public-school advocates gained ground only slowly against prevailing sentiment for private education and tutors.[7]

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3 - Starting notably with John Griscom's report on his tour of Europe to observe and study schools and colleges. (Cubberley, Public Education, 354 f.)

4 - Robert Kane, "Observations on the Present State of Pharmacy in Germany," Amer. J. Pharm., 9: 311, 1837.

5 - Cubberley, Public Education, 164, 245.

6 - Curti, Social Ideas of American Educators, 87; and Cubberley, Public Education, 166.

7 - E. G. Dexter, A History of Education, 124.

By the 1850's a common school education was available in most states to future pharmacists who would or could take the time for it. The day of publicly supported schools of pharmacy awaited another generation, for the great mass of people thought they had gone quite far enough. Beyond common school certainly there should be private enterprise.[8]

The tuition academy, essentially private, remained the undisputed leader in secondary education until well after mid-century.[9] Graduation rolls of the academies probably would show few pharmacists-to-be, although one notes an academy background in the biographies of some teachers in 19th-century pharmacy schools.

Public high schools sprang up in the largest cities before the 1850's, and just before the Civil War gained a firm foothold in several states (see map, p.253).

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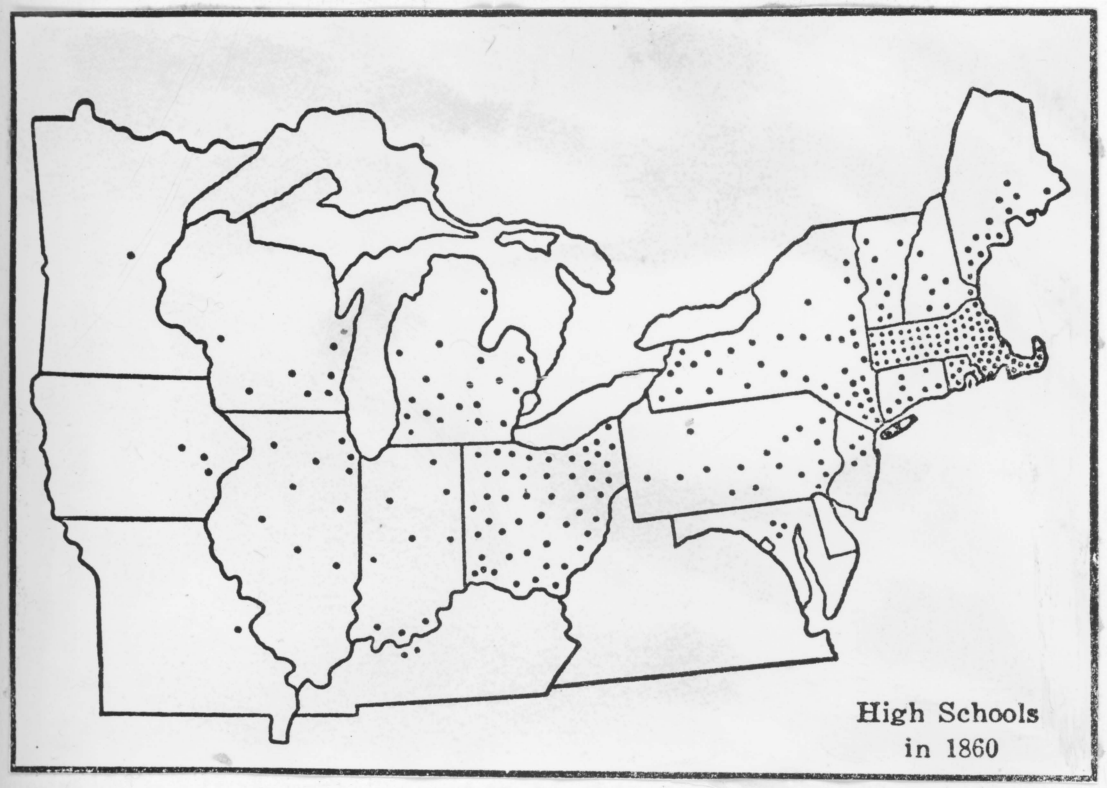
8 - E. G. Dexter, A History of Education, 170.

9 - Ibid., 90.



From Cubberley, Public Education, 262.
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All but 35 of approximately 321 high schools in the United States by 1860 were located in states shown on the map above. Even in these states probably only the rare apothecary's apprentice had entered the doors of a high school before the Civil War, and common school education was still a high goal for most of those becoming pharmaceutists. Note that more than half of the high schools are concentrated in just three states: Massachusetts (78), New York (41), and Ohio (48).

Such education was readily available only to a minority; hardly a goal for even the most far-seeing pharmacists. If a youth of the 1870's had asked how much book learning he needed to enter pharmacy, Pharmacist-A might reply, "...Any boy of 12 to 15 years, who can read, write or cypher a little, is well enough educated to be placed in any store."[10] If the boy turned to Pharmacist-B, he might have been told that to be a real pharmacist he first needed the education "which the common schools supply, supplemented by systematic instruction in natural and physical science where attainable, and by the elements of Latin and Greek, and one or more of the modern languages of Europe."[11] If pressed to say whether the boy really needed that breadth of knowledge in the drug business, Pharmacist-B would probably concede, "That's what some of us hope to find in the coming generation of American pharmacy, but we need sincere lads like you. If you know your arithmetic, grammar and can write a good hand, I shall take you on at my shop."[12]

Even in medicine, which had travelled somewhat farther along the road of professionalization, the average student had little more than a common school education in the 1870's. This represented a sturdy advance over the first half of the century, when one zealous critic could claim that "illiterate men in great numbers" entered medicine.[13] Now, ordinary medical students "have some acquaintance with the English branches; reading, spelling, writing, arithmetic, geography and grammar (although

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10 - David L. Cowen, "Notes on Pharmaceutical Training in New Jersey Before 1900," Amer. J. Pharm. Ed., 12: 303, 1948.

11 - E. Parrish, "The Preliminary Education of Apprentices," Proc. Amer. Pharm. Assoc., 20: 178, 1872.

12 - Cf. David L. Cowen, loc. cit., 303.

13 - Benjamin Lincoln, quoted by Norwood, Medical Education, 221 f. Norwood thought this statement "possibly exaggerated."

they are frequently so deficient as to make their classmates envy their impudence); some of them have, in addition some knowledge [usually gained at a tuition academy] of natural philosophy, of the rudiments of Latin and Greek, and of algebra and geometry..."[14]

There was no lack of recognition that "what is most needed in pharmacy is a higher grade of preliminary education." The German achievement shone as a model and goal for some, but was soon clouded over by conditions in American pharmacy.

"That the colleges of pharmacy, seeing the deficiencies in preliminary education, should require a standard of attainments in advance of entering upon their scientific and practical course of instruction seems reasonable," thought the Philadelphia idealist, Edward Parrish, "and yet, when we consider how small a proportion of the whole number of those entering the business have availed themselves of the advantages of these institutions, it requires care how we cumber the colleges, some of them yet in their infancy, with impediments to their widening, rather than contracting the field of their labors."[15]

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14 - Charles Warren, M. D., "Medical Education in the United States," in Report of the Commissioner for 1870, 385.

15 - Edward Parrish, "The Preliminary Education of Apprentices," Proc. Amer. Pharm. Assoc., 20: 176-78, 1872. The editor of the Proceedings thought that perhaps less than 1600 of the persons in the 14,000 shops dispensing medicines had completed a course in pharmacy.

In the 1870's it was generally assumed that the examination as to preliminary education would, or should, take place when an apprentice entered the store.[16] Yet no measures were taken to assure this or to establish a uniform requirement. Preceptors demanding any definite educational standards of boys employed in the shops apparently were uncommon; and the schools found it expedient to accept the apprentices sent to them by their members, rather than see such youths enter the practice of pharmacy without any formal education at all.

The question of preliminary education had been one of the first issues placed before the association schools in their Conference of the Schools of Pharmacy (f. 1870). While most of the delegates probably recognized the importance of the problem, they failed to find common ground for agreement, much less enforcement, of any admission standard until 1883. They then agreed upon a grammar school requirement, as noted elsewhere,[17] if all boards of trustees unanimously agreed to it.[18]

The first serious attempt to require of matriculants some definite preparation arose in the state schools of pharmacy. Public support largely freed them from worrisome dependence on student fees for a balanced budget; thoughts of letting down the bars to encourage more apprentices to take some formal study were largely counterbalanced by the need and desire to maintain a semblance of general university standards.

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16 - Minutes of the Conference of the Schools of Pharmacy, 1876 proceedings.

17 - See p. 221.

18 - Minutes book of the Conference of the Schools of Pharmacy, passim.

Their hesitant leadership[19] found its importance in setting a goal, rather than in the effect on pharmaceutical practice, for classes were small. What the president of the University of Michigan said of medicine applied equally well to pharmacy:

"We cannot but appeal to the other medical schools to join us in examining students for admission, for we are not blind to the fact that, if we alone take this action, we may shut the ignorant out of our halls, but cannot shut them out of the profession."[20]

There were still not many joiners in 1881 when the U. S. Commissioner of Education reported that of about eighty medical schools "ten have examinations for admission covering several subjects and fourteen employ some slight tests of an applicant's fitness to study medicine."[21]

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19 - A decade after the opening Michigan still only required "for admission to the School of Pharmacy, that the student possess a good knowledge of the English language, as determined by written examination." (Calendar of the University of Michigan, 1877-78 (Ann Arbor, 1878), 81.)

20 - Quoted in "Correspondence.--Reply of the Medical Faculty...," Detroit Review of Medicine and Pharmacy, 9: 680, 1874.

21 - Report of the Commissioner for 1881, CXCII.

Some of the best universities could not operate pharmacy departments if they wished because of their rigid entrance requirements; others avoided the issue through loose affiliations that placed the pharmacy school outside general university requirements; while a few--notably Michigan, Wisconsin, Vanderbilt and Cornell--compromised by requiring somewhat less preliminary education for pharmacy than for other departments, while maintaining a considerably higher standard than the ordinary colleges of pharmacy.[22]

Pharmaceutical instruction at the two essentially private universities mentioned--Vanderbilt and Cornell--eventually was starved out, as previously noted, mainly because of the need for maintaining a university level of general attainment.[23] The same fate befell the school at the University of Virginia, where the faculty voted to abandon pharmacy because "The grade of students proposing to study Pharmacy (judging from those who have come and from the illiterate character of the inquiries made by others) is unable to accomplish a course in this subject which is on a level with other work in this institution."[24]

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22 - "Colleges of Pharmacy or Medicine as Appendices to 'Universities'," Pharm. Rundschau, 6: 258, 1888.

23 - See p. 144 f.

24 - From the Minutes of the Faculty, April 17, 1897, as quoted by Francis L. Berkeley, Jr., curator of manuscripts of the University of Virginia, personal communication of August 4, 1952.

State universities of the Old Northwest were better able to withstand the pressure. Their requirements around 1885 varied from a common school education, as at Purdue,[25] to high school graduation (or examination scores probably lying between common school and high school attainment), as at Michigan and Wisconsin.

The entrance requirements at Michigan appear to have been the more demanding, but special concessions were made to those who had two years of drugstore experience.[26]

The independent colleges also were making some progress on entrance requirements by the mid-80's, although sometimes only in the minds of educators and printed statements in the school catalogues.

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25 - In 1884 a "good common school education" or an equivalent examination and a two-year apprenticeship were required. (C. O. Lee, "The First Courses in Pharmacy," Amer. J. Pharm. Ed., 4: 60, 1940.)

26 - At Michigan those with practical experience were admitted without examination, but had to pass an examination before graduating. Those without practical experience were examined in a wider range of subjects (botany and physics) and had to show a higher attainment in foreign language. At Wisconsin all matriculants had to take the usual examination, without regard to practical experience. (Annual Announcement and Register of Alumni of the School of Pharmacy of the University of Michigan, 1887-88 (Ann Arbor, 1887), 8-10; Catalogue of the University of Wisconsin, 1887-88 (Madison, 1888), 40 and 42; "Universitäts-Pharmacieschulen," Pharm. Rundschau, 5: 128, 1887.

Massachusetts in 1883 was requiring a preliminary examination that was "rigid in arithmetic," in lieu of a high school diploma or its equivalent;[27] California asked "uncertified candidates" to take a preliminary examination after 1884;[28] Maryland required the equivalent of graduation from a Baltimore grammar school after 1885;[29] and New York installed an entrance examination in 1884 based on "the grammar school standard."[30]

These advances, at just this time, quite possibly were related to the agreement reached on a grammar-school requirement at the 1883 Conference of the Schools of Pharmacy. It seems unlikely, and we have no record, that all boards of trustees had unanimously agreed to it, however, as the delegates had so cautiously stipulated.[31] Similar action was taken by the Section on Education and Legislation in 1889.[32]

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27 - Minutes of the Conference of the Schools of Pharmacy for 1883.

28 - Report of the Commissioner for 1883-84, 24.

29 - C. Schmidt, The Maryland College of Pharmacy (1841-1894), 8.

30 - Wimmer, The College of Pharmacy, 77.

31 - Minutes of the Conference of the Schools of Pharmacy for 1883.

32 - "Report of the Committee on Preliminary Examinations," Proc. Amer. Pharm. Assoc., 37: 283, 1889.

This movement brought forth both accolades and opposition, and doubters wondered how strictly the new entrance standards were enforced.[33]

Albert E. Ebert of Chicago, at a meeting of the American Pharmaceutical Association, observed that "The colleges of pharmacy in the United States are like other business enterprises to a great extent. They say a great deal on paper and make many promises, but whenever the money consideration comes in they will very likely be not very exacting."[34]

Professor E. S. Bastin of Northwestern believed in 1888 that "not more than one-fifth of the applicants for matriculation have ever pursued a high school course, not more than one-tenth are high school graduates and probably not more than one in fifty are college graduates, and certainly a very considerable percentage of applicants have not even a good knowledge of the three R's. Yet it is the rarest occurrence," Bastin maintained, "that an applicant is rejected on the ground of lack of preliminary education."[35]

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33 - Frederick B. Power, "The Problems of Pharmacy in the United States," Pharm. Rundschau, 3: 120, 1885; W. F. Rudd, Pharmaceutical Education, Bulletin No. 11, Bureau of Education (Washington, D. C., 1921), 5; Proc. Amer. Pharm. Assoc., 36: 185, 1888.

34 - Proc. Amer. Pharm. Assoc., 36: 185, 1888.

35 - E. S. Bastin, "Pharmacal Education," Western Druggist, 10: 403, 1888.

While Bastin's estimate of the number of college graduates who entered pharmacy ("not more than one in fifty") may be a liberal one, a scattering of students after the 1870's held an academic or other degree. It may be, however, that such men often held the "M. D." and subsequently went into the practice of medicine, preparing and dispensing their own drugs. Hence the significance of this group in the upgrading of pharmaceutical instruction, manufacturing or practice remains an open question.

At the University of Michigan such students represented four to eight per cent of the pharmacy enrollment during the last quarter of the century. In 1884-85 about 25 per cent (11 of 40) students at the University of Wisconsin's new school already held some degree in "letters and science," but the class at the end of the century was probably more nearly typical, when six per cent of the pharmacy students held an "A. B. or B. S. degree." Occasionally other schools reported two or three matriculants who already held a degree.[36]

Seventeen students holding a letters and science degree were reported to the Commissioner of Education in 1884-85 by pharmacy schools, compared with 733 reported from medical schools. Between 1880 and 1890, 15 to 17 per cent of the medical students had such degrees, but most schools were still striving to maintain a high school prerequisite rather than being concerned with pre-medical collegiate work.[37]

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36 - Reports of the Commissioner of Education for 1872, 819; for 1875, 775; for 1880, CLIV; for 1884-85, 659; and for 1899-1900, 2008.

37 - Wellford Addis, "Curricula of Professional Schools," in Report of the Commissioner of Education for 1889-90, vol. 2, 878.

At the end of the century, we may say with some certainty, those holding an A. B. or B. S. degree represented, nationally, slightly less than 1.5 per cent of the student enrollment in pharmacy, slightly more than 2.5 per cent of the dental students, and just over 10 per cent of the students in regular medicine. Of 51 such students reported to be enrolled in pharmacy, 43 were in just two regions, 26 in the North Central states and 17 in South Central states.[38]

These had been the exceptional students in all professional fields. What about the majority? By the 1890's a number of the university schools made a firm bid for high school graduates.[39] Of the independent schools at this time only two stated that their students had a high school level of education; the rest required grammar school or less.[40] Rusby maintained that even when "grammar school graduation was nominally required, neither this nor any other requirement was actually insisted upon."[41]

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38 - Report of the Commissioner of Education for 1899-1900, 1970, 1972, 1973, 2008.

39 - "American Colleges of Pharmacy, A Study," Pharmaceu. Era, 14: 455, 1895. For admission to the "Pharmaceutical Chemist" course in 1894 high school graduation was a pre-requisite at Michigan, Vanderbilt and Northwestern. "The same requirement is published for admission" to the University of Kansas. One year of high school was required at Wisconsin; the others required less. ("The American Pharmaceutical Schools and Their Facilities, Courses and Requirements in 1893-94," The Apothecary, 3: 149, 1894.)

40 - "American Colleges of Pharmacy, A Study," Pharmaceu. Era, 14: 454, 1895.

41 - H. H. Rusby, "Education in Pharmacy," Drugg. Circ., 65: 84, 1921. See also "Standard of Colleges of Pharmacy," (letter to editor), Western Druggist, 20: 465, 1898; Rudolph F. Ruppiter, "The Boy in Pharmacy," Western Druggist, 19: 159 f., 1897; Harry B. Mason, "A Quarter-Century of Pharmaceutical Education," Bull. Pharm., 1905, p. 67.

Bearing in mind this difference between entrance requirements in print and in practice, the following table shows the stated standard of 44 schools in 1897:[42]

High school	5
Enough to enter university	2
Grammar school	11
Common school	3
Good English education, plus Latin and sciences	1
Good English education	16
None stated	6

Pharmacy seems to have kept pretty well abreast of medicine and law in the proportion of schools claiming the equivalent of a high school education as their entrance requirement. Below this top layer in pharmacy--mostly state university schools--requirements fell off sharply. While in medicine and law, near the end of the century, the numerical distribution of schools according to entrance requirements slopes off gradually.

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42 - Compiled from "Our Pharmaceutical Colleges," Drugg. Circ. and Chem. Gaz., 1897, pp. lxxx-lxxxii. The categories shown represent the approximate wording in the reports from the individual schools as given by the journal's editor.

This may be seen by comparing the following table with that for pharmacy given above.[43]

Entrance Requirement	Medical	Law
Some college	1 (degree)	2
4-year high school	12	3
3-year high school	3	12
2-year high school	12	11
1-year high school	97	8
Common school	29	26
None stated	2	16
Total reporting	156	78

Apparently unable to draw heavily upon the better-educated upper classes for recruits,[44] schools depending upon tuition naturally felt that high school requirements were out of the question. For at the end of the century only 9% of American youths of high-school age actually enrolled in high schools. Their number had almost doubled in a decade, however,[45] and from now on the public high school system mushroomed.

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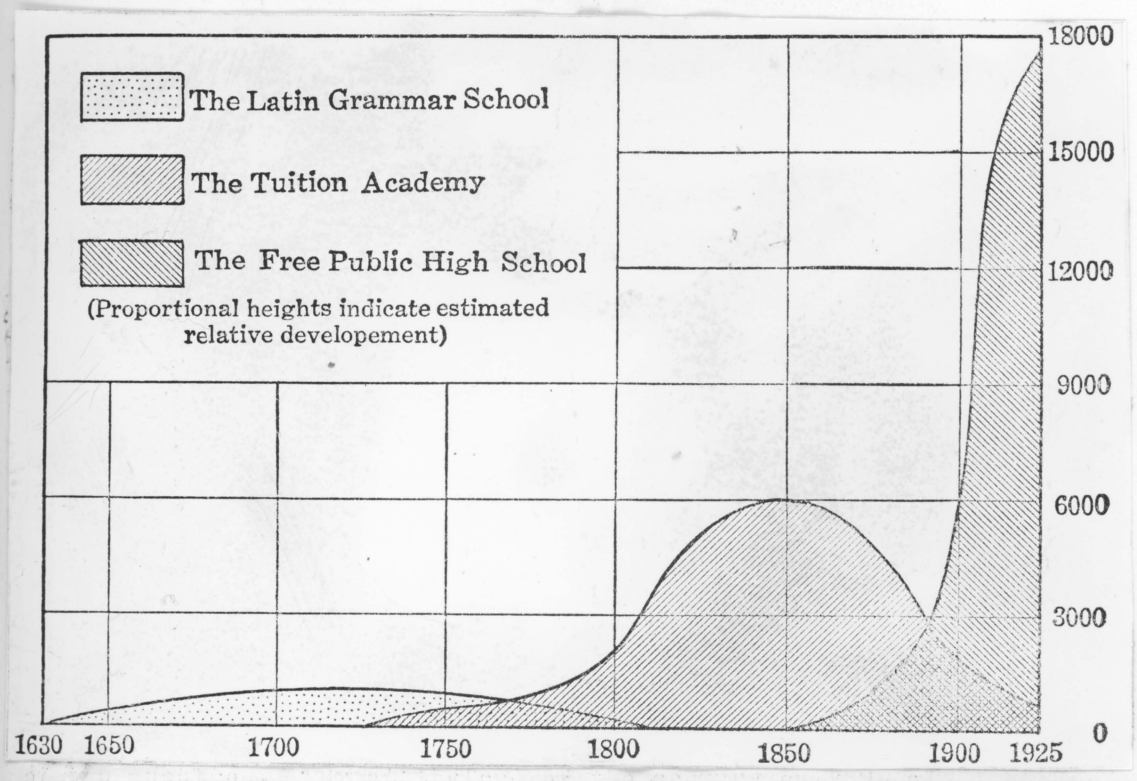
43 - E. G. Dexter, A History of Education, 325 and 336, quoting James R. Parsons. By this time a four-year high school education probably equalled at least two years of college work as given in mid-century. (Ibid., 179.)

44 - Frederick B. Power, "The Problems of Pharmacy in the United States," Pharm. Rundschau, 3: 119, 1885; E. Parrish, "The Preliminary Education of Apprentices," Proc. Amer. Pharm. Assoc., 20: 175 f., 1872.

45 - Cubberley, Public Education, ; Report of the Commissioner of Education for 1903, 1157.



From Cubberley, Public Education (1919), 192.
U. W. Neg. No. 7527-B

The curve depicting the founding of high schools helps explain why pharmacy schools that depended upon tuition fees hesitated to demand high school training of matriculants during the 19th century. Unlike the independent schools, the departments of pharmacy in state universities were in an environment where student material from the better-educated class was the expectation, not the exception. However small their share of the limited reservoir of high-school trained youths, economic pressures tending to lower standards were largely avoided through the support from public funds.

The graph brings out the transitional character of the tuition academy in the development of American secondary schools. Academy instruction was uncommon among 19th-century pharmacy students.

This paved the way for the requirement of one, two, and more years of high school for entrance to pharmacy schools in the early 20th century, following much the same pattern shown by medicine and law in the late 19th century.

The functional needs of pharmacy at its given level of professionalization, however, created little demand for change. Agitators for better preliminary preparation of students met a sluggish, apathetic response in the profession. When a circular from the Section on Education and Legislation attempted to sound out opinion among state associations in 1897, "only a few responses were received." Considering the ignorance of matriculants a pressing problem in pharmacy, the Section sent out another circular the following year to state boards as well as state associations. James H. Beal, who conducted the survey, reported back that "Only two state associations seem to have given the matter any consideration...No report was received from any Board of Pharmacy." One association (Michigan) urged that grammar school should be set as the minimum standard at once, although the advisability of this had already been the subject of agreement on several occasions; the other respondent (Minnesota) thought high school graduation should be required as soon as possible. The president of the Pennsylvania state board, speaking only for himself, thought it obvious that "if an applicant has enough learning in 'readin, writin, spellin and figgerin,' with enough common sense to put what little learning he has to practical use, he will make a competent pharmacist."[46]

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46 - James H. Beal, "Report on Preliminary Education Requirement," Proc. Amer. Pharm. Assoc., 46: 548-552, 1898.

Apprenticeship

"Common sense" and "attention to business" rated high with the preceptor, a key figure in American pharmaceutical education of the 19th century. We have glimpsed in Chapter 2 (see page 19) the erection of the apprenticeship system in American pharmacy before the time of the pioneer schools, as the accepted pattern for "learning the business" but without the old guild controls for standardizing the conditions of such training.

A promising lad might be apprenticed to the local apothecary, instead of the carpenter or blacksmith; the more ambitious youth would prefer the adventure of migrating to a larger city where he might enter one of the more elaborate apothecary shops. When a teaching college of pharmacy opened in a city, it became a magnet for such youths. A watchful parent might stipulate in arranging for the apprenticeship that his son would have the opportunity to attend the college lectures.

The boy began by acting as errand boy, keeping the shop swept and washing the apothecary's utensils, perhaps even doing some work in the master's household. Gradually, he became more useful at the counter, especially during rush hours, and progressed to compounding prescriptions and other technical work. Perhaps he had a room over the shop, where he remained on call during the night. There he would sporadically pore over a few books during off hours, investing the operations of the shop and

the curiously named drugs with more meaning.[47] But the long hours of work and distractions of city life were not conducive to much book learning without the stimulus of formal lecture courses or a conscientious preceptor.

An alert father, such as that of Charles E. Pancoast, took precautions that his son would learn the calling properly. In his autobiography Pancoast tells of his first ride in the "steam cars" in 1832 from Salem County, in New Jersey, to Philadelphia where he was to be apprenticed. The next morning, Pancoast relates, "I was introduced to my new Master, John R. Rowand, and apprenticed to him to learn the profession of an Apothecary. I was to remain with him until I reached the age of twenty-one years, he agreeing to furnish me with Board, Washing, and Clothing, and to send me for two terms to the College of Pharmacy at his expense; but I was to have no spending money, for Father believed spending money to be the primary cause that led Boys into evil habits."[48]

Another first-hand account of apprenticeship conditions comes from John F. Hancock, who became a prominent pharmacist of the last half of the 19th century. This Maryland farm boy did not know what calling he wished to follow, but in 1854 a friend arranged an interview for him with Dr. Large of Baltimore, a physician who operated an apothecary shop.

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47 - Cf. Edward Kremers, The Old Northwest Territory and Pharmaceutical Education, 8.

48 - Charles E. Pancoast (A. P. Hannum, ed.), A Quaker Forty-Niner (Philadelphia, 1930), 15.

"I had never thought of pharmacy as an occupation," Hancock relates in his reminiscences, "indeed knew nothing of its duties and prospects, but without delay went to the city on January 29th, 1854, had an interview with Dr. Large, accepted his offer and entered his employ the next day... My contract with Dr. Large (which was verbal) was to remain with him for four years at a salary of twenty-five dollars for the first six months, with a gradual increase which brought it to eight hundred dollars for the period of four years, with table board in his home and to sleep in a room over the store. I was to be assistant to his clerk and of course do all the drudgery, sweeping the store, cleaning the cases, counters, windows, etc., and also making fires. There was not a hydrant in the shop, therefore it was my duty to go with a bucket across the street to fetch water to wash the pharmacy utensils. I was told that the proper way to reach the ultimate in pharmacy was to place myself firmly on each round of the ladder and ascend by steady, thoughtful steps.

"Early in my apprenticeship the unexpected again happened. In 1855 Dr. Large became financially involved as a builder of houses and as a consequence sold his pharmacy to Dr. Edmund Landis, another physician with a large practice. It was arranged for me to remain with Dr. Landis and to my surprise he proposed co-partnership---the result being the firm of Landis and Hancock.

"We employed Mr. Taylor, a graduate of the Philadelphia College of Pharmacy, who had good store training, and he was invaluable to us, as my experience was extremely limited. I found him to be of especial value to me as a teacher. He mapped out a course of study and gave me practical lessons in

manipulation. Dr. Landis concluded to sell his interest and in October, 1855, I bought his share of the business and established the pharmacy of J. F. Hancock."[49]

This account reveals much concerning both the pharmaceutical apprenticeship and the conditions in medicine and pharmacy around mid-century. It will be noted that twenty-one months after coming in off the farm without a thought of entering pharmacy, Hancock was not only a pharmacist but sole owner of a shop. Lacking formal education in pharmacy he attended the lecture courses after the Maryland College of Pharmacy re-organized and was graduated in 1860.

Hancock's experience typifies the casual and variable circumstances under which youths gained their pharmaceutical apprenticeship and education during most of the 19th century. This is confirmed by a survey made in 1854 by a Committee on Pharmaceutical Education of the newly-formed American Pharmaceutical Association. From cities of the North, South and West the discouraging reports came in. Discerning pharmacists agreed that practically no attention was paid to the preliminary education of applicants for apprenticeship, and that the conditions of service not even remotely resembled a system. Some prominent apothecaries tried to maintain the standard four-year term. Although the New York College nominally required the four-year term, it was reported that "this is not attended to in practice." Indentures

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49 - J. F. Hancock, "Reminiscences Pharmaceutical," Drugg. Circ., 51: 181, 1907.

apparently had fallen into disuse, in most areas, although a three-year indenture was said to be common in Detroit. The upper layer of apothecaries gave considerable attention to the training of their apprentices, but the average youth probably got little personal attention. Many apothecaries struck the best bargain they could, considering it a business transaction rather than a teaching arrangement. Remuneration might be little or nothing the first year, but thereafter the apprentice often received $150 or so per year, ranging up to $200 or $250 in the third or fourth year.

The terms actually served varied widely, and it was not unusual that after a year or two a youth decided he was ready to take charge of a business of his own.[50]

This picture appalled even contemporaries, and the early colleges tried to raise the level of apprenticeship and encourage more systematic study. Attendance upon the lecture courses was not infrequently considered obligatory upon the apprentices of members of a college.[51] Efforts to standardize the term of apprenticeship at four years apparently met with rather indifferent success, and in the Southern and Western states the tenure of

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50 - "A General Summary of the Answers of the Circular of the Committee on Pharmaceutical Education," Proc. Amer. Pharm. Assoc., 3: 30 f., 1854.

51 - "Constitution," J. and Transac. Md. Coll. Pharm., 1 (n.s.): 64, 1858; "Editorial Department," Amer. J. Pharm., 22: 94, 1850.

apprenticeship was believed to be especially short.[52] After serving from a few months to two or three years apprentices often expected, even in Philadelphia, to obtain fully salaried clerkships or establish their own shops.[53]

An editorial in the American Journal of Pharmacy in 1850, probably written by William Procter, Jr., was rather despairing:

"In the United States, pharmacy is virtually unprotected in sight of the laws--is a mere trade or business--which any one may practice who has the money to commence and the assurance to prosecute it with the most meagre smattering of its language and materials. Whilst such is the case, how can it be expected that young men of ability will pass through a tedious course of practice, and study to qualify themselves as competitors to a host of pretenders, whilst a large portion of the public makes no distinction between them save that which arises from a false economy?"[54]

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52 - "American Pharmaceutical Association," Amer. J. Pharm., 26: 89, 1854. Members of the Philadelphia College were obligated by their code of ethics to require a four-year term; at the Maryland College it was required by the constitution. ("A Code of Ethics Adopted by the Philadelphia College of Pharmacy," Amer. J. Pharm., 20: 151, 1848; "Constitution," J. and Transac. Md. Coll. Pharm., 1 (n.s.): 64, 1858.) The German Pharmaceutical Society of New York, through its statutes, obligated members to a sliding scale of apprenticeship terms: four years for youths entering in their 14th year; three years after the 16th year; and two years for those entering after the 18th year. At the completion of the term an apprentice passed a "stringent examination" before a commission of the Society and received a certificate. ("German Pharmaceutical Society of New York," Amer. J. Pharm., 28: 90, 1856.)

53 - "Editorial Department," Amer. J. Pharm., 22: 94, 1850.

54 - "Fatal Effects from the Carelessness of an Apothecary" (Ed. Dept.), Amer. J. Pharm., 22: 379, 1850.

There seems to have been a rather general recognition that the majority of apprenticeships were inadequate, even before the Civil War.[55] Thereafter it became even more difficult to obtain a well-rounded experience in many shops, as the manufacture of stock preparations passed more and more into the hands of large-scale manufacturers.[56] Apothecary and apprentice found less opportunity in the average shop to use many of the manipulations and procedures that were considered essential to the practical education of a novice.[57]

Although laboratory exercises were just becoming a goal rather than an actuality in the schools, the formal courses tended to gain in importance with changing conditions in the shops.

Edward Parrish recognized in 1864 that "if, as in the vast majority of instances, the apprentice is wholly dependent on what he can pick up in his daily routine, the chances are against his ever advancing beyond the mere tradesman--successful enough perhaps in making money, but beneath the true pharmaceutical status and, all his life, falling short of the high requirements of his profession."[58]

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55 - "Editorial Department, Proceedings of the Massachusetts College of Pharmacy," Amer. J. Pharm., 26: 475, 1854; "Proceedings of the National Pharmaceutical Convention...," Amer. J. Pharm., 25: 12 f., 1853.

56 - J. W. England, "Highlights in the History of the Philadelphia College of Pharmacy," Amer. J. Pharm., 93: 610, 1921.

57 - William Procter, Jr., "Address to the Pharmaceutists of the United States," Proc. Amer. Pharm. Assoc., 2: 16, 1853.

58 - E. Parrish, "A Systematic Course of Study and Manipulation for Students of Pharmacy," Proc. Amer. Pharm. Assoc., 12: 274, 1864.

The ideal was to have routine knowledge of the shop "rounded off, during the last year or two, by a certain amount of scientific training..."[59] This became more feasible for aspiring apprentices after 1865 as one school after the other opened its doors. More and more youths migrated to the urban centers where the schools were located, and took positions in local drug shops, from whence they arrived in the class room during hours mutually convenient to apprentice and employer. Since the formal course embraced only about a half dozen lectures each week during the winter months, it did not greatly interfere with the regular work of the apprentice. The regular work may have interfered with his formal schooling, however, for attendance was in the evening after a long day's labor.

Preceptors were not supposed to take apprentices younger than sixteen years of age, and the schools expected a student to have four years' experience in the shop before granting a diploma.[60] In the 1860's some schools began requiring the apprentice to obtain his experience in a dispensing store (not with a wholesale druggist), a policy endorsed by the Conference of the Schools of Pharmacy in 1870.[61]

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59 - E. Parrish, "A Systematic Course of Study and Manipulation for Students of Pharmacy," Proc. Amer. Pharm. Assoc., 12: 274, 1864.

60 - Minutes book of the Conference of the Schools of Pharmacy, 1870 and 1877 proceedings.

61 - See p.176, and Minutes book of the Conference of the Schools of Pharmacy, 1870 proceedings.

The apprentice thus worked his way through school, the lectures "rounding off" and systematizing what he presumably learned in the shop. Association schools depended almost entirely on the city's drugstores for their students, just as the drugstores came to depend on the drawing power of the schools to provide plentiful and relatively inexpensive assistants.[62]

The student faced materially different conditions in the university towns. With few exceptions (e.g., Ohio and Minnesota) the state schools were located in rather small communities, where the drugstores could not absorb any considerable number of students as regular clerks. Moreover, the typical university school required practically the full time of the pharmacy student.[63]

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62 - Edward Kremers tells of an informal placement bureau operated by salesmen for wholesale drug firms who worked out of Chicago. "The traveling representatives...made propaganda for the Chicago College of Pharmacy and secured positions as clerks for the apprentices of small towns throughout the Northwest who wanted to supplement their meagre apprenticeship by drug store experience in a large city... and to earn his way through college while clerking at the same time" (E. Kremers, The Old Northwest Territory and Pharmaceutical Education, 13).

63 - Suggested by manuscript notes (Kremers?) in Edward Kremers Reference Collection.

Even in the cities where association schools were located it became difficult to accommodate the influx of student-apprentices. In 1866 a representative of the Philadelphia College observed that "The New York College appointed a committee to aid in this work of seeking employment, and the effort might well be imitated here, as subsidiary to the advancement of our School of Pharmacy."[65]

By the 1890's a few schools were giving some attention to apprenticeship in the hospital as well as the "store." The Cincinnati College of Pharmacy may have been one of the earliest to take an interest in this field. In 1890 it "pioneered a move to seek internships for junior students in the various local hospitals..." Christ Hospital, at least, accepted the proposal, offering a place to the junior who made the highest grades, with board and lodging but without salary.[66] In 1900 it was announced that "The Maryland College of Pharmacy...is to give its students some practical experience in hospital work by having them serve as dispensers in a local hospital for a certain length of time during the college term..." A similar plan at the Atlanta (Ga.) College of Pharmacy had proved "highly satisfactory...for some years past."[67]

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65 - "The Schools of Pharmacy" (Ed. Dept.), Amer. J. Pharm., 38: 479, 1866. These conditions naturally permitted better selection of apprentices in college towns and make it difficult to judge the general significance of impressions that a better class of youths entered pharmacy after the 1870's. For example, Paul Balluff of New York is quoted as stating in 1873 that "the habit of taking boys from the streets as apprentices in drug stores has pretty much gone out of vogue, and that the so-called better class of persons have been apprenticed in drug stores." ("A Bit of Ancient History," The Graduate, 2: 55, 1894)

66 - H. C. Freking, "Gleanings from the Early History of the Cincinnati College of Pharmacy," Amer. J. Pharm. Ed.,12: 421, 1948.

67 - C. A. Mayo, "Hospital Dispensing" (editorial), Amer. Drugg., 37: 34 (July), 1900.

Late in the century the association schools still attached importance to four years of apprenticeship before graduation, including time in school;[68] and there were still the same complaints about the poor quality of the apprenticeship training students actually received.[69]

At the 1890 meeting of the Section on Education and Legislation a discussion starting on preliminary education soon shifted to a long and strongly contested debate about apprenticeship.

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68 - There appears to have been considerable variation, however, in the term required in American pharmaceutical education at large. And by 1895 we find a resolution from the Section on Education and Legislation asking for legal requirement of thirty-six months apprenticeship, including the period of formal instruction. It may be significant of changing attitudes that requirement of experience before graduation was not specifically mentioned. (Section on Education and Legislation, Proc. Amer. Pharm. Assoc., 43: 377, 1895)

69 - Peter W. Bedford in "Minutes of the Thirtieth Annual Meeting," Proc. Amer. Pharm. Assoc., 30: 591, 1882; E. Kremers, "The Apprenticeship System," Proc. Amer. Pharm. Assoc., 42: 410 f., 420, 1894; D. L. Cowen, "Notes on Pharmaceutical Training in New Jersey Before 1900," Amer. J. Pharm. Ed., 12: 306, 1948. In England the apprenticeship for "chemist and druggist" produced problems similar to those in the United States: poor quality of apprentice material; unqualified preceptors; and a common attitude that the employment of a youth was a business arrangement rather than an educational relationship. (F. Baden Benger, "The Apprenticeship and Early Training of Pharmacists," Pharmaceu. J., 30: 252, 1870.

Stevens of the University of Michigan insisted, "You cannot control it. You say two years' experience. What does that mean? A man can go into a store and wash bottles and do similar work, and yet when he comes to your college he has had two years' experience, and you are obliged to take him in."

Replied J. P. Remington of Philadelphia: "...Now, pharmaceutical education started out in this country, I think, on a correct basis, and that is, to require every candidate for a diploma to have a certain amount of practical experience in the drug business, and I attribute to it the success with which pharmacy has been practised in this country. I believe that to-day pharmacy is in a higher condition in this country than in any other, and it is due to the fact that when a pharmacist gets a diploma from his college, he is ready to go into a store, because the theoretical and the practical have gone together."

There were men, like Kremers at Wisconsin, who knew pharmacy abroad at first-hand and who did not consider American pharmacy the best in the world. But the majority seem to have little realized, or were unwilling to concede, how far pharmaceutical education was beginning to lag behind other professions even here in the United States.

Supporting Remington, George H. Markoe of Massachusetts said, "I believe that the college of Pharmacy is only the advanced adjunct of the store..."

A sour note was then struck by "one of the youngest men in the audience," a Mr. Heller, who rose to say: "I consider that the time I spent in the drug stores before attending a school of pharmacy, was just that many years wasted."

But his voice was little heard as the debate rolled on.[70]

Even proponents of university schools were not unmindful of the value of practical experience; they merely rejected the idea that formal education was merely a supplement to it. State universities only reluctantly followed the lead of the University of Michigan in omitting apprenticeship altogether from requirements, and then only at a time when the responsibility for it could be passed conveniently to the state boards. According to a survey by Hallberg in 1893 only Purdue had joined Michigan in not requiring any practical experience for graduation, although as the optional four-year courses came in none of these carried an apprenticeship requirement. Near the end of the century one school after the other abandoned or reduced its stated apprenticeship requirement, although old independent schools, especially, still clung to the tradition.[71]

James H. Beal, himself not connected with a state university, summarized the stand of opponents of the traditional system: "It should be remembered," he said, "that the schools which led in the abandonment of the apprenticeship requirement did not take this course through any lack of appreciation of the

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70 - Proc. Amer. Pharm. Assoc., 38: 246 ff., 1890.

71 - C. S. N. Hallberg, "The Requirements for Graduation in American Colleges of Pharmacy," Proc. Amer. Pharm. Assoc., 41: 275, 1893. On the disintegrating pre-graduation apprenticeship, see pp. 398 f. and 407 f.

value of actual experience, but because the requirement as frequently enforced was a farce. Very properly the university schools took the ground that their degrees should stand for school work only, and that no institution could honestly vouch for the value of something for which there could be no effective standard and which in many cases was of absolutely no value."[72]

If traditionalists had been unable to make the four-year apprenticeship training conform in practice to what was expected of it, they were hesitant to abandon even the expectation. They were reluctant to concede that the average preceptor and the facilities of his shop were poorly fitted to play any primary role in the modern educational process. Control over the qualifications of those who were to act as preceptors, or over the general education of youths to be accepted as apprentices, represented an invasion of individual rights that rarely came within the range of discussion, much less of action, among the Colleges. Without such control, attention was diverted to means for including within formal instruction the motley crowd of apprentices who by-passed the schools once they learned the routine and practical knowledge of the shop. Against this need, ambitions for high, selective standards made slow progress.

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72 - Quoted by James R. Parsons, Monographs on Education in the United States, No. 10: Professional Education (St. Louis, 1904), 72.

Enrollment and Graduates

Chandler estimated in 1896 that only about 12 per cent of the nation's practicing pharmacists had any technical education aside from shop experience.[73]

Teachers and administrators were keenly aware of this circumstance, which argued for keeping standards low, offering the futile hope that readily available instruction might appeal to the majority. Moreover, only a minority of those who did enter a school in the 19th century ever remained to graduate.

"Of the number who are inscribed as pupils since the institution of these lectures, now nearly twenty years, who have availed themselves of the advantages thus provided, how few have presented themselves for examination, and secured for themselves an honorable distinction as graduates of the College," one Philadelphia teacher lamented, "...They 'come like shadows, so depart', satisfied with their own sense of their acquisitions, their own estimate of their capacity to fulfill all the requisitions of their profession."[74]

There was sound enough ground for this comment, for during the first twelve years of the Philadelphia College only 28 of 400 students remained to graduate; and of 3000 students during the first 48 years there were 701 who graduated.[75]

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73 - Charles F. Chandler, "The College of Pharmacy of the City of New York," Pharm. Era, 16: 860, 1896.

74 - William R. Fisher, "Introductory Lecture Delivered at the College of Pharmacy, November 4, 1841," Amer. J. Pharm., 14: 13 f., 1842.

75 - England, The First Century, 143.

As the oldest and best-known of the colleges, Philadelphia attracted students from the remotest shops; already in 1853 we find among 89 students 28 who were from beyond the borders of Pennsylvania, representing nine states and three foreign countries.[76] Most such students probably returned to home communities after their studies, and some of them provided the spark of professionalism to develop pharmacy elsewhere. They were also joined by some venturesome Eastern students who occupied a pharmaceutical niche in the fashioning of the West.

The dominance of the Philadelphia College in ante-bellum days is illustrated by the fact that among the 513 students who had graduated in the United States up through 1860, 392 were from the Philadelphia College of Pharmacy, or nearly four-fifths of the total.[77]

The second regular course of instruction to be established, at the New York College, enrolled about 20 apprentices annually during its first decade and there were four students in the average graduating class.[78]

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76 - "Class of the Philadelphia College of Pharmacy for the Session of 1852-53. With a List of the Preceptors and of the Localities from whence the Students come," Amer. J. Pharm., 25: 95f., 1853.

77 - See note 17, p. 52.

78 - Wimmer, The College of Pharmacy, 43 and 313. Graduating classes during the 1830's ranged from one to eight persons.

Wimmer presents a graph of graduating classes at New York during the 19th century[79] that probably portrays, in part, the effect of legislative controls upon student enrollment and graduation. Up to 1870 the number of graduates remains essentially constant, so few that it might seem impossible to keep the school alive if we did not recall that far more students enrolled than graduated. Upon passage of the hated Irving bill in 1871 and subsequently a more acceptable pharmacy act, the curve of graduates turns sharply upward and, although fluctuating periodically, keeps rising. Before 1870 there were rarely more than ten graduates in a class; then within two years the classes increased three-fold; by 1880 there were more than 50 graduates each year; after 1890 more than a hundred.

At the Chicago College about 40 students attended the first course, but only two graduated (1861).[80] Up to 1880 the Chicago College had graduated only 66 students.[81] When the Maryland College re-organized in 1856 there were only four graduates from the first class of 20.[82] The first attempt to establish instruction in Baltimore, 1841-1847, had produced only seven graduates, three of these graduating the first year (1841) and three in 1847 when instruction was suspended.

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79 - Wimmer, The College of Pharmacy, 312.

80 - E. Kremers, "The Teaching of Pharmacy During the Past Fifty Years," Drugg. Circ., 51: 67, 1907.

81 - Tabulated from the Alumni Record of the University of Illinois, 1921, 333 ff.

82 - Schmidt, The Maryland College of Pharmacy (1841-1894), 5.

In the earliest medical college to teach pharmacy (1838), which started as the Medical College of Louisiana, we do not have figures on enrollment, but there were never more than one or two graduates in any year up to 1865, when a total of only 17 students had graduated in pharmacy. The number of annual graduates turned upward in the middle of the 1870's, so that an additional 299 students graduated in pharmacy by the end of the century. It is one measure of the relative importance of pharmaceutical instruction in this medical institution that 316 graduated in pharmacy during the century while 3,396 graduated in medicine. Was pharmacy at the Medical College of Louisiana (Tulane) only a "feeder" for the medical course? No, we find that of the 316 pharmacy graduates fewer than 70 also obtained the M. D. degree.[83] Of the medical schools only the Medical College of South Carolina and the Medical College of Virginia were to gain sufficient support to develop a vigorous school of pharmacy surviving up to the present day.

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83 - Catalogue of the Alumni from 1834 to 1901, Inclusive, of the Medical Department of the Tulane University of Louisiana, 8, 34 ff., 41.

The approximate numbers of students in 1870 and of alumni in 1860 and 1870, for the various schools as far as known, are shown below:[84]

School	Students 1870	Alumni 1870	Alumni 1860
Chicago	32	2	0
Maryland	40	70	22(?)
Massachusetts	35	15	—
Michigan	37	51	—
St. Louis	20	25	—
New York	70	143	81
Baldwin	8	?	—
Philadelphia	198	752	392
Howard	?	1	—
Louisiana	?	22	16
		1059	511

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84 - A dash indicates that pharmaceutical instruction had not yet started. Based on Report of the Commissioner of Education for 1870, 525; England, The First Century, 461 ff.; Wimmer, The College of Pharmacy, 313 ff.; The Alumni Record of the University of Illinois, 1921, 333 ff.; "List of Graduates of the Chicago College of Pharmacy with Biographical Synopsis and Latest Addresses Obtainable," The Graduate (Chicago College of Pharmacy), 1: 34-47, 1893; Catalogue of the Alumni from 1834 to 1901, Inclusive, of the Medical Department of the Tulane University of Louisiana, 41; see also note 17, p. 52.

The total number of pharmacy graduates from American schools in 1870 thus may be safely estimated at less than 1,100; in 1873 the total number of alumni reported to the U. S. Commissioner of Education was 1,506.[85] This increase of about 40 per cent in only three years points to the early 1870's as something of a turning point in American pharmaceutical education, with schools becoming firmly established and new ones entering the field. The following table permits a comparison of the enrollments and graduates in pharmacy with those in other professions at five-year intervals between 1870 and 1897:

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85 - Report of the Commissioner of Education for 1873, lxxxii.

Statistics of Professional Schools for a Series of Years[86]

Class	1870	1875	1880	1885	1890	1895	1897
Theology							
Schools	93	123	142	152	145	149	157
Students	3,254	5,234	5,242	5,775	7,013	8,050	8,173
Graduates	.....	782	719	790	1,372	1,598	1,672
Law							
Schools	28	43	48	49	54	72	77
Students	1,653	2,677	3,134	2,744	4,518	8,950	10,449
Graduates	.....	823	1,089	744	1,424	2,717	3,016
Medicine							
Schools	72	80	90	113	129	151	150
Students	6,194	8,580	11,929	11,059	16,660	22,887	24,377
Graduates	.....	2,391	3,241	3,622	4,556	4,827	5,564
Dentistry							
Schools	6	12	16	18	27	45	48
Students	257	469	730	1,116	2,696	5,347	6,460
Graduates	.....	151	266	458	943	1,297	1,640
Pharmacy							
Schools	10	14	14	21	30	39	43
Students	512	922	1,347	1,746	2,871	3,859	3,426
Graduates	.....	208	186	396	759	1,067	1,005
Veterinary Medicine							
Schools	.....	.....	.....	.....	7	9	12
Students	.....	.....	.....	.....	463	474	364
Graduates	.....	.....	.....	.....	143	155	130
Nurse Training							
Schools	.....	.....	15	34	35	131	298
Students	.....	.....	323	793	1,552	3,985	7,263
Graduates	.....	.....	157	218	471	1,498	2,498

86 - Report of the Commissioner of Education, 1896-97, 1780. Figures are only approximately correct since not all schools reported.

It will be noted that the proportion of graduates to students remained constant between 1875 and 1885 (about 4.4 students per graduate), but had markedly dropped by 1895 (about 3.6 students per graduate) despite the fact that some schools had lengthened the curriculum to three years.

Although total enrollment doubled between 1885 and 1897, the number of students per school actually dropped. The average number of students per school can mislead if we do not recognize the wide range in enrollment among the schools. It does help validate the contentions of educators toward the end of the century, however, that the competition for students was becoming more severe.

In 1870 there were on the average approximately 51 students per school of pharmacy (compared with 86 students per school of medicine); in 1885, there were 83 students per school (in medicine, 98); in 1897, there were 79 students per school (in medicine, 162). These data suggest the possibility that the rivalry for students among pharmacy schools may have become even keener than the much-discussed rivalry among medical schools.[87]

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87 - The average number of students in the schools reporting to the Commissioner of Education in 1899-1900 was 76; as compared with 79 in 1897. (Report of the Commissioner of Education for 1899-1900, 1973.) On the other hand a survey made by the Section on Education and Legislation for the year 1896 revealed a considerably heavier enrollment (4,098), with an average of 95 students per school. (C. S. N. Hallberg, "Chairman's Address," Proc. Amer. Pharm. Assoc., 45: 264, 1897.

How were these students actually distributed among the schools? A study by Hallberg based on somewhat higher enrollments (total: 4,098) reported to him for 1896 revealed the following pattern:[88]

Number of Schools		Number of Students
11	had less than	25
7	had	25 to 50
9	had	50 to 75
6	had	75 to 100
5	had	100 to 200
2	had	200 to 300
1	had more than	400

Whether or not the number of student-starved schools was unusually high in pharmacy remains to be shown. Certainly the disparity of enrollments was not peculiar to pharmacy. In 1875 twelve dental schools show a range of nine to 105 students, with enrollments of more than 50 in only three schools. Among sixty-five regular medical schools the enrollment ranged from three to 500 students, with 25 schools having an enrollment of more than 100.

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88 - C. S. N. Hallberg, "Chairman's Address," Proc. Amer. Pharm. Assoc., 45: 264, 1897.

At this time the enrollments in pharmacy ranged from three students at Iowa Wesleyan to 316 at the Philadelphia College. Baldwin University had four pharmacy students; the Tennessee College of Pharmacy had eight; the National College had 26; all the rest had more than 30. The graduating classes ranged from four to 80 students.[89]

What was the picture during these years at the University of Michigan, which had caused such a furor by its scientific curriculum in pharmacy based on laboratory work and by its omission of the pre-graduation apprenticeship? Of the 230 graduates up through 1880 (about 19 per year), 67 per cent had entered the practice of pharmacy and chemistry, including manufacturing; 21 per cent entered the practice of medicine, having also obtained the M. D. degree.[90]

The second pharmacy school at a Midwestern university, the University of Wisconsin, opened (1885) with 28 students enrolled. In the 1890's annual attendance varied between 41 and 65 students. By 1900 there were 185 Wisconsin graduates.[91]

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89 - Report of the Commissioner of Education for 1875, 775 and xcviii. The students and graduates in pharmacy for 1880 may be found in the Report of the Commissioner of Education for 1880, cliv; for the year 1884-85 in the Report for 1884-85, 659 and ccxxiii; for the year 1890-91 in the Report for 1890-91, 875 and 1430. Data for other years may be consulted in this annual series likewise.

90 - Joint Documents of the State of Michigan for the Year 1880, vol. I (Lansing, 1881), 130.

91 - Report of the Board of Regents of the University of Wisconsin, in Governor's Message and Accompanying Documents, 1899-1900, (vol. I), 33; op. cit., 1885 (vol. II), 47; Catalogue of the University of Wisconsin for 1900-01 (Madison, 1900), 295.

Other state universities were likewise turning out relatively small numbers of relatively well educated pharmacists. The striking difference between student bodies of the state schools and the pioneer association schools shows boldly in a tabulation of enrollments for 1887:[92]

State Universities		Old Association Schools	
Wisconsin	38	Philadelphia	607
Purdue	28	Massachusetts	202
Iowa State	19	New York	238
Kansas	40	Maryland	120
Ohio State	19	Cincinnati	464
Michigan	57	Chicago	181

It should not be supposed, of course, that enrollments reflect only a difference in the standards of admittance and instruction; geographical factors played secondary roles, such as the location of rival schools and the size of city in which a school was located.

About one-half of all pharmacy students attending schools in the United States during 1887, for example, were in just three large cities: Philadelphia, New York and Cincinnati.[93] A similar though not quite so striking circumstance prevailed in medical education in 1894-95, when more than one-third of 22,887 medical

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92 - From H. L. Taylor, "Schools and Colleges of Pharmacy," Pharmaceu. Era, 45: 333, 1912.

93 - Ibid. Taylor gives the total enrollment for that year as 2,773.

students (sectarian and regular) were found in three cities: Philadelphia, New York and Chicago. This coincides with the population centers of pharmacy students except that in pharmacy at that time Cincinnati attracted the largest enrollment west of the Alleghenies, rather than Chicago.

Taylor found that about two-thirds of all pharmacy students in 1887 were in the first year class, half of whom would not enter the second year class. Of the seniors (one-third of the total), about a fourth would fail to graduate.[94]

The average age of students studying pharmacy in 1880 was 17 to 18 years in five schools, and 19 to 20 years in five schools. No significant differences in student age appear between different sections of the country.[95]

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94 - From H. L. Taylor, "Schools and Colleges of Pharmacy," Pharmaceu. Era, 45: 333, 1912.

95 - Based on Frank W. Clarke, "A Report on the Teaching of Chemistry and Physics in the United States," in Circular of Information No. 6, Bureau of Education (Washington, D. C., 1880), 216 f.

The following table shows the number of students enrolled and graduated in the United States, by states and by regions for the five-year period 1890-95, as far as reported to the Commissioner of Education. A further break-down by individual schools may be found in the annual Reports. Note how static enrollments were in the South, particularly in the South Central region. The North Central region shows the most vigorous growth of student enrollment, reflecting at least in part the founding of at least eight new schools during this period.

Students and Graduates of Schools of Pharmacy, 1890-1895

State.	Students.					Graduates.				
	1890-91.	1891-92.	1892-93.	1893-94.	1894-95.	1890-91.	1891-92.	1892-93.	1893-94.	1894-95.
United States	2,884	3,133	3,394	3,658	3,859	733	796	827	988	1,067
North Atlantic Division	1,346	1,390	1,459	1,489	1,666	370	383	368	415	420
South Atlantic Division	205	208	207	253	273	53	59	65	68	74
South Central Division	188	157	165	169	176	43	40	36	45	49
North Central Division	1,029	1,275	1,443	1,635	1,580	248	314	321	426	498
Western Division	116	103	120	112	164	19	0	37	34	26
North Atlantic Division:										
Massachusetts	270	279	272	254	255	27	26	23	17	23
New York	425	425	455	537	566	156	142	151	194	175
Pennsylvania	651	686	732	698	845	187	215	194	204	222
South Atlantic Division:										
Maryland	125	135	120	127	119	30	39	43	36	49
District of Columbia	55	73	87	97	98	22	20	22	32	11
Virginia	.....	.....	.....	16	29	.....	.....	.....	.....	5
North Carolina	.....	.....	.....	13	16	.....	.....	.....	0	5
South Carolina	25	.....	.....	.....	.....	1	.....	.....	.....	.....
Georgia	.....	.....	.....	.....	11	.....	.....	.....	.....	4
South Central Division:										
Kentucky	124	78	78	97	65	24	19	17	19	19
Tennessee	31	33	43	40	46	6	8	9	15	13
Louisiana	33	46	44	32	36	13	13	10	11	14
Texas	.....	.....	.....	.....	29	.....	.....	.....	.....	3
North Central Division:										
Ohio	101	100	151	360	283	30	35	37	118	129
Indiana	65	70	88	85	89	22	21	22	36	35
Illinois	421	584	611	690	511	86	124	136	138	197
Michigan	91	81	109	78	108	30	31	27	31	29
Wisconsin	56	64	65	42	42	16	15	14	12	8
Minnesota	4	6	3	4	42	1	1	1	1	11
Iowa	61	77	75	71	87	5	13	15	9	9
Missouri	194	246	284	250	256	52	62	63	69	72
Kansas	36	47	57	55	62	6	12	6	12	8
Western Division:										
Colorado	13	.....	17	17	27	4	.....	4	4	4
Washington	.....	.....	.....	.....	27	.....	.....	.....	.....	0
California	103	103	103	95	110	15	0	33	30	22

From Report of the Commissioner of Education for 1894-95, 253.
U. W. Neg. No. 7525-B

The table below compares the total enrollment and graduates in pharmacy, during these years (1890-95), with those in regular medicine and dentistry. The numbers of graduates in the respective years are in parentheses.[96]

Year	Pharmacy	Regular Medicine	Dentistry
1890-91	2,884 (733)	14,538 (4,303)	3,016 (1,012)
1891-92	3,133 (796)	15,334 (4,277)	2,985 (1,282)
1892-93	3,394 (827)	16,130 (4,324)	2,852 (507)*
1893-94	3,658 (988)	17,601 (4,486)	4,152 (877)
1894-95	3,859 (1,067)	18,660 (4,196)	5,347 (1,297)

* Three-year course adopted at this time.

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96 - Adapted from tables in the Report of the Commissioner of Education for 1894-95, 242.

Inter-relationships and comparisons between the professions concerning student enrollment and graduation were brought out by graphic presentations prepared by the U. S. Bureau of Education during the 19th century. Those pertinent to pharmacy and the other health professions, reproduced on following pages, apparently have not been utilized previously in the pharmaceutical and historical literature concerned.

The first three presentations all relate to the comparative percentage of increase in enrollments among the professions at different periods during the last quarter of the century.

"A": Comparative Statistics of Professional Schools, 1877-78 to 1897-98, with the Percentage of Increase in Enrollments During the Two Decades and During the Second Decade of the Twenty-Year Period

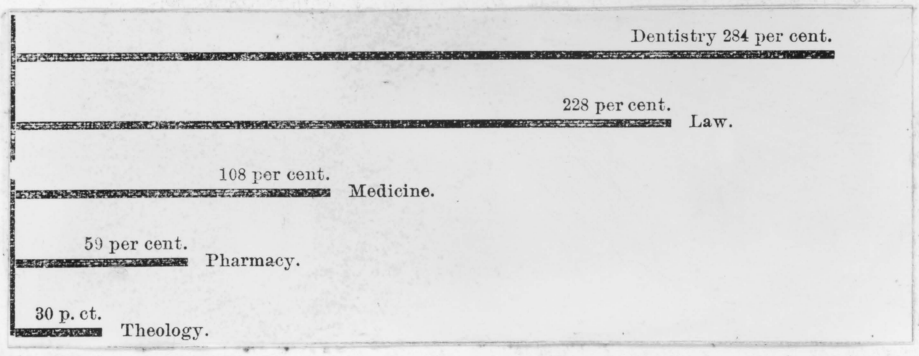
Class.	1877-78.	1887-88.	1897-98.	Increase in 10 years. a	Increase in 20 years.
				Per cent.	*Per cent.*
Theology:					
Schools	125	138	155		
Students	4,320	6,512	8,371	28	94
Graduates	826	985	1,673		
Law:					
Schools	50	49	83		
Students	3,012	3,667	11,615	217	286
Graduates	1,162	1,299	3,065		
Medicine (all classes):					
Schools	81	112	151		
Students	9,942	13,091	23,433	79	136
Graduates	3,080	3,740	5,597		
Medicine (regular):					
Schools	64	88	122		
Students	8,279	11,172	21,002	88	154
Graduates	2,506	3,147	5,023		
Medicine (homeopathic):					
Schools	11	12	21		
Students	1,215	1,118	1,786	60	47
Graduates	363	360	387		
Dentistry:					
Schools	12	25	50		
Students	701	1,588	6,774	327	866
Graduates	218	595	1,848		
Pharmacy:					
Schools	13	26	45		
Students	1,187	2,721	3,712	36	213
Graduates	380	692	1,129		
Veterinary medicine:					
Schools	----	6	14		
Students	----	323	326	1	
Graduates	----	81	109		
Nurse training:					
Schools	9	33	377		
Students	----	1,093	8,805	706	
Graduates	----	421	2,027		

a From 1888 to 1898.

From Report of the Commissioner of Education for 1897-98, p. 1905.
U. W. Neg. No. 7536-B

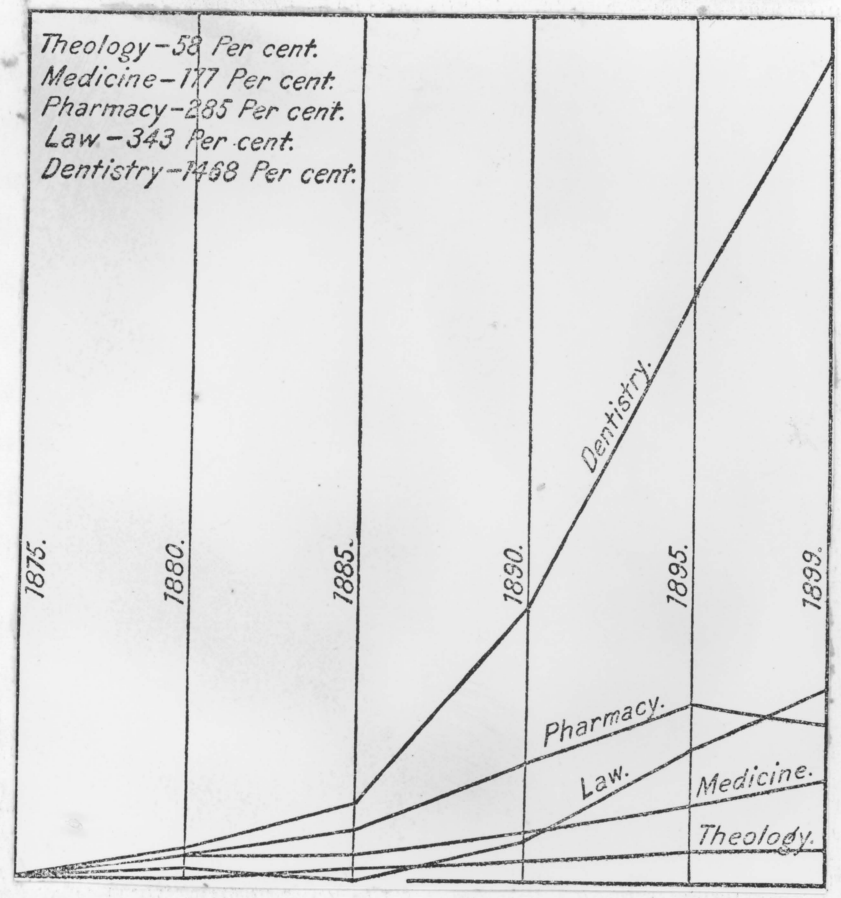
It will be noted from table "A" that pharmacy enrollment took a rather remarkable upsurge between 1877-1887, a decade that was alive with the founding of schools (ca. 20 from 1878-1887 inclusive) and state associations (28 from 1878-1887), and the passage of state pharmacy acts (22 from 1878-1887). The percentage of increase in pharmacy enrollments was relatively low during the subsequent decade (1888-1898). This is brought out graphically in "B."

"B": Percentage of Increase in Students, 1887-1897



From Report of the Commissioner of Education for 1896-97, p. 1773.
U. W. Neg. No. 7542-B

"C": Percentage of Increase in Students, 1875-1899



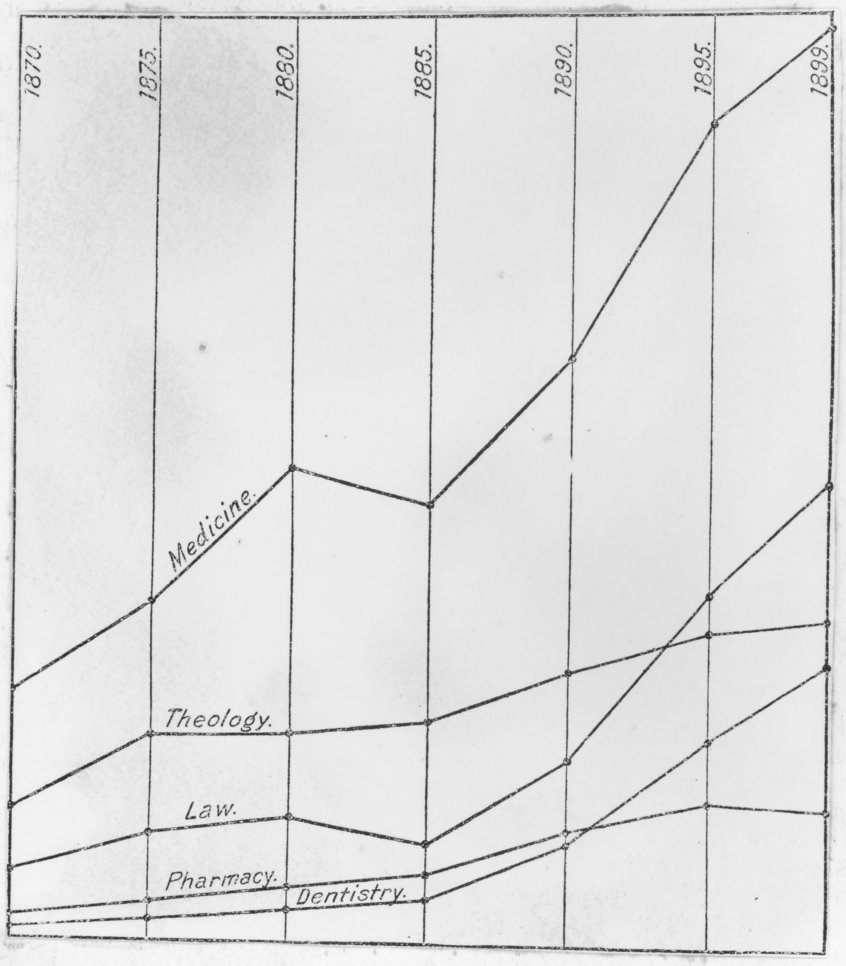
From Report of the Commissioner of Education for 1898-99, p. 1679.
U. W. Neg. No. 7541-B

Dentistry shows a remarkable upsurge of students entering its classrooms, whichever year is used as the base for calculating a percentage increase during the last quarter of the century. This appears most dramatically in "C", which covers the full period (1875-1900).

Regular medicine showed a marked increase in enrollments in both decades covered in "A," while the flat curve in "C" reflects the relatively high enrollments already registered in the base year 1875. Pharmacy, on the other hand, shows a strong rise in per cent increase of enrollment ("C"), compared with most other professions, because the numbers of students were still pitifully small in the base year 1875. The actual numbers of students in pharmacy, it will be noted in "A", remained remarkably small compared with the actual enrollments in other professions (except veterinary medicine). Moreover, among the professions, the percentage increase of enrollments took a downward turn only in pharmacy toward the end of the century ("C").

Graph "D" (p. 301) depicting the comparative number of students in different professions at different periods (1870-1900) offers a remarkable contrast to graph "C" depicting per cent of increase (1875-1900). As we would expect from previous discussion, pharmacy shows the flattest curve among all American professions charted on the basis of actual numbers of students. In the final decade, when there were 35 new schools founded, the increase in numbers of students entering classrooms remained small both absolutely and in relation to other professions. The numbers of medical students, and also of medical schools (see p. 288), can be conservatively termed amazing. Already in 1880 the Federal census showed that this output, together with self-styled physicians in practice,

"D": Comparative Number of Students in Five Professions (1870-1900)



From Report of the Commissioner of Education for 1898-99, p. 1676.
U. W. Neg. No. 7528-B

provided one physician for every 584 persons in the United States and the proportion was still dropping.[97] This is undoubtedly one reason why the separation of pharmacy and medicine proved to be a prolonged and imperfect process in the United States. As far as village practitioners are concerned, still in 1883 "many of them are farmers or druggists."[98]

Dental education, like pharmacy, had got a relatively slow start; hence the actual numbers of students are not as impressive as the percentage increases after 1870.

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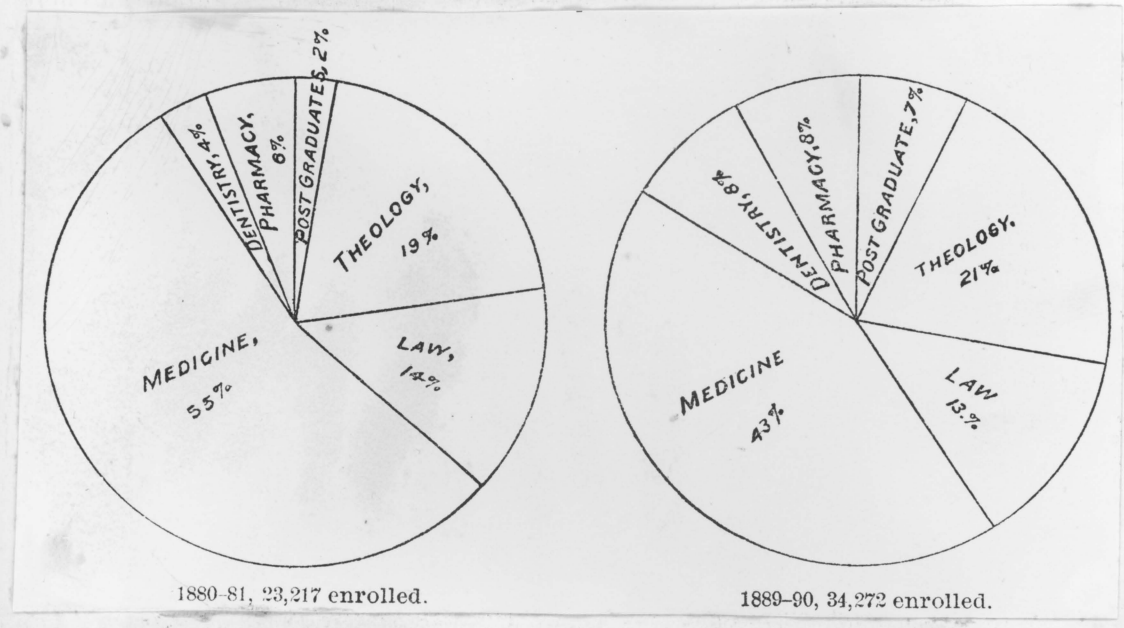
97 - Report of the Commissioner of Education for 1883-84, clxxiii and clxvii.

98 - Report of the Commissioner of Education for 1882-83, clxvi.

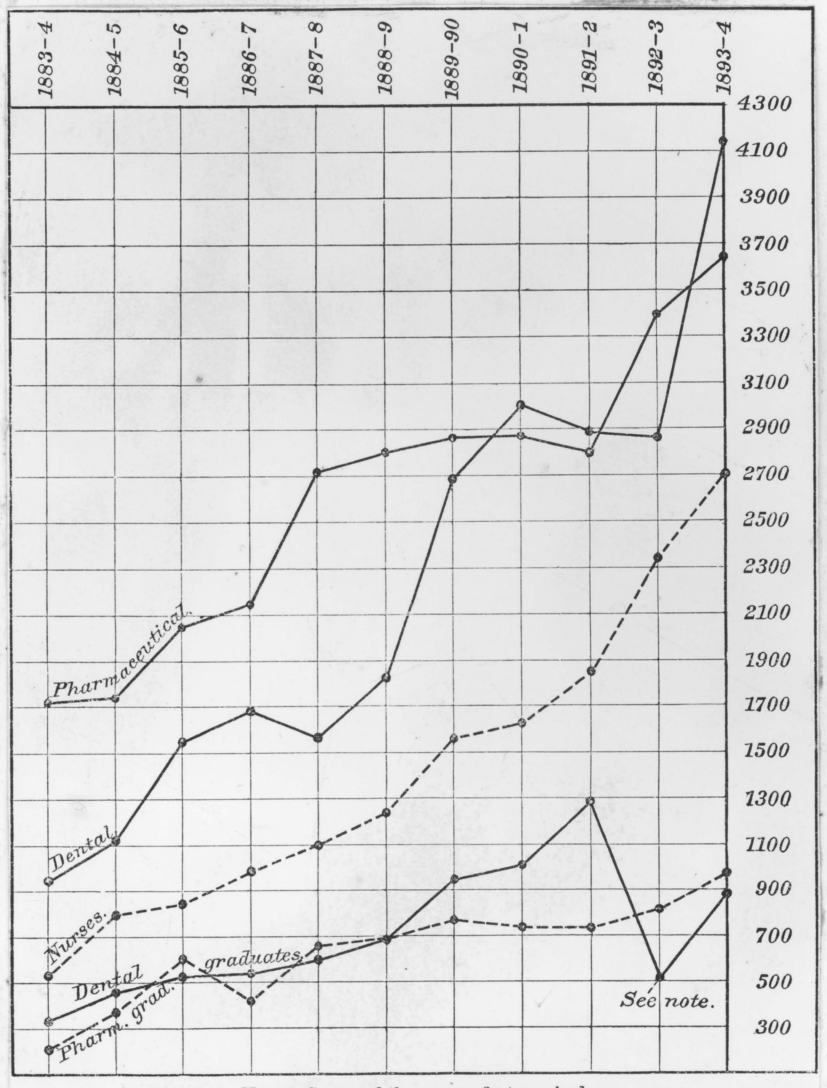
"E": Distribution of Enrollment in Professional Courses of the Schools, Colleges and Universities of the United States, in the Years 1881 and 1890.



From Report of the Commissioner of Education for 1889-90, p. 844.
U. W. Neg. No. 7531-B

The pie chart "E", representing enrollments at the points 1881 and 1890 on Graph "D", shows the share that each profession contributed to the total professional enrollment in institutions of higher learning. Professional students in postgraduate work, it will be noted, are shown here as a separate segment.

"F": Graduates and Students in Pharmacy and Dentistry, and Nurses in Training, 1883-1894

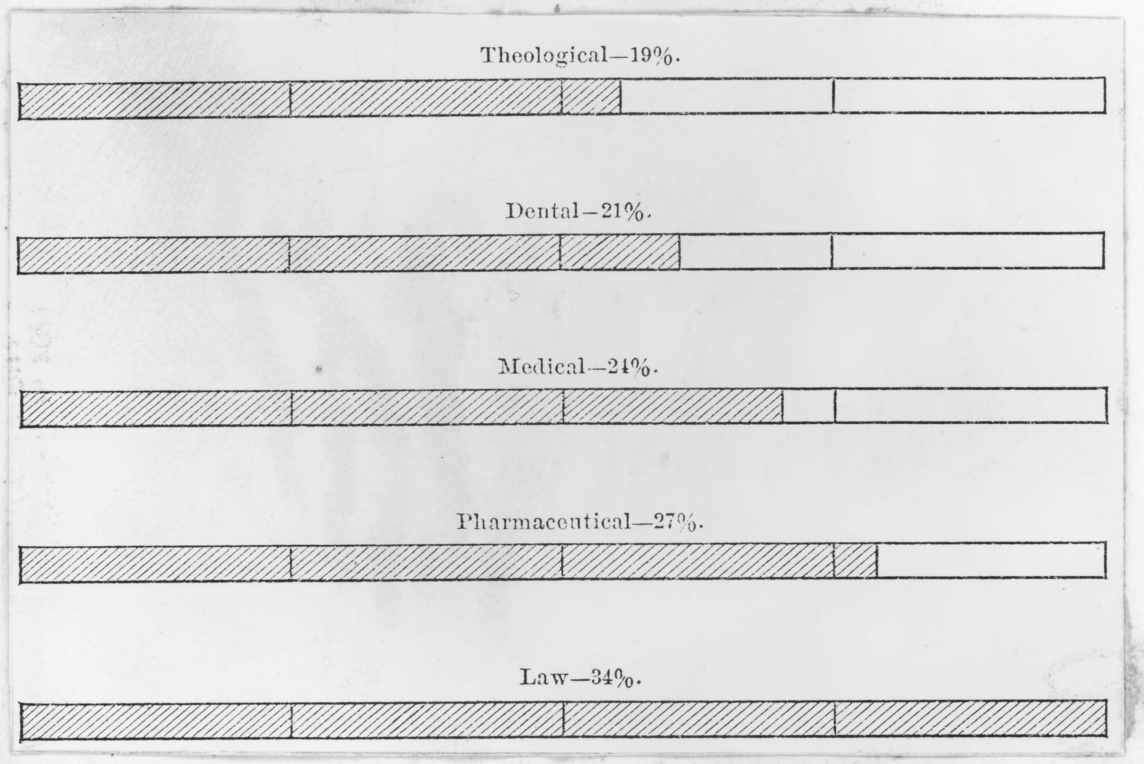


NOTE.—Course of three years first required.

From Report of the Commissioner of Education for 1893-94, p. 989.
U. W. Neg. No. 7538-B

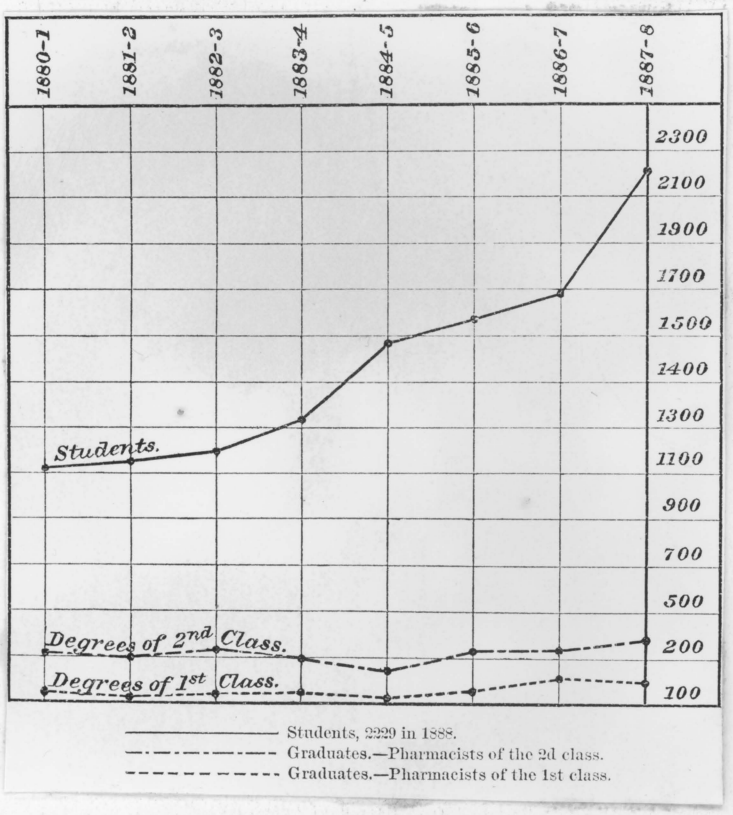
Graph "F" plots the graduating classes (1883-1894) in pharmacy and dentistry in relation to the students enrolled (and to nurses in training). Graduating classes for the last year shown (1893-94) appear in "G" (p.305) as bar graphs depicting, comparatively, the percentage of students graduating.

"G": Proportion of Students Graduating in Pharmacy in Relation to Four Other Professions, 1893-94



From Report of the Commissioner of Education for 1893-94, p. 987.
U. W. Neg. No. 7530-B

"H": Pharmacy Degrees Conferred in France, 1880-1888



From Report of the Commissioner of Education for 1889-90, p. 862.
U. W. Neg. No. 7540-B

The graph depicts the total number of students, and the degrees of both first and second class, conferred annually by the six higher schools of pharmacy and mixed schools of medicine and pharmacy, the two medical schools of "full exercise," and the twenty-one preparatory schools of medicine and pharmacy. Note the small number of pharmacists of the first class. Of special interest is the lack of relationship between the size of the graduating classes and the number of students enrolled.

On the basis of these graphs and the "usages followed in these vocations" the Commissioner of Education concluded that, on the average, medical students at this time had better preliminary education, spent a longer time in professional study, and underwent severer examinations than students in the other professions. Possibly law students began with better preliminary education than medical students, but some lax law schools operating short courses were a factor in making the percentage of graduates higher in law.

At the end of the century student enrollment ranged from seven at the University of Tennessee to 430 at the Philadelphia College. Only a single graduate emerged in 1899 from the Central Tennessee College, the University of North Carolina and the University of Alabama (Medical College). It is noteworthy that two normal schools, Valparaiso and Ohio Normal, were among the institutions most productive in graduates, with 80 and 74 respectively.

Here are the enrollments and graduating classes for the individual schools reporting for the year 1899-1900:[99]

	Men	Women	Graduates 1900
Alabama Polytechnic Institute	37	0	6
University of Alabama, Medical College of Albany	17	-	1
California College of Pharmacy	77	4	35
College of Physicians and Surgeons	29	2	9
Howard University	26	0	13
National College of Pharmacy	54	4	11
Atlanta College of Pharmacy	34	-	5
Chicago College of Pharmacy	144	5	40
Northwestern University	227	8	18
Purdue University	81	0	23
Notre Dame University	10	-	4
Northern Indiana School of Pharmacy (Valparaiso)	110	5	80
Highland Park College	250	30	85
Iowa College of Pharmacy	36	-	15
State University of Iowa	49	4	16
University of Kansas	75	4	21
Louisville College of Pharmacy	47	0	8
Tulane University (Medical Department)	28	3	9
University of Maine	10	-	3
Maryland College of Pharmacy	98	-	47
Massachusetts College of Pharmacy	172	12	19
University of Michigan	65	11	29
Detroit College of Medicine	47	2	20
University of Minnesota	57	7	17
Kansas City College of Pharmacy	37	2	7
St. Louis College of Pharmacy	145	3	50
New Jersey College of Pharmacy	22	2	8
Albany College of Pharmacy	78	1	30
Brooklyn College of Pharmacy	126	6	—
Buffalo College of Pharmacy	94	5	37
New York College of Pharmacy	300	13	97
University of North Carolina	20	-	1
Shaw University	10	-	6
Ohio Normal University	207	-	74
Cincinnati College of Pharmacy	29	2	23
Cleveland School of Pharmacy	46	1	14
Ohio State University	34	3	12
Scio College	26	4	14
University of Oklahoma	41	3	11
Oregon Agricultural College	33	13	2
Medico-Chirurgical College	58	-	18
Philadelphia College of Pharmacy	427	13	100
Pittsburgh School of Pharmacy	85	6	26
Medical College of South Carolina	28	-	11
South Dakota Agricultural College	25	0	8
University of Tennessee	6	1	2
Central Tennessee College	13	3	1
Vanderbilt University	39	3	9
University of Texas	41	4	11
University College of Medicine (Va.)	20	1	8
Medical College of Virginia	12	-	2
Washington Agricultural College	18	1	2
University of Wisconsin	46	5	12

99 - Report of the Commissioner of Education for 1899-1900, 2008.

The numbers of students enrolled in different regions of the United States at this time were:[100]

Region	Men	Women	Graduates 1900
North Atlantic	1,372	58	338
South Atlantic	302	5	104
South Central	269	17	58
North Central	1,746	96	582
Western	157	20	48
Totals: pharmacy	3,846	196	1,130
dentistry	7,768	160	2,029
regular medicine	21,673	1,079	4,720

There is no room for doubt that pharmacy lagged, among the professions, in getting its recruits into formal courses of instruction throughout the 19th century. The beginnings of an educational system did not come especially late, but only slowly attracted sufficient students to make it a going enterprise. The vigorous development of schools during the last two decades, noted elsewhere--while not out of relation to the general development of professional education--had little relation to the numbers of students seeking an education. This led to rather open vying for available students. Some confusion then arose within the profession--either real or assumed--about the relation between the efforts to get more students into the colleges and the overcrowding of the profession.

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100 - Report of the Commissioner of Education for 1899-1900, 1970-1973.

William B. Thompson, a noted Philadelphia pharmacist and druggist, released this emotive statement in 1898: "The colleges have been fostering and encouraging deceptive allurements to scores of illy-advised young aspirants whose keen disappointments in expectation, if recorded on this printed page would be more painfully audible than the mournful cadences of the funeral dirge. The colleges have been crying for more, more matriculants; they are sorely needed to maintain revenues. The trade has been shouting against the overcrowd--but the incubating process proceeds."[101]

This appeal had a certain credibility. But the bald and basic fact was that, nationally, "the graduates will not average more than about 10 per cent of those who are annually registered" to practice pharmacy.[102]

Neither pharmacy--nor apparently the American public through state legislatures--was ready to take one or more of the steps that now seem to have been necessary to change materially the course of events: an enforced standard of preliminary education for apprentices; selection of and standards for preceptors who helped mold the students entering the schools; and some measure of compulsory formal education in pharmacy.

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101 - William B. Thompson, "Control of Colleges of Pharmacy," Western Druggist, 20: 344, 1898.

102 - James H. Beal, "Report on American Colleges of Pharmacy," Pharmaceu. Era, 20: 330, 1898.

The Female Student

The admittance of women to schools of pharmacy never became an issue in the 19th century, although such students were rare until the general influx of women into higher institutions of learning during the last quarter of the century.

The opening of doors in higher education to women followed the greater opportunities for secondary education and for public service. The academies and seminaries of the early decades of the century had already shown that sex differences were not as important in education as had been supposed. And as girls entered the new high schools a demand arose that their education should not stop there.

Oberlin College (Ohio) became the "first fully co-educational institution of college grade in the world" in 1833. Great strides were being made by the 1850's, with the West taking the lead in co-education. The state universities, particularly those founded under the Morrill Act (1862), led the movement and became influential in changing the thinking and policies of other types of schools and colleges toward the female student.[103]

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103 - Dexter, A History of Education, 433, 434, 440, 445, 449; Charles F. Thwing, "American Universities," in Report of the Commissioner of Education for 1903, 306.

A young woman destined to become famous in medicine appears to have been the first woman graduate from an American school of pharmacy: Mary C. Putnam (Jacobi), who graduated from the course of the New York College of Pharmacy in 1863.[104]

The second female student to complete an American course in pharmacy was handed her certificate of graduation at the Massachusetts College of Pharmacy more than a decade later, in 1877. Louise Baker received the certificate rather than the regular "Graduate in Pharmacy" diploma because she lacked the necessary apprenticeship. Miss Baker had been preceded by Celia Low in 1872, who attended the lectures but did not graduate.[105]

There may have been some discussion about the proprieties involved in the admittance of women, for the female student became a matter of discussion at the 1879 Conference of the Schools of Pharmacy. The delegates gallantly resolved that "there was no objection to the admission of female students into all departments of the Colleges of Pharmacy."[106] It became the custom among the association schools to consider the age of 18 years as the minimum for graduation of women, whereas 21 years was supposed to be the minimum age for men.[107]

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104 - Not 1862, as stated by Emma G. Wallace. It was not her aim to practice pharmacy, however. She apparently enrolled only because, as a woman, she could not gain entry to a medical education in New York. (Wimmer, The College of Pharmacy, 57 ff.) There was not to be another woman graduate at the New York College for more than a quarter century.

105 - Emma Gary Wallace, "Women in Pharmacy,II," Pharmaceu. Era, 45: 101 f., 1912; Drugg. Circ., 51: 19, 1907.

106 - Minutes book of the Conference of the Schools of Pharmacy, 1879 proceedings, in Kremers Reference Collection.

107 - C. S. N. Hallberg, "The Requirements for Graduation...," Proc. Amer. Pharm. Assoc., 41: 275, 1893.

In the 1880's schools let it be known that the doors were open; and female students were no longer rarities but were still uncommon. The first woman graduate at the Chicago College, in 1880, was Marian Cecelia Tirrell. Then in 1883 Susan Hayhurst, at the age of 59, became the first woman to receive a degree from the Philadelphia College of Pharmacy. This distinguished lady, who later had charge of the pharmacy at Woman's Hospital of Philadelphia, has sometimes been identified, incorrectly, as the first American woman to graduate in pharmacy. It may be, as England states, that she was probably "the first regularly graduated woman pharmacist who took up the drug business in a practical way after graduation."[108] The Cincinnati College of Pharmacy made its first announcement, for the term 1880-81, that ladies were welcome to enroll on the same terms as gentlemen; and in 1884 graduated its first woman, Mrs. H. M. Merrell,[109] wife of a founder of the early pharmaceutical manufacturing firm by that name in the eclectic field. No woman apparently received a pharmacy degree at the University of Michigan until 1892.[110]

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108 - England, The First Century, 163. In 1876 Clara Marshall, later dean of the Woman's Medical College of Philadelphia, had been the first female student at the Philadelphia College of Pharmacy, but she did not graduate. (Ibid.)

109 - H. C. Freking, "Gleanings from the Early History of the Cincinnati College of Pharmacy," Amer. J. Pharm. Ed., 12: 418, 1948.

110 - Emma Gary Wallace, "Women in Pharmacy, II," Pharmaceu. Era, 45: 101 f., 1912.

The South slowly gave assent to the new education and vocations for women. At the pharmacy department of Tulane University[111] in 1888, "Female students were first admitted to the pharmaceutical laboratory, but not to the full course in pharmacy until 1894." Mrs. Eliza Rudolf became the first woman graduate. By 1901 there had been 18 female students in pharmacy, of whom 11 graduated.[112]

It was in the South that the first and undoubtedly the only American school of pharmacy specifically for women arose. When the Louisville College of Pharmacy for Women opened in March 1883 there were said to be three instructors.[113] The chief promoter and probably also the principal instructor was Dr. Joseph P. Barnum, who operated a drugstore in Louisville.

The Louisville College of Pharmacy for Women is not known to have had a building, and it is said that the ladies came to Barnum's drugstore for instruction. At least the practical work of the shop was taught there.[114]

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111 - Originally part of the Medical College of Louisiana.

112 - Catalogue of the Alumni from 1834 to 1901, Inclusive, of the Medical Department of the Tulane University of Louisiana, 5 f.

113 - Report of the Commissioner of Education for 1883-84, 102 and 694.

114 - C. Lewis Diehl, letter of November 13, 1906, to Edward Kremers, in Kremers Reference Collection; Emma Gary Wallace, "Women in Pharmacy, II," Pharmaceu. Era, 45: 103, 1912.

Exclusion of female students from the school of the Louisville College of Pharmacy, which had given instruction as early as 1871, probably helped call this unique institution into existence.[115] Five students enrolled when the college for women opened, and there were 15 enrolled and three graduating in 1895-96, when the college suspended teaching.[116] Perhaps only 15 or 20 women actually graduated during the 13 years of instruction. Barnum reported a three-year course of 36 weeks each year, which, if taken at face value, would place the school near the top of the list in the early 1880's on the basis of length of course.[117]

C. Lewis Diehl, one of the founders of the other Louisville College of Pharmacy, said, "I personally, never took this institution very seriously, notwithstanding that the names of some of our best citizens appeared in the list of sponsors."[118]

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115 - Wallace, loc. cit., stated in 1912 that the Louisville College of Pharmacy has "for several years numbered women students among its classes and so the real need of a separate training school has passed."

116 - Emma Gary Wallace, "Women in Pharmacy, II," Pharmaceu. Era, 45: 103, 1912; Report of the Commissioner of Education for 1883-84, 102 and 694; ibid., for 1895-96, 205.

117 - Report of the Commissioner of Education for 1895-96, 205.

118 - C. Lewis Diehl, loc. cit.

The following table may reflect an impetus given by Barnum's "college" to the study of pharmacy by women in the South Central states. Here we see the regional distribution of women students in pharmacy at five-year intervals, beginning with 1889, when the Bureau of Education first collected data on women students in professional courses.[119]

	Women Students		
Region	1889-90	1894-95	1899-1900
North Atlantic	17	42	58
South Atlantic	2	4	5
South Central	25	8	17
North Central	14	39	96
Western	2	7	20
Totals:	60	100	196

During the last decade of the century the percentage of women to men students in pharmacy rose from about 2.1 per cent women in 1889-90 to about 4.8 per cent in 1899-1900.

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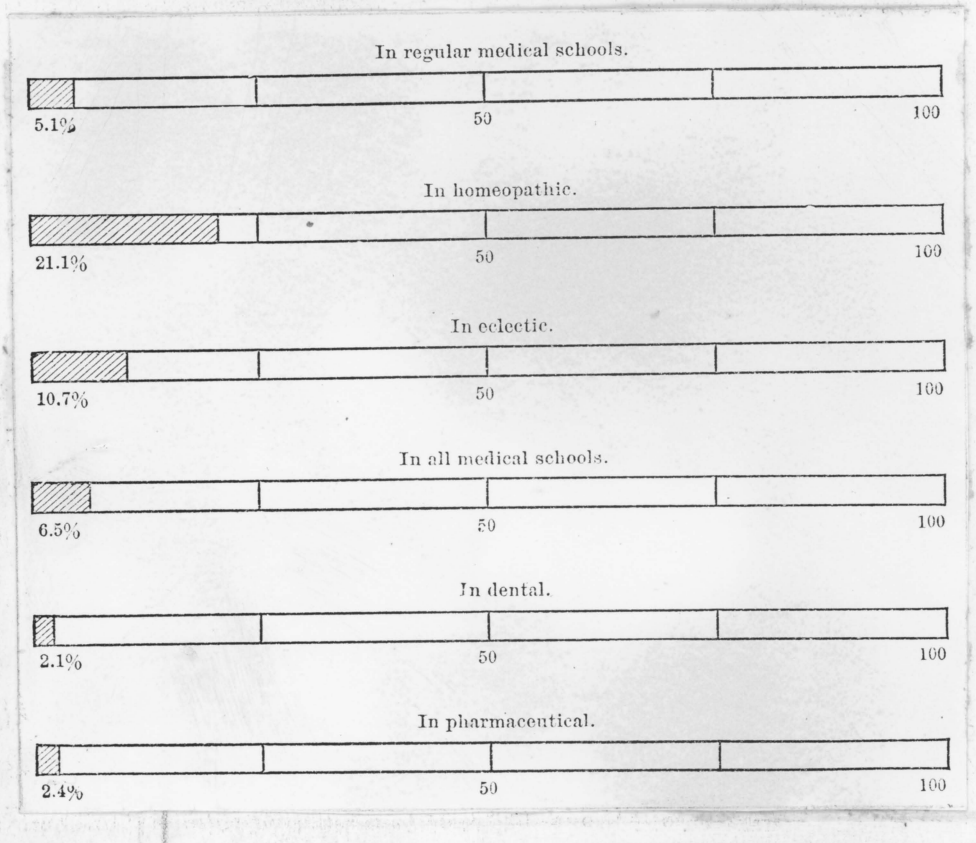
119 - Compiled from data in Reports of the Commissioner of Education for 1889-90, 1024; for 1894-95, 240; and for 1899-1900, 1973. The number of women enrolled at the individual schools is included in the original Reports. It must be remembered that the data are rough approximations of national enrollment, since some schools did not report.

A graphic comparison of the proportion of women students in various health professions in 1893-94 appears below.

Proportion of Women to Total Enrollment of Students Studying for the Health Professions in 1893-94



From Report of the Commissioner of Education for 1893-94, 936.
U. W. Neg. No. 7535-B

Note the relatively high proportion of women studying in homeopathic schools, 351 or 21.1 per cent of the total; the eclectic medical schools had about twice as many women enrolled as the regular medical schools, 86 or 10.7 per cent of the total students; in the regular schools there were 1,419 women students, but they represented only 5.1 per cent of the whole

number. There was, relatively, a much smaller enrollment of women in pharmacy (88, or 2.4 per cent) and dentistry (88, or 2.1 per cent). The law schools had an even smaller proportion of women, 54 students, or 0.7 per cent.[120]

A further comparison of the enrollment of women in schools of dentistry, pharmacy, and medicine, as far as reported, appears below for the years 1889 to 1899, the first decade in which women became a significant and accepted part of the student body in the health professions.[121]

Year	Dentistry	Pharmacy	Medicine
1899-1900	160	196	1,456
1897-98	162	174	1,397
1896-97	150	131	1,583
1895-96	143	140	1,471
1894-95	53	83	1,399
1893-94	88	88	1,411
1892-93	---	---	1,275
1889-90	53	60	884

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120 - Report of the Commissioner of Education for the Year 1893-94, p. 986.

121 - Dexter, A History of Education, 452.

The 1890's were a time for young women of other nations to gain their full status within the schools and the profession of pharmacy, although--as in this country--there were earlier beginnings.

As early as 1872 a Dutch decree admitted women to the practice of pharmacy, and thereafter quite a number of girls studied for that purpose. In 1892, 313 of 727 pharmacist's aids (apothekersbedienten) were women. The universities of Holland had conferred pharmaceutical diplomas on 15 girls, by this time, but none had opened a private pharmacy independently. Ostrogorski is quoted as saying in 1892 that "The first pharmacy conducted by a woman will soon be opened in Utrecht, by Mme. Th. Olivier." Others were practicing in hospitals or in partnership.

In Belgium, between 1881 and 1891, 17 women passed the pharmaceutical examination--perhaps the first there to do so.

Women in Germany were admitted to the study of the health professions (pharmacy, medicine, and dentistry) for the first time through a decree of April 24, 1898.[121a]

Norway offered university privileges to women in 1884, and after about 1888(?) women were entitled to study pharmacy and manage their own dispensaries, under certain conditions. Apparently the first woman to graduate from a university and become an apothecary in Norway was licensed in 1894. In Sweden women gained the same privileges as men in 1891 for the study and practice of pharmacy.

121a - A. Adlung and G. Urdang, Grundriss der Geschichte der deutschen Pharmazie, 145.

In Russia special lecture courses in pharmacy for women opened in 1891 at St. Petersburg. A full course in a girls' high school was a prerequisite. In 1895 the Russian government was planning a special three-year university course in pharmacy for women.

Women are known to have appeared on the rolls of Spanish universities as students of medicine and pharmacy as early as 1892. [122]

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122 - The discussion of women students of pharmacy in other countries is based on Frances Graham French, "Educational Status of Women in Different Countries," in Report of the Commissioner of Education for 1894-95, 953-956.

The Negro Student

Faced by broad problems with which they could not adequately cope, organized pharmacy and pharmaceutical education gave little thought to the education of the Negro in pharmacy. Although we have meager information, Negroes found their way into the classrooms of Northern schools from time to time, and after the period of Reconstruction several pharmacy schools specifically for Negroes sprang up in the South.

I know of only two racial incidents reported in the literature concerning pharmaceutical education of the 19th century. Wimmer states that the New York College had never made racial distinctions, and a Negro enrolled for the course in 1852. At that time the College of Pharmacy held classes in rooms rented from the New York Medical College; and the latter refused the student admittance to the building. As Wimmer relates the incident, the College of Pharmacy considered moving to other rooms, but could find nothing suitable at a sufficiently low rent. The student's fees were therefore refunded, accompanied by a letter of sympathy.[123] Three or four Negroes graduated from the New York College before 1883.[124]

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123 - Wimmer, The College of Pharmacy, 49.

124 - Pharmaceu. Record, 3: 472, 1883.

A rather clear indication that reasonably qualified Negro youths had little difficulty entering pharmacy schools in the North appears in an editorial published by the Pharmaceutical Record in 1883. The editor was outraged by an incident at the National College of Pharmacy in Washington, D. C., where the students abandoned the classrooms en masse in protest against the enrollment of a colored student. This "is not an act that will commend itself to the opinions of most of those who are engaged in pharmacy," the editor believed. "...Such an applicant as the one that offended the thirty-eight [students] would have been received in any other college of pharmacy."[125]

The editor's remarks hardly could have referred, however, to schools south of the Mason-Dixon line. There, under great stresses and difficulties, a rather uneven educational system had been erected on the ruins of the ante-bellum culture, which included some provision for Negro children. Benefactions and hard work eventually extended the range of available instruction through a score or more of mediocre colleges and universities for Negroes.[126]

The best of these was Howard University in Washington, D. C., which established the first American pharmacy course particularly for Negroes. The course began as part of a medical department, which opened in 1868. Indeed, James T. Wormley, the first graduate of the medical department, received the degree of Doctor of Pharmacy (Ph. D.).[127] The University, and school

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125 - Pharmaceu. Record, 3: 472, 1883.

126 - Arthur M. Schlesinger, The Rise of the City, 1878-1898 (New York, 1933), 380.

127 - Ernst T. Stuhr, Pioneers of Pharmaceutical Education (MS in Kremers Reference Collection), 14.

of pharmacy, keeps its doors open to all races; but it serves particularly and primarily Negro youths, whom the institution attracts from far and near. The total number of pharmacy graduates at Howard University after the 1947 commencement was 571.[128] In 1895-96 there were 18 pharmacy students enrolled, of whom five graduated.[129] Of the 19th-century schools of pharmacy particularly for Negroes, only this institution has survived up to the present day.

Howard University was joined in 1889 by the Department of Pharmacy of the Meharry Medical College in the instruction of Negro pharmacy students. This privately supported institution became a part of the Central Tennessee College,[130] later known as Walden University. In 1895-96 there were 19 students and six graduates; by 1897 the school had produced 40 Negro pharmacists: 34 men and six women.[131] Unlike Howard University, the Meharry department drew its students mostly from the Southern states. When its doors were closed in 1937, after 48 years of service, approximately 560 pharmacy students had been graduated.[132]

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128 - Chauncey I. Cooper, The Negro in Pharmacy (mimeographed paper prepared for The Pharmaceutical Survey for private distribution; personal copy), 2 f.

129 - Report of the Commissioner of Education for 1895-96, 2086. Through 1914 there had been 240 graduates, according to F. H. Freericks, "Some Facts...," Proc. Amer. Pharm. Assoc., 4: 32, 1915.

130 - C. I. Cooper, op. cit., 3.

131 - Report of the Commissioner of Education for 1895-96, 2086; Drugg. Circ. and Chem. Gaz., 41: lxxxii, 1897.

132 - C. I. Cooper, op. cit., 3; there were 206 graduates through the year 1914, according to Freericks (loc. cit., 36).

The Leonard School of Pharmacy in Raleigh, N. C. began instruction in 1891, eventually becoming part of Shaw University. Four years after the opening 11 Negroes were enrolled; two of them graduating at the 1896 commencement.[133] This school was not as productive as the ones in Washington, D. C. and Tennessee, graduating only about half as many pharmacy students up to 1914.[134] Most of its graduates—125 when the school closed in 1918—were found in the Carolinas and Georgia.[135]

The total numbers of Negro pharmacy students and graduating students for 1895-96, the only year for which we now have data, appear below in a comparison with the Negro enrollment in medicine and dentistry:[136]

	Students	Graduates
Pharmacy	48	13
Medicine	286	30
Dentistry	32	6

Most of the relatively small number of Negro graduates of the 19th century undoubtedly took positions serving people of the same race, following the present pattern and encountering similar difficulties.

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133 - Report of the Commissioner of Education for 1895-96, 2086.

134 - See Freericks, loc. cit., 35.

135 - C. I. Cooper, op. cit., 3 f. Another school for Negroes, the Flint School of Pharmacy at New Orleans, may possibly have begun instruction still in the 19th century. It was absorbed by the present Dillard University, but Cooper found that records of the school have been lost.

136 - Report of the Commissioner of Education for 1895-96, 2086.

VII. TEACHING TOOLS

Colleges of pharmacy had early ambitions to build libraries and cabinets of crude drug specimens, sometimes even before regular instruction began. A not-too-confident assumption that the student would find laboratory facilities and experience in his preceptor's shop relieved independent schools of the need of squarely confronting the financial problem posed by instructional laboratories until late in the century. For textbooks, American pharmaceutical education relied heavily upon the United States dispensatory and pharmacopoeia, and British texts that proved congenial to American instruction because of the level of presentation as well as the common language.

Libraries

Probably every pharmacy school maintained a collection of books that could be called a library and proudly mentioned it in the annual catalog. Not much is known about the quality of early libraries, or—equally important—the extent to which scientific reference works, or even the regular textbooks, may have been consulted.

Six years after the founding of the Massachusetts College of Pharmacy its twenty-four members had a library of considerable scientific merit for that time, although not used in connection with systematic instruction until much later (1867). The catalog of 1829 for this library, listing a hundred books and periodicals, has been published together with a commentary by Edward Kremers

on the chemical part.[1]

The chemical texts, which dominate the collection, represent both the phlogiston and anti-phlogiston schools. This may offer another bit of testimony concerning the slow rise to dominance of the new chemistry, although it may testify mainly to which volumes the member-donors considered most outdated and eligible for disposal.

At the Massachusetts College about three years after the reorganization, in 1854, the library contained 257 volumes (including books of only historical value) besides periodicals and pamphlets.[2] The present Sheppard Library at the College honors the pharmacist S. A. D. Sheppard, who bestowed his collection of 3000 pharmaceutical, chemical and botanical volumes upon the College in 1889.[3]

In 1852, the Philadelphia College announced: "As in a pharmaceutical library old works of the 18th, 17th and 16th centuries are particularly appropriate, as forming a fund of authorities useful to investigators, the Library Committee now make the appeal to the members, and others who may feel interested,

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1 - "Facsimile of the 1829 Catalogue of the Library of the Massachusetts College of Pharmacy" in Bulletin of the Massachusetts College of Pharmacy (Boston, December, 1934), 16-21; and Edward Kremers, "Works on Chemistry in the Early Library of the Massachusetts College of Pharmacy," ibid., 22-30.

2 - "Proceedings of the Massachusetts College of Pharmacy" (Ed. Dept), Amer. J. Pharm., 26: 473-477, 1854.

3 - Twenty-fourth Annual Catalogue of the Massachusetts College of Pharmacy, 1890-91, 8.

who have in possession works of the kind, that they do not particularly value, asking their donation to the College."[4]

Donations may well have been those that members "do not particularly value," for seven years later the library contained mostly books published before 1835. The catalog of the Philadelphia College library, published in 1859, shows a rather heterogeneous collection, of which a third can only be described as miscellaneous. The remainder consisted of 120 titles on chemistry, including mineralogy, and 150 titles in the field of pharmacy, materia medica and botany.[5] A number of medical books are included in the second group.

The library apparently started about 1839, when nearly 500 volumes were assembled, then stagnated except for the binding of journals. It had "in a great degree been neglected" because of more pressing problems, notably the debt incurred on the College's first building. Now clear of debt, members believed the next most important object "to promote the interest of our profession is the building up of our library."[6]

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4 - "Library of the Philadelphia College of Pharmacy" (Ed. Dept.), Amer. J. Pharm., 24: 387, 1852.

5 - "Catalogue of Books Belonging to the Library of the Philadelphia College of Pharmacy," Amer. J. Pharm., 31: 291-8, 1859.

6 - "Library of the Philadelphia College of Pharmacy. Circular," Amer. J. Pharm., 31: 290, 1859. Between 1865 and 1870 the library shared in a legacy of $200 a year intended for books and scientific apparatus. (E. Kremers, "The Teaching of Pharmacy...," Drugg. Circ., 51: 70 f., 1907.)

An inventory of the outstanding library of the Philadelphia College taken in 1876 reveals something of its growth and content. Half of the 2,263 volumes were serials. The remainder of the volumes were classified as follows:[7]

Encyclopedias, public documents and reports.	344
Chemistry	220
Pharmacopoeias, dispensatories, formularies, materia medica, pharmacy, botany	255
Miscellaneous	313

The New York College of Pharmacy had a library within a few years of the founding.[8] By the end of the Civil War the collection had grown to about 300 volumes, of which the College judged "some few books are valuable, the others very obsolete."[9]

When the erudite Charles Rice took charge of the library, however, it was rearranged and enlarged, and in 1871 reportedly contained "a large collection of standard works [about 450 volumes] on all branches of the profession, in English, German, French and Spanish, including the latest publications. All the American and most valuable foreign pharmaceutical, chemical and botanical journals were kept on file."[10]

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7 - "Minutes of the [Philadelphia] College," Amer. J. Pharm., 48: 222, 1876.

8 - Wimmer, The College of Pharmacy, 41 f.

9 - Quoted by Wimmer, The College of Pharmacy, 60.

10 - Wimmer, The College of Pharmacy, 73; and Report of the Commissioner of Education for 1870, 525.

The New York College library, valued at $3200 in 1879,[11] steadily developed under the hand of Rice, who devoted much time to it as a hobby during the remainder of the century.[12]

Up to 1870 apparently only the Philadelphia College and the Chicago College developed sizable libraries, although the New York College and particularly the Cincinnati College reported extensive accessions a few years later. After 1870 the Reports of the U. S. Commissioner of Education portray the development of libraries in pharmacy schools.

Erratic fluctuations in the reported holdings seem to indicate that inventories were not always taken on the same basis or that the figures were sometimes rather wild guesses. Only a minority of the schools included library information in their reports to the Bureau of Education. Quite a number of the schools not reporting may well have had scanty collections that they preferred not to mention. On the other hand such schools connected with universities undoubtedly had rather complete library facilities but could not readily report because the books used by pharmacy students were not maintained as a collection separate from other university holdings.

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11 - Wimmer, The College of Pharmacy, 76.

12 - Ibid., 85.

In the first survey by the Commissioner in 1870 the Philadelphia College reported 2500 volumes and the Chicago College 2000 volumes. The Maryland, Massachusetts and New York Colleges had libraries of 300 to 450 volumes.[13]

The only dental school reporting at this time was that of Harvard, with 100 volumes. Eighteen of 47 regular schools of medicine included the size of the library. Half of these had between 1000 and 4000 volumes. Four schools had less than 1000; five had 4000 or more.

Five years later (1875) nine schools of pharmacy reported a total of 7,760 volumes (not including pamphlets), but more than 6000 of these were in just three schools: Chicago (2500), Cincinnati (2,350) and New York, (1200).[14] The Philadelphia College did not report, but the inventory of 1876 mentioned previously showed 2,263 volumes including serials and documents.[15]

Some schools at this time could boast hardly more than a shelfful of books, and until the end of the century there were well known schools that had only a few hundred volumes. Some schools accessioned less than ten books a year; while others were adding one or two hundred volumes.[16]

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13 - Report of the Commissioner of Education for 1870, 525. Note the lower figures in the Report for 1872, 819; pamphlets and/or serials may have been excluded from these figures.

14 - Report of the Commissioner of Education for 1875, 779.

15 - "Minutes of the College," Amer. J. Pharm., 48: 222, 1876. Note that a somewhat larger figure, 2500 volumes, had been reported to the Commissioner already in 1870.

16 - E. G., see Report of the Commissioner of Education for 1880, cliv.

Perhaps presently available data on holdings by schools affiliated with or part of a university or other institution had best be ignored, since the scope or basis for the estimates are not known. For example, in 1885-86 the Albany College of Pharmacy of Union University reported 5000 volumes, or twice as many as the University of Michigan. This was exceeded among the schools only by the University of Wisconsin, which reported 15,200 volumes (exclusive of pamphlets), which is larger than the segregated holdings in pharmacy at Wisconsin at the present time.[17]

Among the independent schools in 1885-86, Philadelphia, Massachusetts and New York had between 3000 and 4000 volumes each, exclusive of pamphlets. The Colleges of California, St. Louis and Louisville had less than 100 volumes each; Pittsburgh had 150; the Louisville School of Pharmacy for Women, 318.[18]

The number of books held by schools at this time indicates that the library facilities available to students of pharmacy appear to have been at least as extensive, on the average, as those available to students of regular medicine. For 14 schools of pharmacy reporting, the average number of books held was 3,157; among 30 schools of medicine the average number of books was 2,800.[19] The disparity in the size of libraries among medical schools was similar to that among schools of pharmacy. A majority of the medical school libraries lay within the range of 300 to 2500 books; some had no library, while the medical school at the University of Pennsylvania reported 12,000 books. Dental school libraries were

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17 - Report of the Commissioner of Education for 1885-86, 559.

18 - Ibid., 559.

19 - Based on Report of the Commissioner of Education for 1885-86, 551 ff. Fourteen of 20 pharmacy schools listed reported the size of the library; 30 of 89 medical schools listed gave this information.

relatively small; some schools had none at all, and 500 books seems to have constituted a large library.[20]

Edward Kremers considered the college of pharmacy libraries "depressing,"[21] and it may be that if we could go back and browse through the stacks of 19th-century libraries, the effect would be more depressive than impressive. It seems clear, however, that many pharmacy schools gave considerable attention to building up library resources for their students; and in size, at least, achieved quite as much or more than schools of medicine and dentistry.[22]

At the end of the century a number of the medical schools still had no library. The schools commonly had from a few hundred to two or three thousand volumes. Large medical libraries boasted four to five thousand volumes; a few even more. Hardly more than half the schools reporting to the Commissioner of Education indicated the "number of volumes,"[23] but among 88 regular and sectarian medical schools the average library in 1899-1900 contained 1801 volumes.[24]

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20 - Report of the Commissioner of Education for 1888-89, 1200.

21 - Mentioned in manuscript notes dated 1932 left in Kremers Reference Collection.

22 - This judgment must be based of course on the schools reporting the size of library, representing a minority of the total schools in all fields, and based on the face value of data reported.

23 - There may have been some variation among professional schools as to the types of items counted as "volumes." In some of the previous Reports pamphlets are indicated separately.

24 - Report of the Commissioner of Education for 1899-1900, 1965 and 1992 ff.

Less than a third of the pharmacy schools and the dental schools reporting that year gave similar data. Among 15 dental schools reporting on the library, only two had more than 600 volumes (1500 and 2000). Four schools had no library at all. The average for the 15 dental schools was 435 volumes.[25]

Among 15 schools of pharmacy offering information on the library, four had 5000 volumes or more; six had fewer than 600. The total number of volumes represents an average of 2,248 per school.[26]

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25 - Report of the Commissioner of Education for 1899-1900, 1965 and 2004 ff.

26 - Ibid., 1965 and 2009. Note that averages mentioned are based on all schools reporting under libraries, including those reporting the number of volumes as zero.

The number of volumes reported by individual schools of pharmacy in 1899-1900 appears below:[27]

Philadelphia College of Pharmacy	10,000
Massachusetts College of Pharmacy	5,132
New York College of Pharmacy	5,087
University of Michigan	5,000
Chicago College of Pharmacy	1,800
Brooklyn College of Pharmacy	1,500
Medico-Chirurgical College of Philadelphia	1,500
Cincinnati College of Pharmacy	1,000
Louisville College of Pharmacy	600
Northwestern University	550
Cleveland School of Pharmacy	500
Pittsburgh College of Pharmacy	400
National College of Pharmacy	350
California College of Pharmacy	300
Washington Agricultural College	0

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27 - It must be emphasized that specific figures are presented only to provide a general idea of the development of libraries for teaching purposes and as an approximation of the relative strength of library services in the various schools. The credibility of specific figures for certain schools in some of the Reports is questioned. Note that the number of volumes reported in the library of the Cincinnati College of Pharmacy dropped from 2,350 in 1875 to 1000 in 1900; that the number of volumes reported at the Chicago College of Pharmacy dropped from 5000 in 1889 to 1800 volumes in the year 1900.

One may conclude, despite occasional inconsistencies in the reporting, that pharmaceutical libraries for teaching purposes had a steady, sometimes rapid, development in the latter part of the century. Although we know little specifically about the library facilities of schools whose books were held in common within a university library, they probably compared favorably, on the average, with the facilities at the best independent schools, especially in view of the wider range of scientific and cultural literature a university library could offer.

It is thus difficult to assess the claim of the Chicago College of Pharmacy at the close of the century that its library "comprises the largest collection of pharmaceutical literature in the West, with the sole exception of the Lloyd Library at Cincinnati." This undoubtedly was true as far as the separate, integrated pharmaceutical collections are concerned; and it is particularly noteworthy since the College and its library had been wiped out by the great Chicago fire of 1871. The rebirth of a substantial library at the Chicago College largely resulted from the generous contributions of books received from pharmacists in Europe and America, and particularly Great Britain, following the tragedy.[28]

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28 - [Chicago College of Pharmacy], Western Druggist, 19: 488, 1897.

Textbooks

The earliest American lecture courses probably relied heavily upon the Pharmacopoeia of the United States (1st edition, 1820) and the United States Dispensatory (1st edition, 1833). Although the Pharmacopoeia stood as the authoritative standard, it was substantially displaced in use among pharmacists and students by the Dispensatory, a massive commentary and supplement to the Pharmacopoeia founded by two professors of the Philadelphia College, George B. Wood and Franklin Bache.

Pharmacy. These books were primarily reference works, and a need was soon felt for pharmacy texts. The minutes of the Philadelphia College in 1846 contain the comment, "We look in vain amongst the medical literature of the English language for a single work devoted exclusively and systematically to this branch of knowledge. To French and German Pharmaciens and books we are indebted for most that is interesting, instructive and original in regard to Pharmacy. The latter are only available to a limited extent in this country, and are not well adapted to our different circumstances."[29]

These "different circumstances" naturally asked for elementary and practical texts. Books that appeared by mid-century to fill the gap fitted in well with the American emphasis upon academic instruction as a completion or rounding out of the

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29 - "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 18: 154, 1846.

apprenticeship. The texts Remington found to have been used around 1857 were predominantly practical,[30] and the list of reference works recommended to pharmacists in 1856 by Procter points in the same direction.[31]

Significantly, three of the four real textbooks listed by Remington were taken over from the British by American editors. Lacking such academic tools of its own, American pharmacy preferred to borrow British texts, rather than the more theoretical French and German works.

The list by Procter shows the importance attached to chemistry, in which British, German, and French scientific texts (in English) are suggested; the other volumes, on pharmacy and materia medica, are elementary compilations, formularies, and technologic encyclopedias.

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30 - Remington mentions the United States Pharmacopoeia, United States Dispensatory, Pereira's Materia Medica, Mohr and Redwood's Practical Pharmacy, Parrish's Practical Pharmacy, and Fowne's Chemistry. (Joseph P. Remington, "Pharmacy During the Last Fifty Years," Drugg. Circ., 51: 19, 1907.)

31 - Procter and his Committee on Textbooks list: "Gmelin's handbook of Chemistry. 12 vols., now published by the Cavendish Society, Regnault's Chemistry, 2 vols., Lowig's Principles of Organic Physiological Chemistry, Gregory's Organic Chemistry (1856), Muspratt's Chemistry of Arts and Manufactures, Booth's Encyclopedia of Chemistry, Griffit's Medical Botany, Pereira's Materia Medica, Dorvault's l'Officine (a compendium of information of various kinds that relate to the apothecary business in French), Redwood's Gray's Supplement, Griffith's Universal Formulary, Mohr and Redwood's Practical Pharmacy, Parrish's Practical Pharmacy, Darby's Translation of Wittstein's Pharmaceutical Chemistry." (William Procter, Jr., [Report of the Committee on Textbooks], Amer. J. Pharm., 28: 493, 1856.)

The place several of these volumes held at the University of Michigan in the 1860's was recalled by Albert Prescott. "There were books in those days," he reminisced. "Wittstein's Pharmaceutical Chemistry, Darby's compact edition in English, seemed at that time to be worth its weight in gold, to the enthusiastic student. Mohr, Redwood and Procter's Pharmacy appeared ever ready at the elbow as a never-failing counselor. Parrish's Pharmacy was a code, always orthodox. The 'pharmacopoeia' was more of a novelty...much more to the point than the 'Dispensatory,' and 'Cooley's Receipts'[32] was not to be mentioned at the same time with it."[33]

The two texts in pharmacy proper that long monopolized the field in American schools were the Mohr-Redwood-Procter Practical Pharmacy and Parrish's An Introduction to Practical Pharmacy.[34] Both texts are primarily descriptive compilations concerning the "art," with minimum theoretical content.

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32 - This book went through many, constantly enlarged, editions. Its complete title well characterizes the scope and aim: Arnold James Cooley, The Book of Useful Knowledge. A Cyclopaedia of Six Thousand Practical Receipts, and Collateral Information in the Arts, Manufactures and Trades, Including Medicine, Pharmacy and Domestic Economy. Designed as a Compendious Book of Reference for the Manufacturer, Tradesman, Amateur and Heads of Families (New York, 1857), 576 pp.

33 - A. B. Prescott, "Silas H. Douglas as Professor of Chemistry and Pharmacy," Pharmaceu. Review, 21: 363, 1903.

34 - Francis Mohr (should read Karl Friedrich Mohr), Theophilus Redwood, and William Procter, Jr., Practical Pharmacy: The Arrangements, Apparatus, and Manipulations of the Pharmaceutical Shop and Laboratory (Philadelphia, 1849), 576 pp.; Edward Parrish, An Introduction to Practical Pharmacy: Designed as a Text-book for the Student and as a Guide to the Physician and Pharmaceutist. With Many Formulas and Prescriptions (Philadelphia, 1856), 544 pp.

The first real pharmaceutical text used by American students originated in the fertile mind of Karl Friedrich Mohr, whose Lehrbuch der pharmaceutischen Technik appeared in Germany in 1847. Up-to-date and eminently practical (rather than scientific), the manual was promptly translated for students at the school of the Pharmaceutical Society of Great Britain by their professor of chemistry and pharmacy, Theophilus Redwood. This British version was then rearranged and supplemented by William Procter, Jr., the master pharmacist who had become the first occupant of a separate chair in pharmacy at the Philadelphia College in 1846. The American edition came out (1849) only two years after the first German edition. Procter had increased the size of the book by nearly a fourth, adding nearly all of the chapter on sublimation, calcination and destructive distillation; the material on the preparation and purification of fixed oils and fats used in pharmacy and on cerates, ointments, soaps and plasters; he incorporated material on reagents, apparatus and methods of testing drugs taken from Bowman's Practical Chemistry; and added a table of solubilities compiled mainly from Henry and Guibourt; "besides numerous additions interspersed throughout the book" and a hundred additional woodcuts.[35]

A reviewer for the American Journal of Pharmacy (Ambrose Smith) felt that "Although no instruction of this kind will enable the beginner to acquire that practical skill and readiness which experience only can confer, we believe that this work will much facilitate their acquisition..."[36]

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35 - "A. S.," "Review. Art. XLVII.--Practical Pharmacy...," Amer. J. Pharm., 21: 213 f., 1849.

36 - Ibid., 213.

PRACTICAL PHARMACY:

THE ARRANGEMENTS,

APPARATUS, AND MANIPULATIONS,

OF THE

PHARMACEUTICAL SHOP AND LABORATORY.

BY

FRANCIS MOHR, PH. D.,

ASSESSOR PHARMACIÆ OF THE ROYAL PRUSSIAN COLLEGE OF MEDICINE, COBLENTZ;

AND

THEOPHILUS REDWOOD,

PROFESSOR OF CHEMISTRY AND PHARMACY TO THE PHARMACEUTICAL SOCIETY OF GREAT BRITAIN.

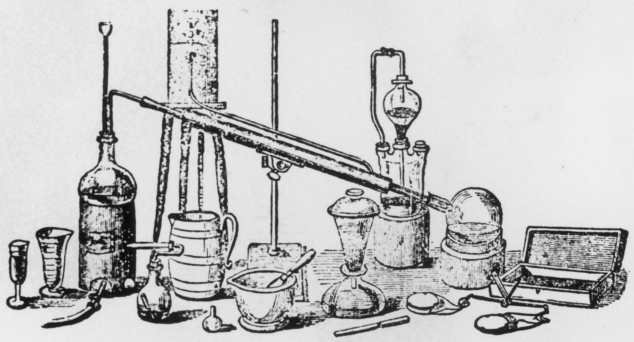
EDITED, WITH EXTENSIVE ADDITIONS,

BY

WILLIAM PROCTER, JR.,

PROFESSOR OF PHARMACY IN THE PHILADELPHIA COLLEGE OF PHARMACY.

ILLUSTRATED BY FIVE HUNDRED ENGRAVINGS ON WOOD.



PHILADELPHIA:

LEA AND BLANCHARD.

1849.

U. W. Neg. No. 51148-C

Titlepage of the first textbook on pharmacy used in American schools, an enlarged American version of a British translation of a German work issued in 1847. The practical, non-theoretical content of the book harmonized well with the level and orientation of British and American instruction at this time. (Note that the real name of the German author was Karl Friedrich Mohr--not Francis.)

The book contained more than 500 woodcuts, mostly of apparatus; and it was said to be the publisher's refusal to meet the costs of properly illustrating a second edition that barred further issuance of the work.[37]

As Kremers and Urdang point out, this opened the way for a similar work, "the first truly American textbook on pharmacy": An Introduction to Practical Pharmacy by Edward Parrish.[38]

There had been an earlier American work on Chemical and Pharmaceutic Manipulations, designed "for the use of Chemists, Druggists, Teachers and Students," which is rarely mentioned in pharmaceutical literature. The book appeared in the same year as the Mohr-Redwood-Procter text, perhaps even preceding it.[39] Written by the chemist Campbell Morfit, assisted by Alexander Muckle, the work was too much concerned with laboratory technic and manufacturing methods to compete with Practical Pharmacy in the instruction of the pharmaceutist's apprentices. A reviewer for the American Journal of Pharmacy felt, however, that Morfit's book "ought to be in the hands of every student of Pharmacy,"[40] but we do not know that it never had extensive use in the schools

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37 - England, The First Century, 403; originally cited by Kremers and Urdang.

38 - Kremers and Urdang, History of Pharmacy, 382.

39 - Campbell Morfit (assisted by Alexander Muckle), Chemical and Pharmaceutic Manipulations; A Manual of the Mechanical and Chemico-Mechanical operations of the Laboratory, containing a complete description of the most approved apparatus, with instructions as to their application and management, both in manufacturing processes and in the more exact details of analysis and accurate research. For the use of Chemists, Druggists, Teachers and Students (Philadelphia, 1849).

40 - "Review. Article XXV.--Chemical and Pharmaceutic Manipulations...," Amer. J. Pharm., 21: 103, 1849; and (on 2nd edition) Amer. J. Pharm., 29: 17, 1857.

of pharmacy. The book did meet a need--among chemists and to a more limited extent among pharmacists--that was not entirely filled by either the book of Procter or of Parrish. When a second edition came out (1857) only a year after Parrish's book, the American Journal of Pharmacy commented that "The importance of such works as this of Prof. Morfit, is more and more felt in our profession..."

Even Parrish's Introduction to Practical Pharmacy was not written primarily for pharmacy students. At the time of publication (1856),[41] the author operated a school of practical pharmacy for medical students[42] and "like all who have been thus engaged, he has felt the want of a text-book..." While writing the book Parrish enlarged its scope beyond his immediate purpose, rendering it "very useful to the strictly pharmaceutical student."[43] Kremers and Urdang point out that Parrish may well have broadened his original plan after learning that no new edition of the Mohr-Redwood-Procter book would be forthcoming.[44]

Arranged in five parts, Parrish's book deals with (1) the furniture of the shop and country physician's office (including weights, measures and specific gravity), (2) galenical pharmacy (14 chapters; includes collection and drying of plants), (3) the pharmacy of plants and plant products; (4) inorganic pharmaceutical preparations (classified as acid, alkali, non-metallic, etc.)

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41 - Not 1855.

42 - See p. 362.

43 - "An Introduction to Practical Pharmacy..." (Review), Amer. J. Pharm., 27: 574, 1855.

44 - Kremers and Urdang, History of Pharmacy, 383.

(5) extemporaneous pharmacy (includes special material on prescription writing for medical students). The chemistry of pharmacy and laboratory processes are very cursorily treated.

In subsequent years the book enjoyed a growing use among pharmacy students, and further editions appeared in 1859, 1864, 1874 and 1884.[45] With the third edition (1864) the word "Practical" significantly disappeared from the title, now termed A Treatise on Pharmacy, and a large amount of theoretical background material was added. While this helped raise instruction in pharmacy to a higher, more scientific level, a reviewer believed Parrish may have gone too far.

He thought "The propriety of introducing so much purely scientific matter into a work designed for the practical apothecary might well be doubted..." Moreover, not enough manipulations were described and not enough commentary was given upon the formulas, which "to the student or beginner may appear obscure or unmeaning." Parrish also exposed himself to criticism by introduing a chapter on Extracta resina, which "savors so much of 'Eclecticism'."[46]

It is noteworthy that in the second edition the section on Pharmacy in Its Relations to Organic Chemistry increased from 90 to 156 pages, and in this third edition expanded to 188 pages.

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45 - The last two editions were edited by Thomas S. Wiegand after the death of Parrish in 1872.

46 - "A Treatise on Pharmacy" (Review), Amer. J. Pharm., 36: 188-190, 1864.

AN

INTRODUCTION

TO

PRACTICAL PHARMACY:

DESIGNED AS A

TEXT-BOOK FOR THE STUDENT,

AND AS A

GUIDE TO THE PHYSICIAN AND PHARMACEUTIST.

WITH

MANY FORMULAS AND PRESCRIPTIONS.

BY

EDWARD PARRISH,

GRADUATE IN PHARMACY; MEMBER OF THE PHILADELPHIA COLLEGE OF PHARMACY, AND OF THE AMERICAN PHARMACEUTICAL ASSOCIATION; AND PRINCIPAL OF THE SCHOOL OF PRACTICAL PHARMACY, PHILADELPHIA.

WITH TWO HUNDRED AND FORTY-THREE ILLUSTRATIONS.



PHILADELPHIA:
BLANCHARD AND LEA.
1856.

U. W. Neg. No. 51150-C

Titlepage of the first truly American textbook on pharmacy, written by a pharmacist. Although originally published primarily for medical students, it filled a need in pharmacy, and each succeeding edition was better adapted to the instruction of pharmacy students. (Kremers and Urdang, History of Pharmacy, 382 f.)

During the last fifteen years of the century several American textbooks on pharmacy appeared. Only one of these, Remington's Practice of Pharmacy, has been periodically revised and remains in print at the present time. This voluminous, practical treatise became widely used and went through three editions before the turn of the century (1886, 1889, 1894). Its comprehensiveness embraced most of the material that pharmacists commonly found useful in the U. S. Pharmacopoeia and, subsequently, in the National Formulary. The broad content and aims were described adequately in the subtitle as "A Treatise on the modes of making and dispensing officinal, unofficinal, and extemporaneous preparations, with descriptions of their properties, uses, and doses. Intended as a Hand-Book for Pharmacists and Physicians and a Text-Book for Students."[47]

This encyclopedic tome, which appeared two years after the final edition of Parrish's book, left the field wide open for more manageable texts. In 1888 Reinhold Rother's The Beginnings in Pharmacy went far in the opposite direction, offering a compendious handbook in simple language that was used both as a textbook in schools and as a guide during apprenticeship in the shop. Kremers and Urdang correctly considered it the first book of its type in American pharmacy.[48] Although Rother's elementary book won favorable reviews,[49] it apparently was not revised after the author's death.

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47 - See titlepage, p. 346. The first edition contained 1080 pages; the third edition, 1448 pages.

48 - Kremers and Urdang, History of Pharmacy, 384; R. Rother, The Beginnings in Pharmacy; an Introductory Treatise on the Practical Manipulation of Drugs and the Various Processes Employed in the Preparation of Medicines, in Eight Chapters with Numerous Formulas (Detroit, 1888, 2nd edition), 342 pp. Kremers and Urdang call the 1887 edition the "first," although the titlepage of the edition dated 1888 (copyrighted 1887) states that it is the "second edition." There appears to be no evidence or record, however, that an earlier edition actually appeared in printed form.

49 - Amer. J. Pharm., 60: 269 f., 1888; Pharm. Rundschau, 6: 148, 1888.

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THE

PRACTICE OF PHARMACY:

A TREATISE

ON THE MODES OF MAKING AND DISPENSING OFFICINAL, UNOFFICINAL, AND EXTEMPORANEOUS PREPARATIONS, WITH DESCRIPTIONS OF THEIR PROPERTIES, USES, AND DOSES.

INTENDED AS A

HAND-BOOK FOR PHARMACISTS AND PHYSICIANS

AND A

TEXT-BOOK FOR STUDENTS

BY

JOSEPH P. REMINGTON, PH.G.,

PROFESSOR OF THEORY AND PRACTICE OF PHARMACY, AND DIRECTOR OF THE PHARMACEUTICAL LABORATORY IN THE PHILADELPHIA COLLEGE OF PHARMACY; FIRST VICE-CHAIRMAN OF THE COMMITTEE OF REVISION AND PUBLICATION OF THE PHARMACOPŒIA OF THE UNITED STATES OF AMERICA; PHARMACEUTICAL EDITOR OF THE UNITED STATES DISPENSATORY, ETC., ETC.

WITH NEARLY FIVE HUNDRED ILLUSTRATIONS.

PHILADELPHIA:
J. B. LIPPINCOTT COMPANY.
LONDON: 15 RUSSELL STREET, COVENT GARDEN.
1886.

U. W. Neg. No. 51154-C

Titlepage (first edition) of the only 19th-century textbook on pharmacy that has been periodically revised and remains in print at the present day. The comprehensiveness and usefulness of the book won a wide following that has yielded only slowly to more specialized treatises in applied pharmacy.

The Handbook of Pharmacy, embracing the theory and practice of pharmacy and the art of dispensing, published by Virgil Coblentz of the New York College of Pharmacy in 1894, took a middle ground between the voluminous work of Remington and the skeleton offered by Rother. Coblentz aimed at a systematic yet concise textbook treating the theory as well as the practice of pharmacy.[50]

This text eventually was displaced by a Treatise on Pharmacy for Students and Pharmacists published in 1895 by Charles Caspari, Jr., of the Maryland College of Pharmacy. The scope and aims largely paralleled those of Coblentz's work, but put much heavier emphasis upon pharmaceutical chemistry. The book went through at least eight editions, being revised by E. F. Kelly after Caspari's death. That same year (1895) Wilbur L. Scoville brought out the first edition of his noted Art of Compounding.

Although Remington's Practice of Pharmacy not only elucidated but duplicated much that was in the U. S. Pharmacopoeia, the position of the latter as the authoritative standard maintained its place among textbooks widely recommended and used in courses in pharmacy and materia medica and, late in the century, in pharmacognosy as well.

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50 - Virgil Coblentz, Handbook of Pharmacy; Embracing the Theory and Practice of Pharmacy and the Art of Dispensing. For Students of Pharmacy and Medicine, Practical Pharmacists, and Physicians (Philadelphia, 1894), 480 pp. A "Second Edition, Revised and Enlarged" appeared in 1899.

Chemistry. In chemistry courses British texts likewise met the early needs of American pharmacy schools and dominated the scene longer than in the pharmacy courses. A Manual of Elementary Chemistry, by George Fownes, Ph. D., chemical lecturer to the Middlesex Medical College and the Pharmaceutical Society of Great Britain, gained early popularity and was only slowly displaced by Attfield's Chemistry. Fownes offered (1844) a systematic and scientific elementary text, which was described by the London Journal of Medicine as "the best text-book on chemistry now in existence" for students.[51] It may well have deserved that position among at least the English-language texts of the time on general chemistry.[52] An American edition was brought out in 1845 by Robert Bridges, professor at the Philadelphia College of Pharmacy, who continued to edit successive editions of the work until 1878.

William Procter, Jr. was one of those recommending Fowne's book, which he considered well adapted to the needs of pharmacy apprentices for a compact text offering fundamental principles. As alternatives Procter and his Committee on Textbooks mentioned similar works by Turner, Kane and Graham, which were earlier products of "prominent English chemists, in an American dress."[53] Fownes was preferred, however, mainly on grounds of conciseness.

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51 - Quoted in advertising section of Jonathan Pereira, The Elements of Materia Medica and Therapeutics (Philadelphia, 1852), vol. I, 15.

52 - Jacob Bell and Theophilus Redwood, Progress of Pharmacy (London, 1880), 192.

53 - "W. P.," [Review] "Elementary Chemistry, Theoretical and Practical, by George Fownes..." (Philadelphia, 1845. 460 pp.) Amer. J. Pharm., 17: 166, 1845; and William Procter, Jr. [Report of the Committee on Textbooks], Amer. J. Pharm., 28: 493, 1856.

His book was divided into four parts: the first on physics; the second on non-metallic elements and their compounds, including a section on general principles of chemical philosophy and chemical laws; a third part on the chemistry of the metals, including a chapter on crystallography and isomorphism; and a fourth and largest part on organic chemistry.

The later 1868 London edition (followed in 1869 by another American edition)---the oldest one available for examination---had lost much of its conciseness, being about twice as large as the first edition. We see a well organized general text on inorganic and organic chemistry, with explicit descriptions of laboratory technic, aided by numerous illustrations of apparatus.

The aim, says the preface, is "to prepare the student for the perusal of original memoirs, which in conjunction with practical instruction in the laboratory, can alone afford a real acquaintance with the spirit of research and the resources of Chemical Science."[54]

The day of practical laboratory instruction had not yet dawned for American pharmacy students, however, excepting experimental work that more fortunate apprentices could conduct in a well-equipped apothecary shop or occasionally in a private laboratory.

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54 - George Fownes, A Manual of Elementary Chemistry, 10th edition (London, 1868), 1020 pp.

The 1869 American edition (based on the 10th English edition) represented a drastic change. There were new views on heat and light, discoveries based on the spectroscope, a revised nomenclature of the oxides, differences in symbolic notation, and different classifications of the metals and organic bodies.

The reviewer for the American Journal of Pharmacy warned that the book would "require close study by all who have not been keeping up with the progress of chemical science since the last edition of Fownes' was published...It will require increased attention on the part of students to follow Fownes in the new edition..."[55]

The increased comprehensiveness and difficulty of Fownes' text may have been one reason for the quick acceptance of a new text by John Attfield, professor of practical chemistry to the Pharmaceutical Society of Great Britain. The first London edition appeared in 1867 (the year before Fownes' new edition), under the title An Introduction to Pharmaceutical Chemistry. "In response to a call from professional friends in the United States in 1870,"[56] Attfield prepared an American edition. Later editions grew in scope, under the title Chemistry; General, Medical, and Pharmaceutical, Including the Chemistry of the United States Pharmacopoeia. A Manual of the General Principles of the Science, and Their Applications to Medicine and Pharmacy.

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55 - "A Manual of Chemistry, Theoretical and Practical, by George Fownes...Edited by Robert Bridges..." (Philadelphia, 1869. 857 pp.), Amer. J. Pharm., 41: 478, 1869. The last American edition in the Library of Congress is dated 1878.

56 - Preface, ix, of Tenth (American) edition. Note that the British and American editions of this work are numbered consecutively in one series.

Unlike Fownes' Chemistry, this text was designed for the practical needs of students of pharmacy and medicine, with the scientific limitations that implies. Although rather comprehensive within its defined scope and not ignoring theory, Attfield's book omitted material concerning compounds and reactions not involved in medicine and pharmacy. Procedures concerning drug adulteration, toxicology and urinalysis occupied an important place.

A reviewer for the American Journal of Pharmacy felt that "As a text-book for the practical laboratory, and for home students who wish to acquire practically a knowledge of pharmaceutical chemistry, this volume will prove very useful, but it is not so well calculated for the study of theoretical chemistry, as usually taught by lecturers in the United States."[57]

The usefulness of Attfield's Chemistry for the particular needs of American students of pharmacy won prompt recognition, and the book retained its popularity through at least 19 editions.[58]

Among eleven pharmacy schools in 1880 six were making use of both Fownes and Attfield in their chemistry courses.[59] Three other schools recommended Attfield; and an additional two schools recommended Fownes.

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57 - "An Introduction to Pharmaceutical Chemistry..." (Review of London edition), Amer. J. Pharm., 40: 191, 1868.

58 - The 19th edition appeared in 1906.

59 - The Colleges of Chicago, Louisville, Maryland, New York, Cincinnati, and Philadelphia.

These two chemistry texts were the only ones upon which the schools were in common agreement, although Fownes' book dropped out of the picture later in the century, apparently for lack of revision. They were supplemented in nearly all the schools by some use of other chemical works. Among twenty other works mentioned the only ones used in more than one or two schools, however, were the Manual of Qualitative Chemical Analysis by C. R. Fresenius, as "translated into the new system by S. W. Johnson" (four schools), and College Chemistry by G. F. Barker (three schools). The texts that found recognition in two schools in connection with analytical studies were: H. Will, Tables for Qualitative Chemical Analysis (translated by Himes); F. Sutton, A Systematic Handbook of Volumetric Analysis; F. Hoffmann, Manual of Chemical Analysis as Applied to the Examination of Medicinal Chemicals; C. W. Eliot and F. H. Storer (revised by W. R. Nichols), Compendious Manual of Qualitative Chemical Analysis; and C. R. Fresenius (edited with additions by S. W. Johnson), System of Instruction in Quantitative Chemical Analysis.[60]

Of these various chemical texts, only the Manual of Chemical Analysis (1873) by Frederick Hoffman, a German immigrant-apothecary, had been written by a pharmacist or teacher in pharmacy on American soil. Hoffman was joined in preparing the second edition (1883) by F. B. Power, who had obtained his Ph. D. degree as a student of the German-Swiss professor F. A. Flückiger at Strassburg, then a German university.

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60 - Based on Frank W. Clarke, "A Report on the Teaching of Chemistry and Physics in the United States" in Circular of Information No. 6 (Bureau of Education, Washington, D.C., 1880), 218 f.

After 1880 chemical texts authored in the United States by pharmacists and/or teachers in pharmacy schools appeared one after the other. Kremers and Urdang listed these as follows:

"In 1881 John Uri Lloyd's Chemistry of Medicines appeared. In 1884, William Simon published the first edition of his Manual of Chemistry. In 1887, Oscar Oldberg and John H. Long published a Laboratory Manual of Chemistry, General and Pharmaceutical. In 1894, an Elementary Course in Inorganic Pharmaceutical Chemistry, written by F. J. Wulling, appeared, and in 1895 S. P. Sadtler and H. Trimble published the first edition of their Textbook of Chemistry for the Use of Pharmaceutical and Medical Students. In 1885 Trimble's Handbook of Analytical Chemistry appeared."[61] In addition there may be mentioned Albert Prescott's First Book of Qualitative Analysis and his Proximate Analysis; and Charles O. Curtman's Chemical Analysis.

These by no means displaced American editions of the British texts of Attfield and Fownes in the schools of pharmacy, nor various other American textbooks of chemistry issued outside of pharmacy late in the century.

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61 - Kremers and Urdang, History of Pharmacy, 388.

Materia Medica-Botany-Pharmacognosy. In materia medica it was also a British text that found wide, almost universal, acceptance in American pharmacy schools until the 1880's. The Elements of Materia Medica and Therapeutics by Jonathan Pereira led Procter to remark that "Next to the United States Dispensatory we would place the great work of Pereira."[62]

The popularity of the work is typified by the decision at the Maryland College of Pharmacy in 1843 to substitute the "English edition of Pereira's Materia Medica" for the United States Dispensatory in giving the lecture course on pharmacy.[63]

The first volume of Pereira's work was published in London in 1839, the second volume in 1840.[64] The work went through several American editions under the editorship of Joseph Carson, M. D., who was on the faculty of the Philadelphia College of Pharmacy (1836-1850). Changes for the American audience consisted mainly of the addition of material on indigenous drugs.

The two-volume text reflects an encyclopedic approach that remained typical of materia medica until the subject fragmented into several disciplines late in the century. Under an elaborate classification the work offered (as the material would be categorized today) a short discourse on clinical psychology, discussions of physical therapy, hygiene and dietetics, pharmacology, and physiological classification of drugs, with the bulk of the treatise

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62 - William Procter, Jr., et al. [Report of the Committee on Textbooks], Amer. J. Pharm., 28: 491, 1856.

63 - C. Schmidt, The Maryland College of Pharmacy, 3.

64 - For biographical notes on Pereira see J. Bell and T. Redwood, Progress of Pharmacy, 225.

devoted to essays on the individual drugs--their therapeutics and pharmacy, with interjections concerning the chemistry or pharmacognosy involved. Volume I covered the chemistry and therapeutics of mineral drugs; volume II, the drugs of plant and animal origin, arranged according to their botanical or biological classification.[65]

In materia medica the first text written by an American pharmacy teacher for American schools, probably was the volume Conspectus of Organic Materia Medica and Pharmacal Botany (Philadelphia, 1879, 220 pp.), by Lucius E. Sayre of the University of Kansas. Another early and much more popular text--sometimes referred to as the "first"--was brought out by a German immigrant, the eminent pharmacist John M. Maisch, who taught at the Philadelphia College of Pharmacy. His Manual of Organic Materia Medica appeared in 1882. Several other American texts on the same subject were authored by teachers in pharmacy schools before the end of the century.[66]

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65 - Jonathan Pereira, The Elements of Materia Medica and Therapeutics...Including notes of most of the medicinal substances in the civilized world, and forming an Encyclopedia of Materia Medica (3rd American edition, edited by Joseph Carson, Philadelphia, vol. I, 1852), 838 pp.; vol. II, 1854, 1226 pp. The previous American edition appeared in 1843. See also review in Amer. J. Pharm., 26: 176-192, 1854.

66 - For example, L. E. Sayre's Manual of Organic Materia Medica and Pharmacognosy (Philadelphia, 1895. 555 pp.), based on his earlier Conspectus; David M. R. Culbreth's Pharmaceutic Botany and his Manual of Materia Medica and Pharmacology; and H. H. Rusby and S. H. Jelliffe, Essentials of Pharmacognosy.

Until after the middle of the century little botany was taught in American pharmacy schools except in incidental connection with materia medica. In 1858 Procter recommended that apprentices study botany, using Asa Gray's First Lessons in Botany and Vegetable Physiology,[67] which became so popular for pharmacy instruction in following decades. The First Lessons were primarily "intended for the use of beginners, and for classes in the common and higher schools..." The 34 lessons were "made as plain and simple as they well can be."[68]

The First Lessons served as an elementary survey of systematic botany, largely devoted to morphology, explaining in simple language how plants grow and live and introducing the student to botanical classification and the terminology for more advanced work. This book was considered an introduction and dictionary to Gray's Manual of Botany, which gained considerable use later in the century among pharmacy schools.

In botany as in chemistry and in materia medica, the 1880's brought the first textbook written by a pharmacist for American students of pharmacy. Edson S. Bastin, while on the faculty of the Chicago College of Pharmacy, issued his Elements of Botany in 1887 (later called College Botany). Botany had become increasingly important in the curriculum, and Bastin's text gained wide use in schools of pharmacy during the rest of the century.

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67 - William Procter, Jr., et al., "Syllabus of a Course of Study Intended as an Aid to Students of Pharmacy Who Cannot Avail Themselves of Regular Instruction," Proc. Amer. Pharm. Assoc., 7: 105, 1858.

68 - Asa Gray, First Lessons in Botany and Vegetable Physiology (Philadelphia, 1857), iii f. and 237. The book Gray's publisher advertised as especially "designed for the use of Professional Students and Amateurs of the Science" was not this work but Gray's Botanical Textbook.

While the textbooks mentioned include most of those widely used, it is not always easy to determine from annual school announcements and catalogs which books, if any, were required in particular courses. The Chicago College of Pharmacy, for example, attached to its list of texts the qualifying statement: "Many valuable works are recommended as text-books, but each student must be governed by his circumstances as to which he will purchase."69

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69 - Twenty-sixth Announcement of the Chicago College of Pharmacy, 1888-89, 18.

Cabinets of Specimens

Most of the ambitious colleges sooner or later built a collection of materia medica specimens, known as "the cabinet." This was maintained not only as a museum exhibition, but to illustrate lectures in the school and to provide authentic specimens as a kind of reference standard for comparison with substances used or obtained in investigations.[70]

In 1847 Daniel B. Smith and some of his colleagues told the members of the Philadelphia College, "When it is understood that the College possesses no Cabinet of Chemical and Pharmaceutical Specimens whatever—that its collection of the Materia Medica is extremely imperfect, (the illustration of the lectures depending almost entirely on the cabinets of the Lecture[r]s), it cannot but excite surprise...One of the first steps taken by the London Pharmaceutical Society, after its organization, was the founding of a Museum; and in the six years that have elapsed since its commencement, it has increased to a very respectable size..."[71]

Thereafter a Committee on the Cabinet of Specimens was appointed, appropriations made, and appeals sent out to alumni for specimens.[72] Efforts were crowned in 1858 by a gift of 12,000 botanical specimens collected by Elias Durand.[73] This led to the appointment of a separate Committee on Herbarium in 1860, and funds

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70 - Daniel B. Smith, "To the Philadelphia College of Pharmacy," Amer. J. Pharm., 19: 311, 1847.

71 - Ibid., 311 f.

72 - "Abstract from the Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 20: 144, 1848, and 22: 187, 1850; "The Cabinet," Amer. J. Pharm., 24: 388, 1852.

73 - England, The First Century, 358. A French pharmacien who once served the Grand Army of Napoleon I, Durand was an influential and highly competent pharmacist in Philadelphia.

were allocated for botanical treatises and a microscope to help develop the herbarium properly. In justifying the purchase of this first microscope, it was pointed out that the College also "is probably in need of such an instrument for other purposes..."[74]

The Philadelphia College continued to build actively upon its collections. It garnered considerable material from the Centennial Exposition (1876) and the Columbian Exposition (1893). Then in 1894 came a remarkable gift of 200,000 herbarium specimens, which had been assembled by Isaac C. Martindale of Camden, N. J.[75]

Perhaps this was Philadelphia's answer to its friendly rival, the New York College of Pharmacy, which had acquired the famous Canby Herbarium in 1892. H. H. Rusby, the pharmacognosist, had raised almost $3000 among friends, and an equal sum was contributed by the New York College to secure the collection.[76] The College had maintained a cabinet from a rather early date.[77] In 1878 the museum held "large collections" of specimens in materia medica, botany and chemistry, which were refurbished and added to from time to time.[78]

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74 - "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 32: 567, 1860, and 33: 282, 1861.

75 - England, The First Century, 224. Howard B. French and the Smith, Kline and French Co. were joint donors of the Martindale collection.

76 - Wimmer, The College of Pharmacy, 143.

77 - Ibid., 49.

78 - Ibid., 73, 76, 83.

Other colleges developed collections on a more modest scale for study and demonstration purposes. We know that in 1854 the Cincinnati College of Pharmacy maintained a cabinet of some 800 specimens in the museum rooms of the Miami Medical College, even though regular courses in pharmacy had not yet been established.[79] After the reorganization of the Maryland College of Pharmacy in 1856 attention turned toward a similar project with the idea of improving teaching facilities.

In 1859 the Cabinet Committee expressed the view that "The usefulness and progress of the College is much enhanced by placing within reach of the Professors and Students samples of those articles which are used by the apothecary. Without them the oral method of instruction is much impaired..."[80]

The reorganization of the Chicago College of Pharmacy likewise found its members "endeavoring to supply itself with a complete cabinet of specimens of Drugs, Chemicals and Pharmaceutical Preparations; also, one of Mineralogy and Natural History..." Even before instruction had resumed, this became in important part of plans to make the College a place where "the young men of the West may obtain a thorough knowledge of the art..."[81]

As a part of or adjunct to the museum room, for demonstration purposes, probably most of the colleges owned wall charts, diagrams of apparatus, plastic botanical models, and last but not least, an oxy-hydrogen (or "magic") lantern.[82]

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79 - "Proceedings of the American Pharmaceutical Association," Amer. J. Pharm., 26: 395, 1854.

80 - "Cabinet of Materia Medica Specimens," J. and Transac. Md. Coll. Pharm., 1 (n.s.): 143, 1859; "Minutes of the College," loc. cit., 230 f.

81 - "Donations to the Colleges of Pharmacy" (Ed. Dept), Amer. J. Pharm., 39: 377, 1867.

82 - See, e.g., Wimmer, 71 f.; Twenty-ninth Annual Catalogue of the Massachusetts College of Pharmacy, 1895-96, 17 f.

Laboratories and Apparatus

The complete lack of laboratory facilities in association schools before the 1870's severely limited instruction in science. It was always hoped that the student would experiment and get some laboratory experience in chemistry, or applied pharmacy, as part of his apprenticeship.

A few leaders in pharmacy had seen the teaching laboratory as a goal in the 1850's, but it was readily recognized "that the expense of conducting them, renders their support by the fees of the pupils almost impossible."[83] Many of the early schools were fortunate, as previously noted, if they could keep the lecture courses going.

Teachers in the early decades did what they could to make up for the lack of laboratory facilities and at times even of demonstration apparatus. Not infrequently they supplied their own equipment, or borrowed it from a better-equipped institution with which they might be connected.[84]

The Philadelphia College went into debt for chemical apparatus at an early date on the assumption that "the experimental illustrations of the science of chemistry form one of the most attractive and instructive exhibitions that modern science affords..."[85]

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83 - [Report of the Committee to Collect Information], Proc. Amer. Pharm. Assoc., 1: 9, 1852; also Edward Parrish, "American Pharmacy," Amer. J. Pharm., 26: 215, 1854; and Wimmer, The College of Pharmacy, 50.

84 - E. Kremers, "The Teaching of Pharmacy," Drugg. Circ., 51: 70 f., 1907; England, The First Century, 82.

85 - "Minutes of the College," J. Phila. Coll. Pharm., 1: 23, 1830; also W. R. Fisher, "A Brief Sketch...," Amer. J. Pharm., 8: 275, 1836.

The College lecturer on chemistry in 1841 introduced his course with the promise that "every effort and means of illustration, at all attainable, will be employed; and the chemical operations witnessed in the daily duties of the shop will be referred to for demonstration."[86]

The "School of Practical Pharmacy" opened by Edward Parrish in the back of his apothecary shop in 1849 represents an unusual and isolated attempt to supply laboratory instruction. This venture served primarily the medical students at the nearby University of Pennsylvania, although later on some students of pharmacy also were in attendance at Parrish's pharmaceutical laboratory.[87]

The busy laboratories at the University of Michigan were the first to become, in 1868, part of a regular course in pharmacy. Wherever other state universities opened pharmacy courses in the 1880's laboratory facilities and work were an integral and important part of the program.[88]

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86 - W. R. Fisher, "Introductory Lecture Delivered at the College of Pharmacy, November 4, 1841," Amer. J. Pharm., 14: 9, 1842.

87 - "Announcement and Catalogue of Edward Parrish's School of Practical Pharmacy for Medical Students...," Amer. J. Pharm., 25: 373, 1853; "Maisch's School of Practical Chemistry and Pharmacy," Amer. J. Pharm., 32: 285, 1860; England, The First Century, 404. It has been stated and implied in the literature that Parrish opened his practical school in the early 1840's. However, 1849 undoubtedly marks the beginning of a formal teaching arrangement. (Amer. J. Pharm., 45: 226, 1873.)

88 - For a discussion of the actual laboratory instruction, see the chapter on "Instruction and Experiment," p. 373.

For independent schools the establishment of a laboratory was a forbidding project, although the Conference of the Schools of Pharmacy recognized the "desirability" of this expensive form of instruction.

Ambitions for a teaching laboratory were voiced at the Philadelphia College of Pharmacy as early as 1861, when a writer commented, "...yet in the future, is a school of Practical Pharmacy, where young men can perfect themselves in manipulation of the higher grades. The expense attending a school of this kind, has heretofore, and probably will for some time, prevent its establishment as a part of the operations of our College of Pharmacy, but it must eventually become an important feature of the tuition extended."[89]

Goading this ambition may have been the practical school for medical students operated by Parrish; the trend toward laboratory instruction in science at American universities after 1850; a realization that apprentices were not getting the expected manipulative experience in many of the shops; and the glowing descriptions of laboratories in pharmacy schools abroad mentioned by Parrish in his "Pharmaceutical Notes of Travel" published in 1859.[90]

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89 - "Our School of Pharmacy" (Ed. Dept.), Amer. J. Pharm., 33: 288, 1861. Probably written by the editor, William Procter, Jr.

90 - Cubberley, Public Education, 469; Edward Parrish, "Pharmaceutical Notes of Travel," Amer. J. Pharm., 31: 2-4 and 211 f., 1859.

Realization of the goal, a laboratory "where pharmacy and chemistry could be practically taught," came through the Alumni Association of the Philadelphia College, which was born in a room above Parrish's drugstore at a meeting in 1864.[91] As one of the very first actions at the first annual meeting, the Association established a laboratory fund, an idea which "many of us have long cherished..."[92]

The following year alumni suggested that the nature and function of the proposed laboratory school should be set down in the constitution of the College, only "leaving the lesser details to the Professors." A certain apprehension that a laboratory might tend to displace shop experience found its counterpoint in a concern that without a laboratory apprentices might not receive adequate instruction. This ambivalent attitude is reflected in a statement published in 1866:

"The question will then come up, whether this instruction is intended to perfect students who may be in shops unfavorable for gaining a practical experience, or whether it is to be a substitute for the shop? We hope not the latter. While the curriculum should involve an examination in the rudiments of Pharmacy, and where these have been but imperfectly attained it should insist on their acquirement, yet the main and true object of the [Laboratory] School should be to give perfect lessons in pharmaceutical manipulation with the best forms of apparatus, and to afford the student full opportunities to become skilful in their uses and applications, especially of those which the tendency of latter years has nearly banished from the shop."[93]

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91 - England, The First Century, 250.

92 - "First Annual Report of the Alumni Association..." (Ed. Dept.), Amer. J. Pharm., 37: 238 f., 1865.

93 - "Alumni Association of the Philadelphia College of Pharmacy," Amer. J. Pharm., 38: 187, 1866.

In 1867 the expectations concerning contributions had not been realized, although $3990 was in hand and alumni reaffirmed their belief that "to keep pace with the rapid progress of pharmacal science, a laboratory is absolutely necessary..."[94]

The drive for funds culminated in the opening of the Alumni Association's "Practical School," or laboratory, in 1870—the first in the United States connected with an independent school of pharmacy. Two years later the Association formally transferred the laboratory to the Philadelphia College.[95]

Major expansion of laboratory facilities at Philadelphia came in the 1880's, which was a most fruitful decade for the establishment of chemical, pharmaceutical and microscopical laboratories throughout American pharmaceutical education.

When the Philadelphia College erected an addition to the building in 1881 the chemical laboratory was doubled in size. Laboratory instruction in practical pharmacy, which had been given in the same laboratory as chemistry, now was housed in a special laboratory. In 1882-83 a microscopic laboratory was originated by the Alumni Association, which controlled instruction there until 1894, when control passed to the College itself. In 1886 another laboratory went up on property adjoining the College for the use of advanced students in analytical chemistry, for original

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94 - "Third Annual Report of the Alumni Association of the Philadelphia College of Pharmacy, Philadelphia, 1867," Amer. J. Pharm., 39: 380, 1867.

95 - England, The First Century, 162 and 250.

investigations, and for women students.[96]

Besides the influences that aroused the Philadelphia College and its alumni to found the first laboratory of its kind, other colleges felt the spur of emulation as they considered the question (and problems) of establishing laboratories in the 1870's. It is of interest that at just this time the first laboratories for science instruction were also opening in American high schools.[97]

The Maryland College of Pharmacy had laboratory facilities from 1872, and in that year created the post of director of the chemical laboratory in its faculty. A major expansion of laboratory facilities came in the ninth decade, as at the Philadelphia College, when the Maryland College moved into its new building in 1887. There nearly a hundred students could be accomodated in the pharmaceutical laboratory (43 x 48'), and there were said to be separate laboratories for chemistry, for microscopy, and a private laboratory for the professor of chemistry.[98]

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96 - H. L. Taylor, "Schools and Colleges of Pharmacy," Pharm. Era, quoting the 67th Annual Announcement of the Philadelphia College of Pharmacy; J. W. England, "High-Lights in the History of the Philadelphia College of Pharmacy," Amer. J. Pharm., 93: 611, 1921.

97 - Cubberley, Public Education, 469.

98 - Vandenbosche, "Historical Notes on Chemistry at the School of Pharmacy, University of Maryland," Amer. J. Pharm. Ed., 4: 46 f., 1940; C. Schmidt, The Maryland College of Pharmacy, 10 and 13.

When the Chicago College of Pharmacy moved to larger rented quarters in 1876 "a laboratory was installed." About eight years later (1884?) the College occupied a new building offering more adequate laboratory facilities. A well-equipped pharmaceutical laboratory provided working tables for 96 students. There was a separate, apparently more modest, chemical laboratory. And a special room for microscopic laboratory work housed "nearly forty" compound microscopes and accessory apparatus. Each professor, it is said, had his own private laboratory for investigations.[99]

Since the Philadelphia and Maryland College both boasted laboratory facilities in 1872, the New York College did the best it could by announcing in the Prospectus for 1872-73 that arrangements had been made for optional chemical instruction in the private laboratory of Isador Walz; as alternatives students might use the laboratory at the Columbia College School of Mines or conduct home experimentation. Apparently the New York College had its own laboratory for the first time in 1878 when it moved into the 23rd Street building. There a fully equipped pharmaceutical laboratory (40 x 70') accomodated 100 students. It seems that the College at first used the laboratory mainly for chemical work.[100]

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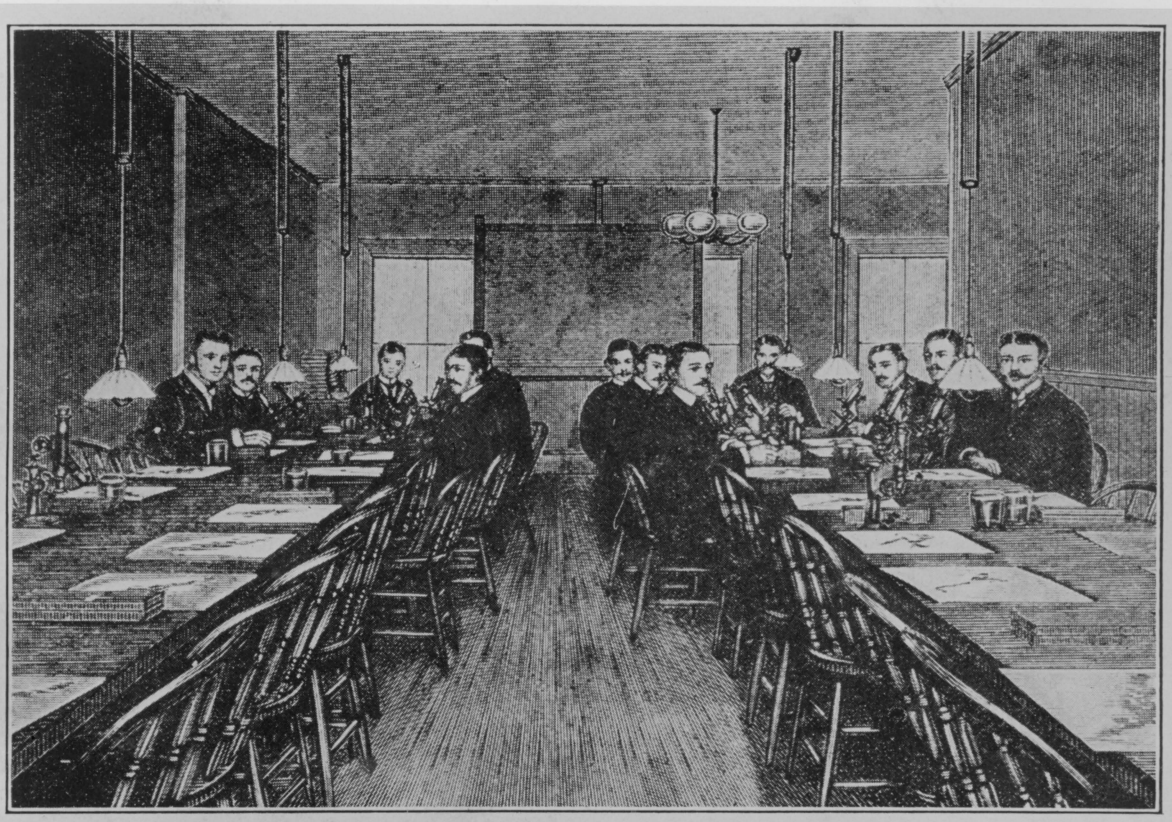
99 - Announcement of the 18th Annual Session of the Chicago College of Pharmacy, 1884-85, 2 and 9 f.; Announcement of the Chicago College of Pharmacy, 22nd Regular Session, 1886-87, 14-16; W. B. Day, "Historical Sketch" in Alumni Record of the University of Illinois, 1921, xxviii and xxix. When the Chicago College reorganized after the Civil War, securing chemical apparatus for demonstration purposes had been one of its first early objectives. (Amer. J. Pharm, 39: 377, 1867.)

100 - Wimmer, The College of Pharmacy, 71 and 76 f.; Prospectus of the College of Pharmacy of the City of New York, 1872-73.



The pharmacognosy room

From Wimmer, The College of Pharmacy, 75.
U. W. Neg. No. 51140-C

The pharmacognosy room, or microscopical laboratory, at the New York College of Pharmacy as it appeared in the early 1880's. Several other schools provided facilities for this form of instruction during the ninth decade.

It was also in 1878 that the St. Louis College of Pharmacy opened its first chemical laboratory. A pharmaceutical laboratory was added in 1881 and a microscopic laboratory in 1885.[101]

The Massachusetts College installed its first laboratory in 1879[102] and the Cincinnati College also had established a chemical laboratory by 1880. Indeed only one of eleven schools supplying information to Clarke in that year—the California College of Pharmacy—admitted to having no laboratory instruction at all in chemistry,[103] although there were unlisted schools, even five years later, that were without any laboratory facilities.[104]

The numbers of students that could be accommodated at one time in chemical laboratories of five independent schools in 1880 were as follows:[105]

Massachusetts College of Pharmacy	64 students
New York College of Pharmacy	60 "
Philadelphia College of Pharmacy	60 "
Cincinnati College of Pharmacy	30 "
Chicago College of Pharmacy	15 "

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101 - "St. Louis College of Pharmacy," Meyer Brothers Druggist, 13: 357, 1892.

102 - Twelfth Annual Catalogue of the Massachusetts College of Pharmacy, 1878-79, 9.

103 - Frank W. Clarke, "A Report on the Teaching of Chemistry and Physics in the United States" in Circular of Information No. 6 (Bureau of Education, 1880), 154-6.

104 - See, e.g., F. B. Power, "The Problems of Pharmacy in the United States," Pharm. Rundschau, 3: 121, 1885. Occasionally one of the less reputable, more desperate, educational ventures would announce and even picture laboratories which in fact did not exist. ("Pharmaceutical Statistics" (Editorial), The Apothecary, 1: 15, 1891.

105 - Clarke, loc. cit., 154-6.

The Northwestern University School of Pharmacy laid claim to being the first, in 1886, to have a special dispensing laboratory, where extemporaneous compounding was practiced under conditions simulating work in a pharmacy. This may be correct for, as far as known, the earlier "pharmaceutical laboratories" were devoted mainly to teaching the techniques and processes of manipulative and manufacturing pharmacy. By the early 1890's at least two or three other schools had joined Northwestern in establishing a dispensing laboratory, and several others are said to have shifted more emphasis to extemporaneous pharmacy in their pharmaceutical laboratory instruction.[106]

Evidence has been noted corroborating Hoch's statement that it was between 1876 and 1887 that "the procurement of microscopical equipment for student use to supplement the demonstration microscopes used in lecture courses made it possible to incorporate real laboratory instruction in microscopy."[107] Indeed, most of the facilities for opening this field of practical study in pharmaceutical botany seem to have been acquired, in the better-known association schools, within the short space of five or six years after 1881.

The first laboratories of the 1870's, emphasizing chemical instruction, were accompanied or closely followed by laboratory facilities for pharmaceutical instruction. The 1880's had brought a major expansion of the laboratory program in the stronger schools,

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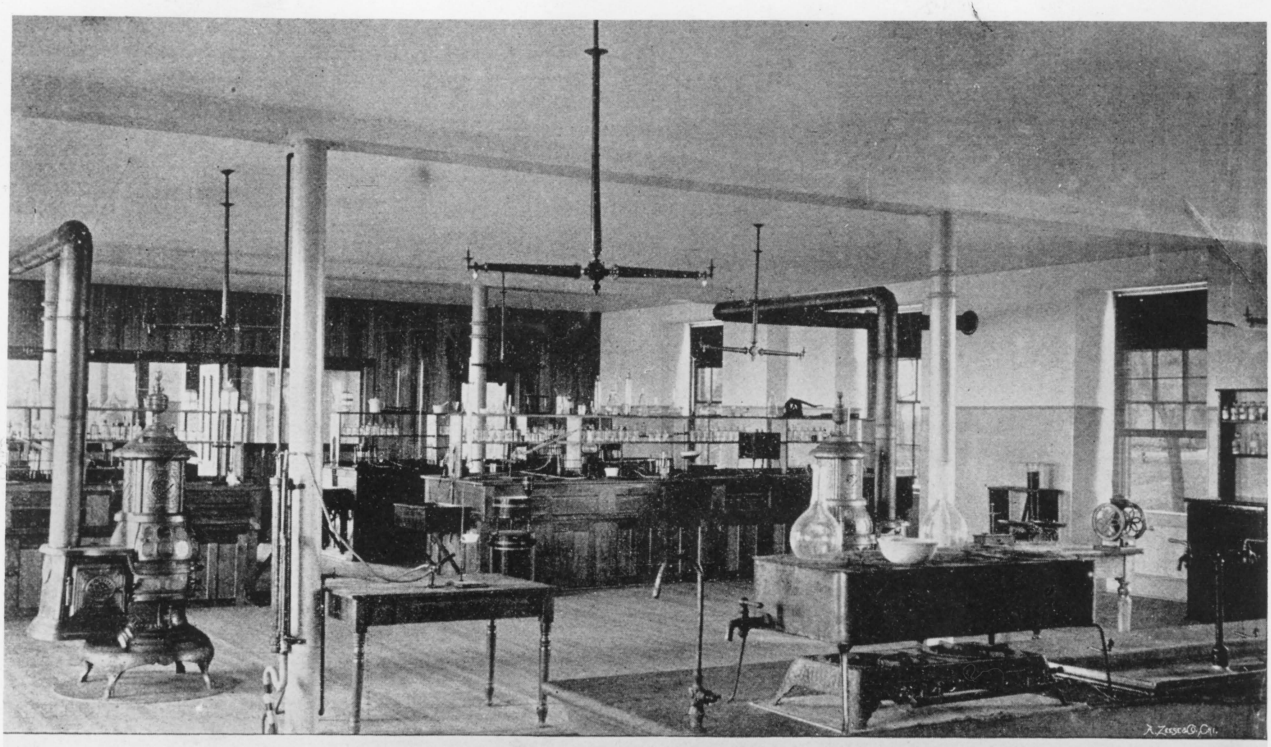
106 - Oscar Oldberg, "The Dispensing Laboratory," The Apothecary, 3: 75, 1893.

107 - J. H. Hoch, "A Survey of the Development of Materia Medica in American Schools and Colleges of Pharmacy from 1821 to 1900," Amer. J. Pharm., 12: 155, 1948.



PHARMACEUTICAL LABORATORY, 1890.

From the Badger Pharmacist, 1900, 121.
U. W. Neg. No. 51144-C

A pharmaceutical laboratory at the University of Wisconsin five years after Wisconsin had become the second Western university to open a pharmacy school. When this picture was taken, similar laboratories were common in both university and independent schools.

its introduction in others. It is understood that laboratory facilities were provided and stressed from the beginning in schools opening within state universities, which always had vigorously emphasized applied science. The equipment of laboratories in the independent schools varied widely at the close of the 1880's, as shown by the valuation placed on scientific apparatus in reports to the Commissioner of Education:[108]

Chicago College of Pharmacy	$20,000
Massachusetts College of Pharmacy	20,000
Philadelphia College of Pharmacy	20,000
Louisville School of Pharmacy for Women[109]	17,500
St. Louis College of Pharmacy	7,500
New York College of Pharmacy	6,000
Pittsburgh College of Pharmacy	4,000
Kansas City College of Pharmacy	3,000
University of Buffalo	1,500
Louisville College of Pharmacy	1,000
Maryland College of Pharmacy	1,000
National College of Pharmacy	1,000
Cincinnati College of Pharmacy	500
Minnesota College (Institute) of Pharmacy	350

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108 - Derived from Report of the Commissioner of Education, 1888-89, 1200. State university schools made it a policy not to report such data, since their facilities were part of the university community and extended into various departments.

109 - On the basis of what is known about this school, the valuation of $17,500 seems to be either a misprint or an exaggerated estimate. It is understood that some schools might offer rather generous estimates in reporting such data to the Bureau of Education.

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VIII. INSTRUCTION AND EXPERIMENT

Evening lectures constituted American pharmaceutical education until the last quarter of the century. For both instructors and students the "pharmacy school" represented a part-time, if not incidental, activity supplementing a full-time occupation elsewhere. While attention focussed on the University of Michigan after 1868 mainly because it ignored the pre-graduation apprenticeship, the Michigan course foreshadowed several other major changes in American pharmacy schools: graded courses, daytime instruction, laboratory work, and a curriculum that demanded nearly the full-time attention of the student, plus the beginnings of admission standards.

Other university schools, in general, followed this pattern in the natural course of events--particularly the state schools beginning instruction in the 1880's. Innovations represented in the Michigan course re-shaped instruction at independent schools during the last three decades of the century, but came to full fruition slowly, imperfectly and unevenly in pharmaceutical education as a whole.

Whatever the curriculum or the student's preliminary education, the knowledge to be gained at an association school was severely self-limited by the short period of attendance required. Slow progress in this direction lay as a heavy weight upon the development of pharmaceutical education through most of the century.

Length of Courses

Wherever instruction started before the Civil War, apprentices made their way by horse car or on foot to the rented lecture room two or three evenings a week, after a long day in the shop, to hear lectures on chemistry and materia medica and pharmacy. Lectures usually began in late fall and continued four to five months, although the total number of lectures varied widely among the schools at given times and places. In the earliest schools only two lecture series were given (materia medica and pharmacy being combined); then as instruction gained a foothold the standard trio of subjects divided into three separate series. It is of commanding importance to recognize that instruction remained ungraded until the 1870's, or even later in some schools. That is, when two terms of lectures were required, a student attended the same lectures for a second time, following the pattern of medical instruction.

Before 1846 at the Philadelphia College of Pharmacy apprentices were attending three lectures a week in each of two courses for about four months. When the College split pharmacy from materia medica as a separate chair and course (1846), Daniel B. Smith tried to allay fears that the curriculum was being unduly lengthened: "By each professor giving two lectures a week, instead of three as at present," he explained, "and by continuing the course six weeks longer, commencing about the second week in October and ending in the fourth week of March, the whole ground could be traversed without imposing greater burthens upon the students than at present, at the same time that forty additional lectures would be communicated."[1] This

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1 - "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 18: 155 f., 1846.

apparently did not gain acceptance, at least permanently, for in the late 1860's the lectures were being given three evenings a week, not until the end of March, but only to the end of February.[2]

At the New York College of Pharmacy lectures for the two courses, in the early years after 1829, were delivered three times a week but only lasted three months.[3] The few apprentices who graduated probably were rather faithful attendants upon the lectures, but we know that Dr. Stephen Brown found it disconcerting in 1829 when most of those who came to hear the lectures on chemistry by John Torrey did not remain to hear his discourses on materia medica and pharmacy, which were given the next hour.[4]

At the Maryland College of Pharmacy in the 1840's, and at first when instruction resumed in 1856, the student attended only one term of lectures to obtain his diploma, rather than repeating the course for a second time. After the reorganization, each professor obligated himself to deliver at least twelve lectures on his subject during the season.[5]

The course inaugurated by the Chicago College of Pharmacy in 1859 consisted of lectures three evenings a week for twenty weeks.

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2 - England, The First Century, 147.

3 - Wimmer, The College of Pharmacy, 23.

4 - Wimmer, op. cit., 28.

5 - C. Schmidt, The Maryland College of Pharmacy, 3 f.

However abbreviated the courses, requirements at times seem to have been still less imposing in practice than in the announcements. Such laxness probably became more common under the stress of increased competition after the Civil War, although flagrant derelictions were not accepted with complacency. Delegates to the Conference of the Schools of Pharmacy were scandalized when a letter dated December 10, 1874 and signed by the treasurer and acting secretary of the Tennessee College of Pharmacy came to light that told a prospective student:

"...You could matriculate now, without being present, and could then take out your tickets as you desire, and attend whenever you could; after getting tickets for two sessions you could come up for graduation at the end of any session, just the same as if you had attended all the lectures. If you wish any further information we will furnish it cheerfully."[6]

Delegates roundly condemned this procedure, although it was pointed out that "cases have frequently occurred" in which students took tickets for the first course but did not appear in the classroom until the beginning of the second (final) term of lectures.[7]

Lax legal restrictions and a lack of social responsibility fostered the feeling among a host of students in both medicine and pharmacy that one course of lectures was quite sufficient--especially since they would hear the same lectures during a second term.

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6 - From reproduction of letter pasted in back of Minutes book of the Conference of the Schools of Pharmacy, in Kremers Reference Collection.

7 - Ibid., 1877 proceedings.

Many medical students, especially in the West, were taking only one course of lecturex around 1870,[8] and the same could be said of pharmacy students. The general rule in medical colleges at this time, however, asked for three years' study, including at least two terms of lectures. These lectures were preceded and often accompanied by apprenticeship, as in pharmacy. After three months to a year with a practitioner, Dr. Charles Warren reported, "The neophyte then hies to some medical school, pays a small matriculation fee, writes his name, age, and residence, and the name of his preceptor on the matriculation book, which are absolutely the only necessary qualifications for his entrance."[9]

It was a matter of some concern that "pharmacy is being gradually but surely separated from medicine, in accordance with the tendency of the age; and medical students, especially in cities and towns are year by year less likely to have a practical knowledge so useful in these respects to the profession."[10]

The medical apprentice could find--if he wished to shop around--a school to fit a purse or ambitions of any size. Among a group of 51 medical schools, 24 offered a three-year course, 23 offered a two-year course and four offered a one-year course. A "year" of instruction might be anywhere from 13 to 40 weeks of

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8 - Charles Warren, "Medical Education in the United States" in Report of the Commissioner of Education for 1870, 386.

9 - Ibid., 385.

10 - Ibid.

lectures.[11] And although most medical schools nominally required three years of study including two or more terms of lectures, as previously noted, Dr. Warren believed in 1870 that "Comparatively few men (at least in the South and West) ever study three full years before applying for a diploma."[12]

Unlike pharmacy, however, American medical education later unified and upgraded standards so that soon after the turn of the century only a rare renegade school required less than a four-year academic course.[13]

In the early 1870's the length of course in pharmacy's association schools had become remarkably well standardized. Eight association schools all required for graduation 40 to 44 weeks of attendance upon lectures, in two separate terms or "years"; this probably was linked in all colleges to an apprenticeship of four years, at least nominally. Two private universities were the only exceptions in 1872 to the practice of requiring two terms. Iowa Wesleyan University required the standard 40 weeks of instruction for graduation but offered it within a single term or year. Baldwin University, however, required only a single sixteen-week term of instruction for graduation. A third institution outside the customary pattern was the state university of Michigan, which required 72 weeks of instruction, divided into two years.[14]

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11 - Report of the Commissioner of Education for 1872, 817.

12 - Charles Warren, loc. cit., 386.

13 - Dexter, A History of Education in the United States, 336.

14 - Report of the Commissioner of Education for 1872, 819. Nearly all of the schools started the lecture term in October. (Report for 1870, 525.)

Three years later (1875) Baldwin University had lengthened its one-term course to 30 weeks. An association-type school that had not reported previously, the California College of Pharmacy (affiliated with the University of California), required only a single term of 24 weeks for graduation. Ten other association schools required two terms totaling at least 40 weeks of instruction; three of these had taken the lead in lengthening their lecture course: Massachusetts reported a total of 50 weeks; Maryland, 48 weeks; and St. Louis, 48 weeks.[15]

It should be noted that a "week" of instruction usually meant a total program of either three or six evening lectures a week. The leading independent schools gave two lectures a week in each of three subjects; weaker schools, a single lecture. Before the Civil War professors sometimes lectured three times a week, but the term of instruction initially was shorter and only two (rather than three) lecture series comprised the curriculum.

The addition of a third chair (by splitting pharmacy and materia medica) did not, however, extend instruction as much as might be supposed. Instead of giving three lectures a week in two subjects, two lectures a week were then given in three subjects, although the term was somewhat lengthened. At the New York College,

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15 - Report of the Commissioner of Education for 1875, 775. The New York College is listed as offering 41 weeks in each of two years; this represents a misprint or a misunderstanding of the Commissioner's questionnaire. The term was about 25 weeks, less vacation time. (Prospectus of the College of Pharmacy of the City of New York, 1874-75, 7.)

for example, in 1860 there were three lectures a week in two subjects for about 21 weeks; after a third chair was established there were two lectures a week in each of the three subjects for about 25 weeks.[16]

Graded Courses. Up to the 1870's the only difference the student might find between his two terms in school was that in the junior (first) year he sat in the rear of the classroom; in the senior (final) year he sat in the front of the room.[17] In all other respects the two annual courses required for graduation were identical. The student heard 60 to 120 lectures each year, ordinarily (varying according to the school attended), one or two lectures a week for about five months in each subject.[18]

There was some talk about the radical change to offering different material in the different years of a course, which had been tried experimentally in several progressive medical schools by the 1860's. Although the idea had failed to gain a firm foothold in medical education, such a change was boldly recommended in 1867 by the short-lived Medical Teachers Association; and thereafter a few additional medical colleges offered a graded course on an optional basis.[19]

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16 - Cf. reproduction of advertising leaflets for the terms 1859-60, 1861-62 in Wimmer, The College of Pharmacy, 52, 55, and Prospectus of the College of Pharmacy of the City of New York, 1870-71, 8. Concerning similar action at the Philadelphia College, see p.374.

17 - Wimmer, The College of Pharmacy, 71.

18 - "Colleges of Pharmacy of the United States," Western Druggist, 15: 52 ("extra"), 1893.

19 - F. C. Waite, "Advent of the Graded Curriculum in American Medical Colleges," J. Assoc. Amer. Med. Colls., 25: 314 ff. and 317 f., 1950.

This move did not go unnoticed in pharmacy. The American Journal of Pharmacy noted with interest the meeting of delegates from medical schools and commented upon the proposed graded curriculum: "Restricting the professional student to an attendance upon certain branches, and progressing with the same in accordance with the knowledge actually acquired, is a step in the right direction, and one which deserves to be followed by every professional college."[20]

In subsequent years many medical schools were to adopt an optional graded curriculum, but Waite points out that this had little meaning since apparently not more than two or three students out of a class would elect to take it.[21] Considerable opposition developed, and a few of the hesitant educators admitted to fears, as Waite relates, that graded courses probably "would result in laboratory instruction, and the installation and support of laboratories would be expensive and leave a smaller surplus,... which was the only source of their recompense." Still others thought the plan smacked of foreign ideas, hence was unpatriotic.[22]

It was men of a different caliber to whom medicine, like pharmacy, owes its professional development. In medicine the school at Harvard made the first substantial gain by requiring a three-year graded curriculum of all students beginning in 1871-72. Ten medical schools followed Harvard's lead before the end of the decade,[23] and a number of other schools adopted a two-year graded

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20 - "M." (John M. Maisch?), "Professional Education" (Ed. Dept.), Amer. J. Pharm., 39: 375 f., 1867.

21 - F. C. Waite, loc. cit., 317 f.

22 - Waite, loc. cit., 320.

23 - Waite, loc. cit., 318 f.

course.[24] By 1890 43 medical schools had graded courses, although a few were still not obligatory.[25]

Was it only the medical schools that Harvard influenced by taking the giant stride to a compulsory graded course? The very next year, in the same city of Boston, the Massachusetts College of Pharmacy proudly announced: "The Faculty are so well persuaded of the disadvantages of the one course or single class system hitherto pursued in this school and still used by all the other Colleges of Pharmacy in the United States, [that they] have determined to make an entire change in the method of instruction. ...No student will be admitted into the Senior class until he has passed the Junior examination. The members of the Senior class can attend the lectures given to the Junior class, and are advised to take advantage of the privilege to review their earlier studies."[26]

Beginning in 1872-73 the Prospectus of the Massachusetts College describes only courses offering different material in the junior and senior years and states that an examination must be passed before entering the senior year.

Graded instruction had already entered American pharmaceutical education four years earlier, when the University of Michigan opened its pharmacy course (1868). Michigan again pointed the way; but the rest of pharmaceutical education was apt to be recalcitrant in following in any direction this outsider pointed. Graded pharmaceutical instruction at Michigan of course followed routine

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24 - Report of the Commissioner of Education for 1881, cxciii.
25 - Wellford Addis, "Curricula of Professional Schools" in Report of the Commissioner of Education for 1889-90, 898.
26 - Prospectus of the Course of Instruction in the Massachusetts College of Pharmacy, 1872-73, 3.

university practice. At Massachusetts it represented a bold innovation by an old College (association) that had started regular instruction only five years before.

During the subsequent six years Massachusetts alone among the independent schools claimed this distinction; then in the fall of 1878 a similar program was introduced by the New York College, Maryland College, and perhaps others.

Why, then, were pharmaceutical writers twenty years hence dating the inception of graded instruction at 1879, or attributing the innovation to the Philadelphia College of Pharmacy?[27] Were the proud statements of self-styled pioneers prior to 1879 meaningless? The contemporary or subsequent literature has supplied no clear answer.

The actual circumstances surrounding this development begin to unfold, however, in the unpublished minutes of the Conference of the Schools of Pharmacy. There, in 1876, grading the courses became an important issue for the first time, and it was the consensus that the time was not ripe. The Conference did adopt a committee report that presented an outline for a "progressive" or graded curriculum with the statement that "while such a course of instruction is very desirable, the time has not yet arrived when it can be successfully introduced in all our Colleges." As a substitute for adoption of this plan, the committee report, which was approved by the Conference,

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27 - See, e.g., Oscar Oldberg, "The Educational Condition of American Pharmacy," Amer. Drugg. and Pharm. Record, 36: 176, 1900; and "Colleges of Pharmacy of the United States," Western Druggist, 15: 52 ("extra"), 1893.

recommended more lectures in the ungraded course and the introduction of an examination at the end of the first term of lectures that would be optional on the part of the student.

During consideration of this committee report, the graded course at the Massachusetts College naturally came up for discussion. John M. Maisch, the Conference secretary, sceptically scrawled into his minutes that Professor Markoe of Massachusetts "claimed this to be a progressive course." Maisch himself told the Conference that he believed "the Massachusetts College of Pharmacy had merely split the usual courses of other colleges into two halves, and that the students heard only one half the number of lectures as delivered in other colleges." The Massachusetts delegate then admitted the "splitting," but insisted that although only one lecture was given each week in each subject the duration of the lectures often was one-and-a-half hours, sometimes two hours.[28]

Unless we credit Markoe's statement that the lectures were "often" longer than the customary hour, it appears that students at the Massachusetts College were not receiving much more instruction under the new program than under the old. It should perhaps be added that in giving only one lecture a week in each subject Massachusetts had the company of a number of schools that retained ungraded instruction, although at least some of the better-known schools offered two lectures a week.

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28 - Minutes of the Conference of the Schools of Pharmacy, 1876 proceedings.

Whatever the exact circumstance, the action by the Massachusetts College had a salutary effect: it undoubtedly helped center attention on the need for graded instruction; it inaugurated a compulsory examination at the close of the first term of lectures—quite probably the first such among independent schools; and by splitting the instruction into two halves, it at least opened the way for building a progressive curriculum, with advanced study following elementary instruction in subjects basic to it.

In 1878 the question of graded instruction again came up in the Conference of the Schools of Pharmacy, but was tabled on the ground that it already had been acted upon. Two proponents of the idea, however, went ahead with their plans. At least the New York College and the Maryland College announced with a flourish, in catalogs for 1878-79, the graded instruction "long contemplated." It was "hoped, that the greatly increased labor, which this change entails both upon the faculty and upon the officers of the College, will be duly appreciated."

Did this at last fulfill the concept and objective of graded instruction such as the Harvard medical department had in mind: essentially doubling the amount of instruction by giving different material in the first term than in the second?

Unfortunately both schools had only followed the lead of Massachusetts by splitting the existent course. At New York the ungraded term of 1876-77 lasted from September 25 to March 9, with two hours of lecture a week in each of three subjects.[29] The

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29 - Prospectus of the College of Pharmacy of the City of New York, 1876-77, 8.

1878-79 term extended from September 23 to March 7, with one lecture a week in each of three subjects.[30] The Annual Circulars of the Maryland College of Pharmacy show precisely the same change in the teaching program. While these catalogs express considerable enthusiasm in general statements about the expected improvement in pharmaceutical education, nowhere is there mention of any proposed lengthening of the individual lectures; nor is there any mention that the number of lectures per term had been cut in half!

Thus it remains an open question whether the heralded advent of "graded courses" in American pharmacy really tended to raise the educational standards.

In earlier years, it will be recalled, the student attended two lectures each week in a subject the first term, then went back and repeated the lectures during a second year--more likely, of course, he did not go back to graduate but went into practice instead. Now the student heard only half the lectures the first year and had to go back the second year to hear the other half. Naturally, the price of the annual lecture tickets remained the same as before.

This was the meaning of "graded instruction" before 1879; although individual sources are often ambiguous, the combined evidence seems to offer a fairly reliable picture. It is a picture of half-hearted advance, equivocation and pretense. But at least the light was seen, and the principle of graded education (i.e., checked and continually progressing) was established.

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30 - Prospectus of the College of Pharmacy of the City of New York, 1878-79, 12 f.

In 1879-80 the Philadelphia College and the St. Louis College inaugurated graded courses. Unlike the other schools mentioned they took a full and firm step forward by retaining the previous length of term and number of lectures per week (two in each subject), while offering different, more advanced, material the second term.[31]

During the subsequent fifteen years apparently all of the association schools that had existed in 1871 adopted some form of the graded system of instruction.[32] In 1893 the Western Druggist commented that "now there is probably no school of pharmacy pursuing the old plan."[33]

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The purported revolutionary change of the 1870's now seems only a rather flaccid gesture. With a few notable exceptions there had been little real progress in extending the courses, and in the 1880's some discontented voices were heard.

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31 - Prospectus of the Saint Louis College of Pharmacy, 1882-83, 4 and 7; "St. Louis College of Pharmacy," Meyer Brothers Druggist, 13: 357, 1892; "Philadelphia College of Pharmacy," Amer. J. Pharm., 50: 314 f., 1878. The Philadelphia College announced that its new program had been arranged "according to the plan which received the sanction of the 'Conference of the Schools of Pharmacy' in 1876..." It will be recalled that the Conference actually had recommended a substitute plan, although at the same time agreeing that graded instruction would be "very desirable" even though "the time has not yet arrived..."

32 - Oscar Oldberg, "The Educational Condition of American Pharmacy," Amer. Drugg. and Pharm. Record, 36: 176, 1900.

33 - "Colleges of Pharmacy of the United States," Western Druggist, 15: 52 ("extra"), 1893.

The Pharmaceutische Rundschau, which maintained a steady drumbeat of criticism, called the length of course in association schools "glaringly inadequate," comparing "more nearly with the 'commercial college' courses of this country, than with any graduating courses of standard professional training."[34]

Professor Edson S. Bastin of the Chicago College of Pharmacy maintained that "Everyone who has known much about the great sciences of physics, chemistry and botany knows that even a good foundation for these sciences cannot be laid in the mind of the average student in the short time allotted to the whole course in pharmacy in most of our colleges."[35]

Bastin knew of the inadequacies first hand, for he taught at a school that did not introduce graded instruction until 1886-87 and that graduated students within a single year, after two terms of 18 or 26 weeks each.[36]

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34 - "Editoriell. State Boards of Pharmacy, College Education and Diplomas," Pharm. Rundschau, 3: 71, 1885.

35 - E. S. Bastin, "Pharmaceutical Education," Western Druggist, 10: 403, 1888.

36 - Cf. Announcement of the Eighteenth Annual Session of the Chicago College of Pharmacy, 1884-85 and the Announcement for 1886-87. There is a slight possibility that graded instruction might have begun a year earlier, in 1885-86. It is interesting that in 1884-85 Bastin's course in botany was graded but not the other courses.
The College's catalogs and reports to the Commissioner of Education indicate that two terms of 26 weeks each were required in 1885. Day stated, however, that at this time "the courses developed so as to occupy two sessions of 18 weeks each, with graduation at the end of this period."
The graduation of students within a single calendar year was a matter of some disagreement among members. (W. B. Day, "The School of Pharmacy" in The Alumni Record of the University of Illinois, 1921, xxviii.)

Among 13 dental schools at this time one gave a one-year course; nine gave a two-year course and three gave a three-year course. The weeks per instruction-year ranged from a low of 18 weeks in one three-year course to a high of 52 weeks in a two-year course.[39]

Of 14 pharmacy schools reporting in 1880 ten seem to have retained the 40- to 44-week standard for graduation.[40] Vanderbilt University also lay within this range. The length of the course at the University of Michigan remained unchanged or was slightly shorter in time (reported as 68 weeks, compared with 72 weeks five years earlier).

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39 - Report of the Commissioner of Education for 1880, 712 ff.

40 - Ibid., 717. The National and St. Louis Colleges are included, since the additional weeks represented by the special summer terms probably were optional. The Louisville College is reported as offering two years of 40 weeks each, which has been counted as a misprint since five years later the school offered a total of 40 weeks in the two years together. The Massachusetts College reported the only three-year course among the 14 schools (60 weeks of instruction), but no such course is mentioned in the Annual Catalogue for 1880-81 or 1881-82; it is therefore included here among schools giving 40-44 weeks of instruction. Two other association schools reported a course other than the customary 40-44 weeks total instruction. Chicago reported 52 weeks, about which there is some question, as previously noted. And Maryland apparently had made a temporary retreat, reporting two years of only 17 weeks each. (Ibid., 717.)

Four years later (1884-85) 21 schools of pharmacy reported, among which there are several new courses or changes in the old that claim attention. The California College reported an increase in total instruction from 40 to 60 weeks. The Massachusetts College still claimed 60 weeks of lectures but now as a two-year program; however, the Annual Catalogue (1884-85) indicates that the regular course lasted only from October 6 to March 27. Maryland had returned to its old standard, reporting 46 weeks during two years (instead of 34). The National College of Pharmacy (Washington, D. C.) listed 72 weeks of instruction for graduation. The Annual Circular (1884-85) indicates this was an ungraded course (except in practical and analytical chemistry), offering only one lecture a week in each of three subjects and a three-hour weekly session in analytical chemistry. The Louisville School of Pharmacy for Women made the remarkable claim of a three-year course, with 36 weeks in the school year, which presumably meant a total of 108 weeks of instruction.[41] This typifies impressive claims made by the Louisville school concerning facilities and standards, which are given an air of improbability by what we know of its general nature. These claims coupled with the school's uniqueness as an institution for women make it an inviting topic for further historical investigation.

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41 - Report of the Commissioner of Education for 1884-85, 666. The Philadelphia College reported a 20-week term, with four years in the "full course"; it may be assumed that in reporting four years the College merely emphasized its assumption that the apprenticeship was an integral part of pharmaceutical education.

Several state universities of the West now joined Michigan in offering pharmacy courses but by no means followed it in setting the term of instruction. The University of Wisconsin began in 1883 by requiring two years of 27 weeks each[42] in pharmacy, the shortest course then given at the University.[43] Purdue University started instruction in 1884 with two years of only 20 weeks each.[44] The State University of Iowa opened a course of 22 weeks in 1885-86, two ungraded terms in three subjects being required, plus laboratory work.[45] Ohio State University launched instruction in 1885 with a three-year course.[46] Although the total number of weeks in the curriculum of some of the university schools did not notably exceed that of many association schools, there was a basic, significant difference in the content of a "week." For example, the University of Michigan at this time (1885) required of the student "seven or eight hours a day in college, with some hours daily in private study, and constituting a progressive course for two collegiate years of nine months."[47] In contrast, the New York College, one of the stronger independent schools, required of the student attendance upon four or five lectures a week during a five-and-one-half-month term, and 15 laboratory sessions during each of two terms.[48]

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42 - Report of the Commissioner of Education for 1884-85, 666.

43 - Proceedings of the Wisconsin Pharmaceutical Association, 1897 (Janesville, 1897), 87.

44 - Report of the Commissioner of Education for 1884-85, 666, and C. O. Lee, "The First Courses in Pharmacy," Amer. J. Pharm. Ed., 4: 60, 1940.

45 - State University of Iowa, Department of Pharmacy, First Annual Announcement, 1885-86, 3, et passim.

46 - "Ohio State University College of Pharmacy---Historical Sketch," (MS in Kremers Reference Collection), 4.

47 - Annual Announcement of the School of Pharmacy of the University of Michigan, 1885-86, 5.

48 - Prospectus of the College of Pharmacy of the City of New York, 1885-86, 4, 20, 24, 27.

The contrast in the extent of instruction between independent and state schools almost vanishes, however, if New York is compared with one of the new state-university courses, such as Iowa. Although it is difficult to form any clear picture from many of the catalogs, the disparity in the extent of instruction among state university schools was much greater, at this early stage of their development, than among the old association schools that had gone through a period of unification, if not ossification.

By the early 1890's the pharmacy student might attend school five or six hours a week, or five or six hours a day. He could graduate within a single calendar year, or he might study for three academic years. And before long the student that was ambitious enough, or looked far enough, would find courses requiring four, and even five, years for an undergraduate pharmacy degree.

Most of the association schools had taken only slow and hesitant steps in extending the time of instruction since adopting the graded course. Professor Charles T. P. Fennel of the Cincinnati College impatiently described conditions in 1891:

"The requirements for the degree of graduate in pharmacy have virtually remained in status quo for the last twenty years," he said, "the attendance on two courses of college instruction, fortified usually by four years' practical experience, without regard to the nature of this experience, whether this experience has been obtained behind soda and cigar counter, or in a general merchandise store, which usually carries as a side-issue a drug department; the writing of a thesis; the possession of a good moral character, the attainment of twenty-one years of age, and the

sustaining of a creditable examination in the several branches taught."[49]

Fennel left the state university schools out of account, but it was not unusual to make the tacit assumption during discussions that university schools did not exist. Teachers in the independent schools naturally were concerned about the conditions and problems presented in their own type of institution. Fennel maintained that such teachers saw the need to improve conditions but had never been able to get reforms off paper and into action because each school waited for the other to move first, lest it lose students. Fennel concluded on a satirical note:

"Colleges attempt to outdo each other. More instruction is offered in every way, larger fields for laboratory work are introduced, and greater facilities are presented by tempting catalogues; but the time of acquiring this amount of information is shortened and the final requirements for graduation are lowered, and in the majority of cases the expense considerably reduced."[50]

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49 - Charles T. P. Fennel, "Pharmacal Legislation and Education," Proc. Amer. Pharm. Assoc., 39: 227, 1891.

50 - Ibid., 228. The paradox that Fennel referred to annoyed contemporaries as it does historians. The editor of The Apothecary complained: "It is not an easy matter to determine just how much instruction or school attendance is included in the required course in the colleges of pharmacy, for it does not seem to be deemed necessary to be explicit as to these matters. General statements are too frequently the only information presented in the catalogues, and even these are occasionally so carelessly made that they may easily be misunderstood." ("Pharmaceutical Statistics" (Editorial), The Apothecary, 1: 14, 1891)

The reports to the Commissioner of Education in 1891 confirm that few schools had made notable innovations in the time required for the course. Of 30 schools, probably all but 13 required between 40 and 48 weeks of attendance for graduation. Of the 13, five independent schools required between 48 and 56 weeks: California, Chicago, Minnesota Institute, New York, and Cincinnati. The Louisville School of Pharmacy for Women reported a shorter course than previously but still claimed 66 weeks. The Massachusetts College had the next longest attendance requirement: 64 weeks. Six universities complete the group that claimed instruction lasting more than 48 weeks: Howard University, 96 weeks; Michigan, 78; Ohio State, 126; University of South Carolina, 80; Vanderbilt, 72; Wisconsin, 54.[51]

The four-year apprenticeship, including time in school, was still standard, although eleven of the 30 schools deviated from this. A three-year apprenticeship was named by the State University of Iowa and the Louisville School of Pharmacy for Women; a two-year apprenticeship by the University of Kansas (40 weeks instruction), Tulane University (48 weeks instruction), and University of South Carolina (80 weeks instruction); a one-year apprenticeship by the Iowa College of Pharmacy (40 weeks instruction); and no apprenticeship at Purdue University (40 weeks instruction) and Michigan (78 weeks instruction). Howard and Ohio State universities did not report upon the apprenticeship requirement.[52]

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51 - Report of the Commissioner of Education for 1890-91, 1430.

52 - Ibid., 1430. The Chicago College did not report an apprenticeship requirement, but specified four years in the catalog at this time.

Five schools gave supplemental courses in the spring or summer: the Louisville College and Louisville School of Pharmacy for Women gave a course of the usual length; the Maryland College, Philadelphia College and the University of Wisconsin offered summer courses of eight to twelve weeks.

Associative and legislative action in medicine and dentistry now began to revolutionize education in these fields, leaving pharmaceutical education far in the lurch. In the early 1890's medicine was in the throes of completing the shift from the old course of four or five months for two years to eight or nine months for three and four years. In 1894 the Association of American Medical Colleges amended its constitution to require member colleges to install by 1896-97 a curriculum of four annual courses of not less than six months each. The picture now changed year by year, while students of the medical field disagreed on how to weigh the factors that powered the progress.

Besides new medical practice acts of the previous five or six years, the firm stand of the college Association, and the vigorous American Medical Association, two other factors were stressed by A. Erskine Miller, writing for the Bureau of Education: first, the vigor of medical departments that shared the strength of heavily endowed private universities (plus the state universities, which were also disturbing the equilibrium of pharmaceutical education); secondly, the remarkably large numbers of youths attracted to medicine as a calling, which made it possible for even the weaker schools to raise standards and still get all the students they could comfortably accomodate. These influences were buttressed by the fact that state boards not only functioned but some functioned militantly. For example, the Illinois Board of Health ruled that no school would be in good standing if it had

less than a three-year course, and no graduate of a shorter course could be licensed without examination.[53]

By 1896 the four-year course had been adopted by 76 medical schools, and by the end of the century nearly all schools had made the change. Dentistry likewise took firm action. By 1891 all but seven of 27 schools had swung over to the recommended three-year course; in 1892-93 it became required for good standing, and when the Commissioner of Education surveyed dental education in 1896 all schools reporting were on the three-year plan; one had gone to four years.[54]

A three-term course of six months per term in pharmacy became a live issue in the Section on Education and Legislation of the American Pharmaceutical Association around 1890. While the time was not thought to be ripe for three terms, a resolution passed at the 1891 convention requesting colleges "to extend the time of their respective courses of instruction at the earliest practicable time to six months."[55]

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53 - Report of the Commissioner of Education for 1892-93, 1617.

54 - Report of the Commissioner of Education for 1890-91, 1428, also 1422 ff.; Report for 1895-96, 2048, also 2040 ff.; F. C. Waite, "Advent of the Graded Curriculum in American Medical Colleges," J. Assoc. Amer. Med. Coll., 25: 322, 1950.

55 - Proc. Amer. Pharm. Assoc., 39: 235, 1891.

Although no penalties could be levied for non-compliance, the reports to the Commissioner of Education for 1895-96 show that in the previous few years a majority of pharmacy schools had extended the length of the annual term to six months or more. Only 12 of 44 schools admitted to a curriculum requiring less than 52 weeks of instruction for graduation. Three schools graduated in a single year; six had divided instruction into three terms. The group of schools offering the first three-term courses in pharmacy is notable for its heterogeneity in type and caliber: National College (78 weeks total); Louisville School of Pharmacy for Women (120? weeks); Shaw University (60 weeks); Ohio State University (117 weeks); Philadelphia College (72 weeks); and Central Tennessee College (60 weeks).[56]

A "week" in most independent schools at this time consisted of two or three lectures a week in pharmacy and in chemistry (for two terms), one or two lectures a week in materia medica (for two terms), and one or two lectures a week in botany for one term (occasionally both terms), usually with a few hours additional work in the laboratory.[57]

By 1895 apprenticeship requirements for graduation were disintegrating. Twenty of the 44 schools stated frankly that they gave no consideration to apprenticeship in graduating students. Six other schools stated a requirement of only two or three years,

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56 - Report of the Commissioner of Education for 1895-96, 2050 f.

57 - "American Colleges of Pharmacy," Pharm. Era, 14: 454, 1895. Another study indicated that 11 hours a week was required by association schools on the average, with a range of six to 19 hours. ("The American Pharmacy Schools and Their Facilities, Courses and Requirements, in 1893-94," The Apothecary, 3: 150 f., 1894.

which now usually implied inclusion of time spent in school.[58]

Evening schools were now on the way out. Twenty-three institutions gave instruction only in the daytime; seven schools scheduled classes in both daytime and evening; four still gave only evening instruction.[59]

The state university schools of course held a much more substantial lead in the amount of instruction given than a comparison of the total weeks of instruction indicates. While a student at the average independent school was in attendance 11 hours or so per week, as previously noted, the university student was in the classroom or laboratory about 30 hours per week, on the average.[60] The university student probably spent about two-thirds of the instruction time in laboratories; hence the marked difference between the university and independent school lay in this field rather than in the lecture work offered.

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58 - Report of the Commissioner of Education for 1895-96, 2050 f.

59 - Report of the Commissioner of Education for 1894-95, 2190 f. Institutions still operated entirely as night schools were the National College, Detroit College of Medicine, Albany College, and the department at Howard University. Some afternoon classes were given already in the late 1870's. Changes in the lecture schedule were sometimes made to avoid taking the apprentices out of the shops on busy evenings. (See, e.g., Prospectus of the College of Pharmacy of the City of New York, 1878-79, 13, and "Philadelphia College of Pharmacy," Amer. J. Pharm., 28: 377, 1856.

60 - "The American Pharmacy Schools and Their Facilities, Courses and Requirements, in 1893-94," The Apothecary, 3: 150 f., 1894.

It was previously noted that the amount of instruction time among university schools by no means followed a uniform pattern. Ohio State University had held a substantial lead over other university schools since the pharmacy course opened in 1885, offering a three-year course in which professional instruction was based on high school graduation and basic studies in college.[61] Five years after the opening this course required the student's attendance upon 126 weeks of instruction.[62] In 1893 Oldberg described the course as nine months full work for three years, including extensive laboratory courses, for which the "Ph. G." was conferred without regard for practical experience. Michigan, Wisconsin, and Vanderbilt universities required at this time two terms of nine months full work each. Purdue University had developed its course to two years of seven months each, which required attendance of at least 29 hours a week in the classroom and laboratory.[63] The State University of Iowa required two years of five-and-one-half months each, graded courses being inaugurated in 1892-93.[64]

At this time (1893-94) Wisconsin made its momentous announcement that an undergraduate course in pharmacy would be offered requiring four regular academic years, as an optional curriculum to its two-year course. This opened a period of changes in the length of pharmaceutical courses in universities during the rest

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61 - "Ohio State University College of Pharmacy, Historical Sketch," (MS in Kremers Reference Collection), 4.

62 - Report of the Commissioner of Education for 1890-91, 1430.

63 - Oscar Oldberg, "Compulsory Pharmaceutical Education in America," The Apothecary, 3: 54, 1893; A Brief Account of the First Fifty Years of Pharmacy Education at Purdue, 9.

64 - State University of Iowa Department of Pharmacy, Annual Announcement, 3 f., cf. Announcement for 1891-92.

of the decade. Other universities followed the lead of Wisconsin in adopting an optional four-year program, including Maine, Alabama Polytechnic, Purdue, Kansas, Michigan, and Oregon.[65] The new school at the University of Washington even went a step farther. Instruction started unobtrusively enough in 1894 as a two-year course. Then the professor of chemistry who had become dean of pharmacy within the College of Chemistry brusquely announced in the 1895-96 catalogue that "Hereafter the pharmaceutic degree will be given only as post graduate to the baccalaureate degree of B. S." It thus took five years of study to obtain the "Ph. C." degree. The student body promptly dropped to the vanishing point. Four years later, under a new chairman of the chemistry department, pharmacy returned to the two-year course.[66] Thus came to an inglorious end the first five-year course in American pharmaceutical education, leading to a professional degree.

Ohio State University, which had stoutly maintained its full three years of instruction for more than a decade, yielded its claim to leadership shortly before 1900 by following Wisconsin, and other universities, into a dual program of two-year and four-year courses. Since students now had a choice most of them took only two years.[67] Although we do not know to what extent this was a response to keen competition among schools in the Ohio region, the Cincinnati College of Pharmacy had been seriously affected.

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65 - Report of the Commissioner of Education for 1899-1900, 2008 f.

66 - C. W. Johnson, "History of the University of Washington College of Pharmacy," (MS in Kremers Reference Collection), 9.

67 - "Ohio State University College of Pharmacy, Historical Sketch," (MS in Kremers Reference Collection), 4.

There was some doubt in 1896 that the Cincinnati College would even open, and an angry letter-writer commented in the Pharmaceutical Era: "The College course has been reduced in a way to put it on a level with the cheap one-horse institutions that are scattered throughout this and other States. It is proposed to grant a diploma after 40 weeks of continuous study, instead of after a course of two years of 26 weeks each, as at present. I understand that this is done with a view to attracting students..."[68] The College went even farther than had been feared. After 1897 it bestowed the Bachelor of Pharmacy degree for "34 full weeks" of "logical, progressive and comprehensive" study.[69]

Even more alarming to educators than the average student's reluctance to choose the longer curricula now available, was the fact that a majority of the students in most schools did not bother to stay for a second term, for "after completing their junior work they are usually able to pass the State board examinations, and when once licensed or registered they seem to be content with their partial education."[70]

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68 - "Cincinnati and Ohio" (letter), Pharmaceu. Era, 16: 221, 1896.

69 - Cincinnati College of Pharmacy, Annual Announcement [1900-01?], 5 f. and 9.

70 - "Pharmaceutical Statistics" (Editorial), The Apothecary, 1: 22, 1891; and W. F. Rudd, Pharmaceutical Education, Bulletin No. 11 (Bureau of Education, 1921), 4.

Some schools made it especially attractive for students of such limited ambitions, still in the 1890's, by graduating the student in one year, either after one extended term or two short consecutive terms. Such schools were Ohio Normal, Ohio National Normal, Northern Indiana Normal, Louisville College of Pharmacy, Scio College, and, most notably, the school affiliated with Northwestern University.[71]

The one-year courses provoked lively discussion among teachers, but there was no unanimity of opinion in the face of the argument that the total instruction hours in courses of two consecutive terms often equalled that of accepted courses extending over two separate years. The consensus seemed to be that it was not quite decent to graduate in a single year, that there should be a period of "rest and digestion," and more especially some full-time practical experience between the two terms.[72]

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71 - C. S. N. Hallberg, "The Requirements for Graduation in American Colleges of Pharmacy," Proc. Amer. Pharm. Assoc., 41: 274 f., 1893. Hallberg also mentions Vanderbilt University but this does not seem to be substantiated, unless a short course was given besides the two-year course ordinarily attributed to it. Scio College discontinued its one-year course of 42 weeks (Report of the Commissioner of Education for 1895-96, 2050 f.) sometime after 1895; Hallberg asked that Scio be deleted from his list and apologized for calling it a "business venture."

72 - Proc. Amer. Pharm. Assoc., 37: 293-295, 1889.

The operation of such a school is described in the 1892 Announcement of the Northern Indiana Normal School (Valparaiso). The prospective student was told that "the course is continuous throughout the year, enabling students to enter at almost any time and pursue their studies from the beginning of the junior term to the conclusion of the senior term without delay or hindrance" in 50 weeks, with the additional advantage that "there are no forms of amusement or dissipation as there are in a large city..." One-third to a half of the student's time was to be spent in the laboratories. During the year, through an "elaboration of the pharmaceutical college course" ordinarily given, the student studies "pharmacy, theoretical, practical, operative, and extemporaneous, inorganic, organic, and analytical chemistry, pharmacognosy (organic materia medica), botany, microscopy, urinalysis, physiology, therapeutics, toxicology, zoology, geology, mineralogy, bookkeeping, Latin and jurisprudence."[73] No wonder the catalog emphasized that the 50 weeks of instruction were to be "without intermission" and without "dissipation"!

It could be argued that a school of this type, conscientiously conducted, was not much worse than some respected institutions that gave the same length of course divided into two terms; but ambitious teachers felt that all such abbreviated courses, in whatever form, were a brake on pharmaceutical education as a whole in filling social and professional needs.

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73 - Announcement of the Department of Pharmacy of the Northern Indiana Normal School, 1892, 1-3.

Professor Oldberg of Northwestern, whose students graduated after 40 consecutive weeks, disagreed. "...While these schools [having two, three or four years of work] are of great value and importance," he said at a meeting in 1894, "and must exert considerable influence upon the further improvement and spread of pharmaceutical education, it is certainly equally true that those colleges of pharmacy which are striving to give as extended a course as a considerable number of students can be induced to take under existing conditions, are entitled to equal respect and support, and are performing an even more important use. Who shall answer which is the more important, the school for the thousands, the school for the hundreds, or the school for the tens?"

Then Oldberg hammered home some sobering statistics:

"Although there are at least 130,000 persons employed in the retail drug business in our country, and more than one-half of those are compounding medicines on physicians' prescriptions, probably only about 10,000 of them are graduates in pharmacy; less than 3,700 annually attend any pharmaceutical school; less than 900 annually finish their college courses; less than 300 annually attend colleges in which the minimum of time required for the completion of the course is at least two terms of nine months each; and less than 100 of these have gotten beyond their first nine months' work. Nearly three-fourths of all the pharmaceutical students in the United States drop out after the 'Junior course'; in other words, they devote only from twenty to thirty weeks of their lifetime to the special studies intended to prepare them for their life pursuit. Nearly nine-tenths of the persons who become registered pharmacists and assistant pharmacists never attend any college of pharmacy."[74]

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74 - Oscar Oldberg, "Can a Minimum Standard of Pharmaceutical Education be Adopted?" Proc. Amer. Pharm. Assoc., 42: 348, 1894.

In arguing for the short course, Oldberg spoke for conservative, for reactionary, forces in pharmacy. Consciously or unconsciously he spoke for pharmacy as a trade, rather than for further professionalization through theoretical and scientific study. On the social side, the assumption was that pharmacy did not represent a health service in which public welfare asked for more than, say, ten months of special training. Men like Oldberg recognized that schools graduating from an extended curriculum had "great value and importance" in pharmacy, but they viewed such graduates as an elite and held that a good school should also have a shorter course for the ordinary pharmacy student, which "could be made to occupy ten months; it certainly could not be made longer."[75]

American pharmaceutical education as a whole faced in another direction, although extensions in the course of instruction came slowly and unevenly in the absence of any enforced standards, or organized leadership. At the end of the century the length of the course of instruction and apprenticeship for graduation in 53 schools of pharmacy were as follows:[76]

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75 - Oscar Oldberg, "Conditions Favoring Good Pharmaceutical Education," The Apothecary, 3: 72 f., 1893.

76 - Report of the Commissioner of Education for 1899-1900, 2008 ff., with a few additions by the present writer.

School	Years in Course	Weeks in Year	Years of Practice Required	Day or Night Instr.*
Alabama Polytechnic Institute	4	36	0	D
Medical College, University of Ala.	2	26	0	D
California College of Pharmacy	2	30	4	D
College of Physicians and Surgeons (San Francisco)	2	28	4	E
Howard University	2	28	4	E
National College of Pharmacy	3	26	4	E
Atlanta College of Pharmacy	2	26	—	—
Chicago College of Pharmacy	2	30	2	D
Northwestern University	1	40	0	D
Purdue University	2,4	37	0	—
University of Notre Dame	2	42	0	D
Northern Indiana Normal (Valparaiso)	2,4	25	0	D
Highland Park College (Iowa)	2	24	0	D
Iowa College (Drake University)	2	25	0	D
State University of Iowa	2	26	0	D
University of Kansas	2	40	2	D
Louisville College of Pharmacy	2	24	4	D
Tulane University	2	26	2	D
University of Maine	2,4	36	1,3	D
Maryland College of Pharmacy	2	32	—	D
Massachusetts College of Pharmacy	2	34	4	D
University of Michigan	2,4	36	0	D
Detroit College of Medicine	2	36	0	E
University of Minnesota	2	33	0	D
Kansas City College of Pharmacy	2	26	3	E
St. Louis College of Pharmacy	2	28	4	E
New Jersey College of Pharmacy	2	30	4	"P.M." & E
Albany College of Pharmacy	2	23	4	E
Brooklyn College of Pharmacy	2	32	4	D
University of Buffalo	2	28	0	D
New York College of Pharmacy	2	27	4	D
University of North Carolina	2	32	4	D
Shaw University	3	24	0	D
Ohio Normal University	1,2	40	0	D
Cincinnati College of Pharmacy	1	34	0	D
Cleveland School of Pharmacy	3	30	0	D
Ohio State University	2,4	36	—	D
Scio College	2	36	0	D
University of Oklahoma	2	38	1	D
Oregon Agricultural College	2,4	36	0	D
Medico-Chirurgical College (Phila.)	2	27	4	D
Philadelphia College of Pharmacy	3	29	4	D
Pittsburgh College of Pharmacy	2	24	4	D
Medical College of South Carolina	2	26	2	D
South Dakota Agricultural College	3	36	0	D
University of Tennessee (Memphis)	1	40	0	D
Central Tennessee College (Meharry)	3	24	0	D
Vanderbilt University	2	36	0	D
University of Texas	2	34	0	D
University College of Medicine (Va.)	2	31	2	"P.M." & E
Medical College of Virginia	2	30	0	D
Washington Agricultural College	2	38	0	D
University of Wisconsin	2,4	36	0	D

* D = daytime; E = evening; "P.M." = afternoon

Only seven schools now operated entirely as night schools, it will be noted; two others gave instruction in both afternoon and evening.[77]

About half the schools (27) had broken all ties with apprenticeship. Not quite three out of ten still claimed a four-year practical experience requirement for graduation. At least eight schools now offered optional curricula of different lengths, and the number was to increase after the turn of the century. Most schools, including the state universities, still offered a two-year course (43 schools), although seven schools also offered an optional four-year course. The three-year course had not yet made much headway, being offered by six schools in 1899. Among 53 schools reporting, three still offered a one-year course.

Educators attempting to extend the amount of instruction were surprised and reassured by a survey showing that schools that had lengthened the course suffered no significant decrease in enrollment.[78]

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77 - Those operating entirely as night schools were the College of Physicians and Surgeons (San Francisco), Howard University, National College, Detroit College of Medicine, Kansas City College, St. Louis College, and Albany College.

78 - James H. Beal, "Report on American Colleges of Pharmacy," Pharm. Era, 20: 330, 1898.

Comparative Table of Number of Students and Length of Course in Professional Schools of the United States, 1870–1897

Class.	Whole number of students.	Students with degrees. *a*	Course of four years.		Course of three years.		Course of two years.		Course of one year.		Course not stated.	
			Schools.	Students.	Schools.	Students.	Schools.	Students.	Schools.	Students.	Schools.	Students.
Theology.												
1870	3,254	(*b*)	(*b*)	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	.....	.....
1875	5,234	1,254	26	1,527	77	2,942	9	529	0	.....	11	236
1880	5,242	1,345	21	1,074	85	3,368	8	204	0	.....	28	596
1885	5,775	1,312	26	1,923	98	3,091	6	153	0	.....	22	608
1890	7,013	1,559	(*b*)	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	.....	.....
1895	8,050	2,354	23	979	114	6,719	9	320	1	32	2	.....
1897	8,173	2,566	22	1,054	116	6,523	7	217	1	10	11	369
Law.												
1870	1,653	(*b*)	(*b*)	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	.....	.....
1875	2,677	623	0	.....	1	165	30	2,173	10	324	2	15
1880	3,134	758	0	.....	4	502	34	2,422	5	199	5	11
1885	2,744	632	0	.....	5	547	38	2,134	6	63	0	.....
1890	4,518	983	0	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	.....	.....
1895	8,950	1,867	0	.....	16	2,786	50	5,928	6	236	0	.....
1897	10,449	1,932	0	.....	21	4,942	47	5,095	7	255	2	157
Medicine.												
1870	6,194	(*b*)	(*b*)	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	.....	.....
1875	8,580	394	0	.....	*c* 3	502	*c*72	7,721	5	357	0	.....
1880	11,929	953	0	.....	*c* 3	539	*c*84	11,305	3	85	0	.....
1885	11,059	861	0	.....	5	757	103	10,302	0	.....	(*d*)	.....
1890	16,660	1,387	(*b*)	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	.....	.....
1895	22,887	(*b*)	42	8,312	98	12,769	2	222	*e* 2	51	(*f*)	.....
1897	24,377	1,498	99	16,542	49	7,774	0	.....	*e* 2	61	.....	.....
Dentistry.												
1870	257	(*b*)	(*b*)	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	0	.....
1875	469	65	0	.....	0	.....	12	469	0	.....	0	.....
1880	730	49	0	.....	2	74	12	635	1	21	1	.....
1885	1,116	71	0	.....	5	213	13	903	0	.....	0	.....
1890	2,696	100	0	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	.....	.....
1895	5,347	(*b*)	0	.....	45	5,347	0	0	0	.....	0	.....
1897	6,460	.....	1	18	47	6,442	0	.....	0	.....	.....	.....
Pharmacy.												
1870	512	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	.....	.....
1875	922	.....	0	.....	0	.....	10	845	3	47	1	30
1880	1,347	.....	0	.....	1	60	13	1,287	0	.....	0	.....
1885	1,746	.....	0	.....	0	.....	21	1,746	0	.....	0	.....
1890	2,871	.....	.....	.....	(*b*)	.....	(*b*)	.....	(*b*)	.....	.....	.....
1895	3,859	.....	0	.....	3	150	34	3,668	1	41	1	.....
1897	3,426	.....	0	.....	5	694	34	2,398	2	275	2	59

a So far as reported.
b Not indicated in table of the Education Report for that year.
c Distinction between medical schools having courses of two and three years in 1875 and 1880 can not be made with entire certainty.
d There were five postgraduate schools.
e Preparatory schools.
f There were seven postgraduate schools, with 1,533 students.

Report of the Commissioner of Education for 1896-97, 1781.
U. W. Neg. No. 7539-B

The table above offers a picture of the number of students pursuing pharmacy courses of different lengths, at different periods, in relation to the approximate total number of students and in relation to other professions. Note that within a decade (1885–1895) both medicine and dentistry made a substantially complete shift from two-year to three-year curricula. In only two or three years thereafter the main body of American medical students were shifted from three-year to four-year curricula. Throughout this same period the relatively small and slowly growing student body of American pharmacy remained in two-year curricula, which were being lengthened hesitantly. The establishment of three-year curricula in pharmacy

schools lagged at least a decade behind other professional fields, and once started showed a weak growth. The schools offering a three-year course enrolled only about two per cent of the nation's pharmacy students in 1897; before that time, 0.5 per cent of the students or less. The one-year courses of pharmacy were not graduating significant numbers of students, in relation to the whole, although it must be borne in mind that a majority of the students in the longer courses did not remain to graduate.

Note that all figures in the table may be assumed to be incomplete and approximate. While the number of years in a course has little meaning without the number of weeks and instruction hours, it does provide an acceptable basis for rough comparisons when dealing collectively with relatively large numbers of schools, as in the present table. When the three- and four-year curricula began in pharmacy late in the century the number of weeks per term and instruction hours were, in general, equal to or greater than the annual time required in the two-year courses. The optional four-year pharmacy courses are missing from the table; for information on these, see pages 400 ff. and 407.

Until the last quarter of the century the instruction followed the highly standardized pattern of chemistry, materia medica, and pharmacy. This was "all that the present state of our business will admit."[79]

By the three lecture series the colleges expected to "round out" and systematize knowledge gained in the shop, thus upgrading the safety and competency of pharmaceutical practice and combating the purveyance of adulterated or substandard drugs. They also saw in education a weapon against quackery, which was largely equated with the exploitation of secret remedies. George D. Coggeshall, president of the New York College in 1854, said that quackery "is ever present and ever ready with its temptations, in opposition to the common understanding of right minded men connected with the regular professions of medicine and pharmacy, that discoveries of any means calculated to alleviate human suffering should be made generally known,... while tampering with medicines by ignorant persons, and the manufacture of worthless trash under its [medicine's] name, are grades of depravity with which no compromise should ever be made...We hope better things of our graduates, (though we must confess we are sometimes disappointed,) than that they should degrade their profession and deprave themselves by such prostitution of their talents and position."[80]

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79 - Daniel B. Smith, "Address Delivered by the President, Daniel B. Smith, before the Philadelphia College of Pharmacy...," J. Phila. Coll. Pharm., 1: 257, 1830.

80 - G. D. Coggeshall, "Address Delivered to the Graduates of the College...," Amer. J. Pharm., 26: 203 and 206, 1854.

At the Philadelphia College, that same year, Edward Parrish expressed his convictions that education was "of paramount importance in connection with the advancement of the profession and the suppression of quackery."[81]

To combat what Professor Joseph Carson called "gaunt, lean, hideous charlatanry," Professor Procter--abandoning hope of legal control--concluded that "The only clear course that remains for us, is to enlighten public opinion through the agency of properly educated and skilful pharmaceutists, disseminated through the country, who will take a firm stand in upholding their profession from the polluting influence of empyricism [= quackery], whilst they ennoble it by the cultivation of science."[82]

Of the three subjects taught to gain these ends, most importance was attached to chemistry, by both college administrators and apprentices. At the New York College in the early years, we noted that many apprentices who came to hear the chemistry lectures did not bother to stay for the next hour for the lectures on materia medica and pharmacy.[83] In the early course at St. Louis about twice as many apprentices registered for the lectures in chemistry as for either materia medica or practical pharmacy.[84]

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81 - Edward Parrish, "American Pharmacy," Amer. J. Pharm., 26: 211-17, 1854. See also, Franklin Bache, "Address Delivered Before the Graduates...," Amer. J. Pharm., 7: 97-102, 1835; Joseph Carson, "Address Delivered to the Graduates...," Amer. J. Pharm., 11: 101 f., 1839; and Lewis H. Steiner, "The Pharmacy of Two Hundred Years Ago Compared with the Pharmacy of the Present Day... Valedictory Address...," J. Transac. Md. Coll. Pharm., 1: 102, 115, 1859.

82 - Joseph Carson, "Address to the Graduates...," Amer. J. Pharm., 18: 83, 86 and 92, 1846; and William Procter, Jr., "Introductory Lecture on the Course of Practical Pharmacy," Amer. J. Pharm., 19: 256 f., 1847.

83 - See p. 375.

84 - Edward Kremers, "The Teaching of Pharmacy During the Past Fifty Years," Drugg. Circ., 51: 68, 1907.

Chemistry. Chemistry as the scientific core of American pharmaceutical education gained early dominance. There are several reasons why it hardly could have been otherwise. Of the three basic sciences—physics, chemistry and biology—chemistry was the one most readily and usefully applied to the pharmaceutist's art. Moreover, aspirations in chemistry received an affirmation and stimulus from the tide of popular interest in science and its practical applications that swept through American life during the second quarter of the century.[85] Speaking at the third commencement held by the Maryland College of Pharmacy, the chemist Lewis H. Steiner reflected this influence:

"Why should not the stirring notes which science is sending forth, in all parts of this vast republic, be taken up by the pharmaceutist and be made the sound cheering him on to study, and to victory over nature," he demanded. "Such interrogatories are receiving their proper answer at the hands of the College of Pharmacy..."[86]

When American pharmacy colleges thought of science they thought, mainly, in terms of chemistry not only because it was utilitarian and fashionably fascinating, but because chemistry had dignified, and been dignified by, pharmacists in other lands.

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85 - Dirk J. Struik, Yankee Science in the Making, 202-216; supra, p. .

86 - Lewis H. Steiner, "The Pharmacy of Two Hundred Years Ago Compared with the Pharmacy of the Present Day...," J. and Transac. Md. Coll. Pharm., 1: 102, 1859.

Particularly in France and Germany pharmacists "helped to transform diffuse chemical knowledge into that systematical arrangement of facts which we call science today, by writing the first and best real chemical textbooks." Such men of the 17th and early 18th century were at the same time lecturers, and later on professors of chemistry at the universities.[87]

The cultivation and application of chemistry was likewise reflected in academic courses for the pharmaceutical novice in Europe during the first half of the 19th century, where particular emphasis was placed on analytical chemistry.[88]

Although the men who had grown into the role of apothecary on American soil did not share this scientific tradition, discerning leaders saw the goal and felt that chemistry was the mainstay of the scientific, the ideal, pharmacist.

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87 - George Urdang, Pharmacy's Part in Society (Madison, 1946), 24 f. Among the early pharmacist-authors in France were Nicaise LeFebvre, Christoph Glaser (a Swiss in France), Nicolas Lemery, and in Germany most notably Caspar Neumann. Later outstanding pharmacist-chemists in Germany writing textbooks included men of the caliber of J. P. Spielmann, Ph. L. Geiger and K. G. Hagen.

88 - George Urdang, "Pharmaceutical Education from the Historical Point of View," Amer. J. Pharm. Ed., 6: 57, 1942; Samuel S. Garrigues, "Pharmacy in Germany," Amer. J. Pharm., 25: 404, 1853, and M. Bussy, "On the State of Pharmacy in Germany and Prussia," Amer. J. Pharm., 25: 328 et passim, 1853 (from Journal de Pharmacie); M. Orfila, "Pharmacy in Spain," Amer. J. Pharm., 19: 209, 1847; C. R. B. Barrett, The History of the Society of Apothecaries of London, 197 f.

Speaking to the graduating class of 1837, Daniel B. Smith, president of the Philadelphia College, pointed to the "steady march of improvement which has elevated our profession to the important station it now occupies; and which is mainly due to the ability with which its members, in France and Germany, have cultivated the science of Chemistry."89

American pharmaceutical education, nevertheless, could not move far toward the goal until near the end of the century. Confronting the three students who had successfully completed the evening course of lectures in 1845, George D. Coggeshall of the New York College reflected on the lack of public and governmental support of pharmaceutical standards, as compared with European countries, and observed, "...If we have approached so distantly the standard of other schools in older nations, we may congratulate ourselves on having done much according to our ability."90

Except in the later university schools, a distinction rarely was made between general and pharmaceutical chemistry. The terms seem to be used interchangeably in school catalogs; and with only a single lecture series on chemistry its applications to pharmacy naturally received emphasis.

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89 - Daniel B. Smith, "Address Delivered to the Graduates...," Amer. J. Pharm., 9: 89, 1837.

90 - George D. Coggeshall, "An Address Delivered to the Graduates...," Amer. J. Pharm., 17: 245, 1845.

As we listen to part of an introductory lecture at the Philadelphia College in 1841, Professor W. R. Fisher tells the students what they may expect during this early chemistry course:

"...A knowledge of the elements of General Chemistry is essential, and he who would teach either [of the professional arts] must commence his instruction with the study of these, if he hopes to make the particular division at all intelligible...Without them your Pharmaceutic Chemistry would have none of the characteristics of a science, but would be mere empiricism; a catalogue of crude, unarranged facts...Therefore it is, that you are required to have a knowledge of General Chemistry, its constituents, its laws, its objects...such are the doctrines of Specific Gravity, the laws of Caloric, Light and Electricity, in its different modes of manifestation, and a very brief sketch of the general properties of matter. These all form necessarily a portion of the course, although no more space is assigned to them than can possibly be spared. Of these doctrines, which are purely chemical, we have affinity in its varied phases; the doctrines of equivalent proportions; atomic theory; system and principles of nomenclature; and the use of chemical symbols, becoming daily of greater importance from its almost universal employment...[91]

"The character and relations of the electro-magnetic elements, as well as of those of simple combustibles, occupy necessarily prominent grounds, and after these the metals present important matter for study. Some insight into organic structure is also needed, and in all these especial attention will be paid to those substances, which are most intimately connected with Pharmacy.

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91 - The lecturer emphasized that lack of time would make this portion of the course "much restricted."

"In regard to these, we have to consider the properties of those elements and their compounds, which are employed in medicine, or occupy space in the apothecary shop assigned them by long usage. We are to understand the chemical characters of the compounds, and the manipulations requisite for their production; we are to become familiar with the employment of re-agents, which will put into your possession means of detecting and exposing the fraud of the adulterator, or accidental impunity of the unskilful manipulator; we are to study, as of equal importance in the education of a pharmaceutist, the character of the substances regarded poisonous, and the means requisite to counteract their efforts; and in organic bodies there are certain proximate principles whose properties and relations are intimately connected with Pharmacy."[92]

The New York College in 1859-60 divided the seventy chemistry lectures into four sections: general laws, with "numerous experimental illustrations"; "imponderable forces," including demonstrations with a "powerful galvanic battery"; inorganic chemistry; and organic chemistry.[93]

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92 - W. R. Fisher, "Introductory Lecture Delivered at the College of Pharmacy, November 4, 1841," Amer. J. Pharm., 14: 7-9, 1842. Fisher stressed that discussion in the chemistry course would have to be limited to bodies connected with pharmacy, "however interesting the relation of others may be."

93 - See reproduction of an announcement, Wimmer, The College of Pharmacy, 52. The chemistry course at the Maryland College at this time, closely paralleled the lectures of 1841 outlined by Fisher in the previous paragraphs (see Fifth Annual Circular...1860-61, 5.)

If students learned any physics, it was in connection with the general laws and "imponderable forces" discussed in the chemistry lectures. Still in the 1890's physics was a subject "usually overlooked in our Colleges of Pharmacy."[94] One of the exceptions was the New York College, which offered a separate physics course of ten lectures, for which a syllabus will be found in Appendix D, page 662.

Organic chemistry was demanding more attention late in the century, but except at the university schools it merely claimed a larger share of the general course (usually most of the senior lecture series in chemistry). The remarkable development of chemical science in the last half of the century coupled with the small increase of lecture time frustrated the conscientious teacher.[95] The course undoubtedly became more difficult; some pharmacists objected that there was "too much theory and speculation..." in the instruction. Samuel P. Sadtler, professor of chemistry at the Philadelphia College, offered a spirited defense against the "practical men," believing that " a well-educated pharmacist ought to have not only a thorough acquaintance with the results but some knowledge of the theories of modern organic chemistry...No undue emphasis need be placed upon them [the theories], but they are indispensable in their place."[96]

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94 - H. M. Whelpley, "Synopsis of a Course in Microscopy for Pharmacists," Proc. Amer. Pharm. Assoc., 38: 253, 1890. Even at university schools physics remained an elective except in the optional four-year course.

95 - E. g., see Prospectus of the St. Louis College of Pharmacy, 1897-98, 15.

96 - Samuel P. Sadtler, "Has the Study of Organic Chemistry a Practical Value for Pharmacists?" Amer. J. Pharm., 79: 531, 1879.

A survey of chemistry teaching in ten association schools and the University of Michigan in 1880 showed that five taught only general chemistry without laboratory work, although three of these schools offered optional work in qualitative analysis (at New York also some quantitative analysis). Five other schools required general chemistry and some qualitative analysis (or other elementary laboratory work).[97] One school, the University of Michigan, required general chemistry, quantitative analysis, organic analysis, urinalysis and toxicology.[98]

In the 1880's examination questions show that students were expected, especially, to be familiar with the formulas, properties and uses of compounds used in pharmacy (particularly inorganic), and with the qualitative tests.[99]

After the association schools not only split the lecture term into junior and senior parts but somewhat lengthened the course, most of the second term in chemistry was devoted to analytical and organic material. Beginning in the 1870's chemical laboratories were established,[100] but the amount of laboratory work actually required during the rest of the century seems to have been less impressive than many of the catalogs indicate. The state university schools had both the facilities

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97 - These schools were Maryland, Massachusetts, St. Louis, Cincinnati and National. F. W. Clarke, "A Report on the Teaching of Chemistry and Physics in the United States" in Circular of Information No. 6 (Bureau of Education, 1880), 154-6 and 218 f. The Prospectus of the St. Louis College, however, said that students were "expected" to take the analytical course.

98 - Ibid., and Calendar of the University of Michigan, 1876-77, 81 ff.

99 - "Examination Questions--Cincinnati College of Pharmacy, 1889," Pharm. Era, 3: 234, 1889.

100 - See p. 361 ff.

and outlook for a much more vigorous program. In the 1870's the University of Michigan boasted that "the required laboratory work employs about four hours daily through both years," including three semesters of analytical chemistry.[101] For Edward Kremers at the University of Wisconsin in the 1890's there was never any question about the focus of the curriculum: "The courses in the sciences are naturally to be largely laboratory studies."[102]

First among the association schools to require a course in analytical chemistry was the Maryland College, where the German-born William Simon, who held a Ph. D. from the University of Giessen, became professor of analytical chemistry in 1872.[103] The trustees at the New York College had talked about having laboratory instruction in chemistry, and pharmacy, as early as 1857, but this wish did not materialize for another twenty years.[104] In 1879 the Massachusetts College of Pharmacy announced "Compulsory and Free Laboratory Exercise" of one hour a week in connection with its new chemical laboratory.[105]

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101 - Calendar of the University of Michigan, 1876, 79.

102 - E. Kremers, "The Position of the American Pharmaceutical Association Toward Pharmaceutical Education," Amer. Drugg. and Pharm. Record, 27: 377, 1895.

103 - Vandenbosche, "Historical Notes on Chemistry at the School of Pharmacy, University of Maryland," Amer. J. Pharm. Ed., 4: 46 f., 1940.

104 - Wimmer, The College of Pharmacy, 50, 76 f.; C. F. Chandler, "The College of Pharmacy of the City of New York," Pharm. Era, 16: 860 f., 1896. Catalogs show that laboratory practice was still optional in 1879, although Wimmer seems to imply otherwise.

105 - "Massachusetts College of Pharmacy," Amer. J. Pharm., 51: 220, 1879; F. W. Clarke, loc. cit., 154-6.

There was some question, however, whether the time devoted to such work in most of the schools was sufficient to have any practical value.[106]

Taylor found that in 1887 laboratory work was connected with 20 of 39 chairs of chemistry included in his study (14 offered work in the first year and 14 offered work in the second year).[107]

By 1894 a number of the university schools required, for the entire course, more than 1500 hours of obligatory laboratory instruction, of which a large percentage was in chemistry.[108]

In contrast, an independent school such as the New York College required 44 laboratory sessions during the entire course (1889), equally divided between chemistry and pharmacy. Sixteen of the 22 sessions in chemistry covered qualitative analysis of metals; three sessions were devoted to separation and identification of inorganic acids and one session to organic acids; during the final two sessions the students analyzed unknowns and took examinations.[109]

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106 - F. B. Power, "The Problems of Pharmacy in the United States," Pharm. Rundschau, 3: 121, 1885.

107 - H. L. Taylor, "Schools and Colleges of Pharmacy," Pharm. Era, 45: 262 f., 1912.

108 - "The American Pharmaceutical Schools and Their Facilities, Courses and Requirements in 1893-94," The Apothecary, 3: 170, 1894. For the "Ph. C." the University of Michigan, Northwestern and (?)Vanderbilt claimed more than 1500 laboratory hours; for the "Ph. G." the University of Wisconsin, Purdue University and (?)University of Kansas claimed more than 1500 hours; Northwestern University, 800 hours.

109 - The syllabus of the laboratory exercises appears in Appendix D, p. 662.

The syllabus of the New York curriculum gives us one of the most complete records available on chemistry teaching at an association school in the late 19th century. The junior course in general chemistry consisted of 25 lectures on non-metallic elements. The lecturer gave special attention to common gases, waters, the halogens, sulfur and carbon. In the final two lectures students learned about nomenclature and notation, classification, equivalents and atomic weights, and general laws.

The senior course in general chemistry, another 25 lectures, began with two lectures upon metals as a class, followed by discussion of the individual metals in subsequent lectures, covering in sequence the history, occurrence, preparation, impurities, purification, properties, tests, compounds, functions in nature and uses of the metal in the arts, pharmacy and medicine. Attention centered upon the metals and their compounds appearing in the U. S. Pharmacopoeia.

A third lecture series, for seniors, was devoted entirely to organic chemistry. The first two lectures covered synthesis analysis and types of formulas and reactions; next came two lectures on classification of organic compounds and general discussion of physical constants. During the remainder of the term students heard nine lectures on "fatty compounds" and twelve lectures on "aromatic compounds."[110]

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110 - See syllabus, Appendix D, p. 662.

Most graduates of the independent schools were not accomplished analysts, nor could they talk learnedly of chemical theory. They had gained some understanding of the nature and chemical relationships of substances with which pharmacy dealt; they gained some insight into chemical changes wrought under their hands; and perhaps new respect for accuracy, for the possibilities of their calling, perhaps even for themselves. They had been introduced to science but it must have been the rare and ambitious graduate who felt well acquainted.

Materia Medica and Its Offspring. If in chemistry the student got some glimpse of nature's unifying "laws" and a sense of system, in materia medica he met a mixed mass of information that "embraced everything relating to remedies used in the treatment or prevention of disease."[111]

Since it was assumed that the novice of pharmacy learned his art best in the apprenticeship, and because of the limited instruction time available, pharmacy as academic instruction became part of the catch-all course called materia medica. After the pioneer period of the schools, and pharmacist-teachers emerged, pharmacy split off as a separate subject.

With pharmacy as a special branch and chemistry strongly oriented toward pharmaceutical chemistry, the materia medica course centered more and more about the study of plant and animal drugs--

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111 - J. Hampton Hoch, "A Survey of the Development of Materia Medica in American Schools and Colleges of Pharmacy from 1821 to 1900," Amer. J. Pharm. Ed., 12: 149, 1948.

although the subject traditionally embraces drugs of whatever kind. Within its comprehensive scope lay embryonic fragments of specialized studies that emerged in the latter part of the century as pharmacognosy, pharmacology, physiology and toxicology.

The course focussed particularly on the physical and therapeutic properties of drugs, and adulterants that might be encountered. At the Maryland College in 1860 the materia medica lectures considered the animal and vegetable drugs that were designated "officinal by the United States Pharmacopoeia, also those which constitute part of the stock of every complete shop." The botanical characteristics were to be exhibited "either by specimens or by accurately colored illustrations." Moreover, "The microscope will be employed throughout the course, whenever available, to demonstrate..."[112]

One reason that pharmaceutical botany did not receive more stress in the early courses appears to have been the gap between the educational level of apprentices and the level of available texts.[113] A reviewer of Royle's Manual complained in the American Journal of Pharmacy that "If we take up a Dispensary, or work like the present, and turn to the account of vegetable substances, a large portion will be found devoted to the description of plants from which they are derived, in language

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112 - Fifth Annual Circular and Catalogue of Matriculants, Maryland College of Pharmacy, 1860-61, 5 f. The course at Philadelphia was also devoted entirely to vegetable and animal drugs, introduced by two lectures on structural botany. ("Lectures in the Philadelphia College of Pharmacy... 1851-52" (adv.), Amer. J. Pharm., 23: 196, 1851.)

113 - See "Review. A Manual of Materia Medica and Therapeutics... by Forbes Royle...," Amer. J. Pharm., 18: 263 f., 1846.

strictly technical. To one unacquainted with the key, which is a comprehension of the botanical alphabet, or in other words the elementary principles of the branch, this portion of the very textbooks of Materia Medica must remain sealed, a dead letter..."[114]

This explains the wide popularity of Gray's First Lessons later on as a text. Lecturers tried to make up part of the deficient background of apprentices by treating botany in introductory lectures of the materia medica course. William Procter said in 1856 that "None of the American Schools of Pharmacy have regular courses on botany, as far as we know, yet the rudiments are generally explained by the teachers of materia medica." He felt that "apothecaries would be the gainers by encouraging their apprentices to cultivate a taste for this science..."[115] As early as 1852 the Philadelphia College went further by offering a preliminary course on medical botany which "will prove extremely useful to students who have not given their attention to this branch of science before entering the school."[116] Although the New York College gave early attention to botany, only a few students attended the special course offered in 1848. In 1849 half the usual course in materia medica was devoted entirely to botany.[117]

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114 - "Review. A Manual of Materia Medica and Therapeutics...by Forbes Royle...," Amer. J. Pharm., 18: 264, 1846.

115 - William Procter, Jr., et al. Report of the Committee on Textbooks , Amer. J. Pharm., 28: 493, 1856.

116 - "Philadelphia College of Pharmacy" (Ed. Dept.), Amer. J. Pharm., 24: 292, 1852.

117 - Wimmer, The College of Pharmacy, 47; cf. Hoch, "A Survey of the Development of Materia Medica...," Amer. J. Pharm. Ed., 12: 150, 1948.

Although chemistry took first place, some pharmacists as well as teachers deplored the general neglect of pharmaceutical botany.[118] Agitation found response in the increased emphasis on the subject in the 1860's, signalized by a dual chair of Materia Medica and Botany in several schools.[119]

The St. Louis College of Pharmacy appears to have been the first, in 1865, to establish a separate chair in botany.[120] The editor of the American Journal of Pharmacy nodded encouragement, pointing out that "The greater tendency to the use of vegetable remedies in the West, and the great variety of valuable indigenous plants that are found all over the country, render this Chair especially important."[121]

And it was in the West that three other separate appointments in botany were made between 1871 and 1873: Cincinnati, Chicago and San Francisco.[122]

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118 - "Botany in Its Relations to Pharmaceutists" (letter to the editor), Amer. J. Pharm., 25: 210, 1853.

119 - Chicago, 1859; Philadelphia, 1867; Massachusetts, 1867; New York, 1870; Cincinnati, 1872; Louisville, 1872; Maryland, 1873 (Hoch, "A Survey of the Development of Materia Medica...," Amer. J. Pharm. Ed.,12: 150, 1948; C. Schmidt, The Maryland College of Pharmacy, 11.

120 - "St. Louis College of Pharmacy," Amer. J. Pharm., 37: 234, 1865.

121 - Ibid., 316.

122 - Hoch, loc. cit., 150.

The New York College was struggling at this time to put botany on a firmer footing, but found weak support. In the spring of 1867 John M. Maisch, then in New York, offered a gratuitous course in systematic botany with excursions into the surrounding countryside, but only 18 students from the winter's class of about 160 participated. The editor of the American Journal of Pharmacy thought this was "partly caused by the impossibility of the young men to be absent from the business during an afternoon; but we feel convinced that a spirit of greater liberality would prevail among the employers if they fully understood the importance of botany to the practical pharmacist, and if the young men themselves fully realized the advantages which may be derived from a familiarity with this discipline."[123]

The next year the editor was "pleased to observe that several courses of lectures on botany have been announced; but he was still puzzled that "this science, so important to the pharmaceutist, should be so difficult to engraft on his attention... it is to be hoped that ere long botany will become as much a part of the curriculum as chemistry."[124]

During the last quarter of the century the fragmentation of the old materia medica continued, giving rise to several specialized subjects that gained increased importance and time in pharmaceutical curricula after 1900.

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123 - "Summer Courses" (Ed. Dept.), Amer. J. Pharm., 39: 376, 1867.

124 - [W. Procter, Jr.], "Botany in Its Bearings on Pharmacy.—Botanical Gardens," Amer. J. Pharm., 40: 228, 1868.

Microscopical botany entered pharmaceutical education at the University of Michigan as an optional course in 1875, which became compulsory after the first year. The instructor, M. W. Harrington, issued a pamphlet on the Identification and Microscopic Examination of Crude Drugs and Other Vegetable Products, which represented a departure from standard texts by systematizing the course according to the organological, physical and structural characteristics of the drugs. Up to that time most texts on medical botany and materia medica followed either a botanical or alphabetic arrangement, those for medical students sometimes following a therapeutic or physiologic classification.[125]

In the 1880's several association schools began to offer optional laboratory work in microscopy, and in 1886 the New York College made a botanical laboratory course compulsory.[126]

The laboratory work at New York, however, appears to have been only a supplement to and part of the botany course of 25 lectures for juniors. During the first six lectures flowers were dissected. The seventh to twenty-first lectures were mainly on structure and classification, with the last four periods devoted to "practical analysis."[127]

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125 - Hoch, "A Survey of the Development of Materia Medica...," Amer. J. Pharm. Ed., 12: 152, 1948;

126 - Ibid., 155. Optional microscopy was launched at the Philadelphia College in 1882, Chicago College in 1884, St. Louis in 1885 and Maryland in 1887.

127 - See 1889 syllabus, Appendix D, p. 669.

Hoch says, "The close liaison between microscopic botany and pharmacognosy led to general appelations such as materia medica, microscopy, and pharmacognosy being applied to essentially similar courses in different colleges. The University of Michigan and the New York College were the first to use the title 'pharmacognosy' in their chairs."[128] At New York Joseph Schrenk had been designated Professor of Botany and Pharmacognosy in 1885-86.[129,130]

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128 - Hoch, "A Survey of the Development of Materia Medica,..," Amer. J. Pharm. Ed., 12: 155, 1948.

129, 130 - The term pharmacognosy was introduced in the United States in 1887 when Frederick B. Power published his translation of the Grundlagen der Pharmacognosie by F. A. Fluckiger and A. Tschirch (Berlin, 1885), under the title Principles of Pharmacognosy (New York, 1887). See George Urdang, "The Golden Eggs," Scientific Monthly, 40: 162, 1945.

Students at New York studied pharmacognosy as a separate course in both years. The junior course consisted of six lectures upon the microscope and its use, cell structure, vegetable secretions, and the preparation of specimens. The senior course consisted of twelve lectures, including laboratory exercides. The first three lectures dealth with morphology; the remainder of the course covered the most important individual drugs, as many being "remarked upon and examined as time will permit." The lecture material included "name and classification, geographical distribution, physical characteristics, morphology and anatomy, constituents, substitutions, and, occasionally, historical data." The students were "assisted, throughout the course, in preparing their own specimens for microscopical examination."[131]

These twelve lecture-laboratory sessions in pharmacognosy ran concurrently with the senior course in materia medica. Systematized on the basis of the botanical orders, this course consisted of 25 lectures on vegetable drugs, except for two lectures on animal drugs and two general introductory lectures.[132]

Only New York had a separate chair in pharmacognosy, although the subject appeared in the title of a joint chair at two other schools.[133]

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131 - For further detail, see 1889 syllabus, Appendix D, p. 680.

132 - See Appendix D, p. 671.

133 - Edward Kremers, "Notes on Pharmaceutical Education: The Study of Materia Medica," Proc. Amer. Pharm. Assoc., 40: 310, 1892; see also p. 542 infra, notes 7 and 8.

An early recognition of toxicology came at the University of Michigan in 1869, when special laboratory work was offered. Optional lectures in toxicology were given at the Maryland College as early as 1871, becoming obligatory a decade later. Philadelphia followed Maryland in inaugurating optional lectures (1872). Joint chairs of materia medica and toxicology were set up at Chicago in 1872 and Cincinnati in 1884;[134] and at three other schools by 1887 toxicology appeared in a joint title with chemistry.[135]

In the last decade of the century physiology gained in importance as a foundation for the study of the action of drugs and for the study of toxicology. In 1887 physiology appeared as part of a joint chair at two schools,[136] and the trend toward further specialization of instruction was reflected later in the "addition of physiology to other chairs at the Kansas, Michigan, and New York colleges."[137]

Signalizing the "final fragmentation of the old general materia medica," Michigan offered a laboratory course in experimental pharmacology before the end of the century, and laboratory work in bacteriology was introduced at Michigan, Minnesota, Purdue and Wisconsin.[138]

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134 - Hooh, "A Survey of the Development of Materia Medica...," Amer. J. Pharm. Ed., 12: 153, 155, 1948.

135 - H. L. Taylor, "Schools and Colleges of Pharmacy," Pharm. Era, 45: 262 f., 1912.

136 - Ibid., 262 f.

137 - Hooh, loc. cit., 160.

138 - Ibid.

Materia medica as a field of pharmaceutical study was in flux, course content was changing, titles shifting, new courses splitting off. The relative emphasis now placed on various segments of the field varied widely among the schools, probably depending largely, as Hoch concluded, upon the background and education of the instructor—the botanist, the physician, and the pharmacist each viewing instruction from a different angle of vision.[139]

In the early 1890's, according to Hallberg's Pharmacal Calendar, among 35 schools of pharmacy:[140]

11 had combined chairs of Botany and Materia Medica
7 had separate chairs for Materia Medica
3 had combined chairs of Pharmacy and Materia Medica
2 had combined chairs of Materia Medica and Therapeutics
2 had combined chairs of Materia Medica and Toxicology
1 had combined chairs of Materia Medica and Pharmacognosy
1 had separate chairs for Materia Medica and Pharmacognosy
1 had a chair of Physiology, Botany, Pharmacology and Materia Medica

In at least eight schools a separate chair had been established for botany, alone or with microscopy.[141] Originally neglected amost entirely, botanical subjects now were gaining a prominent place, although there was the greatest variety in the amount and kind of instruction offered under this heading.

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139 - Hoch, "A Survey of the Development of Materia Medica,..," Amer. J. Pharm. Ed., 12: 160, 1948.

140 - As quoted by Kremers, "Notes on Pharmaceutical Education: The Study of Materia Medica," Proc. Amer. Pharm. Assoc., 40: 310, 1892.

141 - Taylor, "Schools and Colleges of Pharmacy," Pharm. Era, 45: 262 f., 1912.

The old pattern of materia medica had broken up without a definite decision as yet on what the new pattern should be. Development of related sciences asked for a new level of instruction, but without a major extension of the length or number of courses it was difficult for independent schools to replace the old cataloguing and memorization with really scientific instruction in this field.

Memorization rather than systematized understanding apparently had been the student's main task, and it became a matter of some concern at teachers' meetings. Remington felt that rote memorization was "the bane of education, and yet there seems to be little relief from it in our methods of education."[142]

Pharmacy. The study of pharmaceutical chemistry and of materia medica (including pharmaceutical botany and the actions, uses and doses of drugs) seemed to provide the essentials of pharmaceutical education, except for pharmacy as a practical art. That art, as repeatedly noted, was to be learned best where it was practiced: in the shop. Hence, of the standard trio of 19th-century studies pharmacy at first held a subsidiary position in the schools.

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142 - Joseph P. Remington in Proc. Amer. Pharm. Assoc., 36: 184, 1888.

As an appendage to materia medica, pharmacy sometimes seemed to detract from doing justice to a very broad subject, and therefore might be "limited to a cursory notice of the more prominent preparations of drugs, introduced as occasion offers in the course of [materia medica] lectures."[143] Where a pharmaceutical course was given within a medical school, instruction in pharmacy might be omitted altogether.[144]

Since physicians usually taught materia medica in schools of pharmacy, the stress on therapeutics and posology often was even heavier than the members of the early Colleges had intended. The cursory instruction in pharmacy seemed less tenable with the growing recognition that the apprenticeship as a teaching device fell short of what the system represented as a traditional ideal.

Thus, in 1846, the Philadelphia College separated pharmacy from the materia medica course as a discipline where "the most recent and approved methods of manipulation were [to be] taught, and the best kinds of apparatus exhibited; and if these were followed by a thorough and detailed application of them in the preparation of medicines, in many instances repeating the operations before the class, and in all cases exhibiting the preparation in its most perfect condition, that the student would be able to correct the knowledge derived at home..."[145]

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143 - "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 18: 150 f., 1846.

144 - S. E. Chaillé, dean of Tulane University Medical Department, letter of November 9, 1906, to Edward Kremers (in Kremers Reference Collection).

145 - "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 18: 150 f., 1846.

While, for example, the professor of chemistry would explain "the theory of Caloric and the laws which govern its influence on matter in the abstract," a professor of pharmacy would "show when its [Caloric's] influence is required in acting on matter destined for medicinal use, how it is best applied in effecting the modifications desired, and what the means and instruments are by which its power is controlled and directed to the end in view."[146]

In William Procter, Jr., the Philadelphia College found the man who could not only fill this role, but would strongly influence the teaching of pharmacy in other schools.

The New York College followed Philadelphia in creating a separate chair in pharmacy in 1864, and thereafter pharmacy rarely took a subordinate position in American curricula.

The teachers of pharmacy, in the United States, worked on a new frontier; and there were divergent views on how it should be taught. Some teachers blocked out the course in units representing the different forms of administration, such as extracts, tinctures and pills. Others found it simple and logical to begin at the beginning of the Pharmacopoeia and follow a straight course from the A's to the Z's. Teachers of a more scientific turn of mind might systematize the course based on botanical or chemical relationships of the simple drugs, bringing the preparations of each drug together for joint consideration.[147]

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146 - "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 18: 150 f., 1846.

147 - William Procter, Jr., "Can Practical Pharmacy Be Taught Effectively by Lectures?" Amer. J. Pharm., 43: 98, 1871.

A variant of the last-mentioned teaching method that Procter felt "appeals most forcibly to the reflective mind, is that of groups based on the similarity of active principles, the preparations of each drug being together...Before speaking of the preparations of a drug, its proximate constitution should always be stated...and with regard to active principles the precautions necessary to insure their solution or to avoid their injury."[148]

Under this system the tannin-containing drugs are considered together, as would be the drugs yielding volatile oils, the starches, or resins. In the part of the course dealing with "drugs and preparations derived from the Mineral Kingdom" a chemical classification was used, the preparations and compounds of each element being considered together, acids and alkalies used medicinally being studied in separate groups, and so on.

Procter followed this plan in his teaching at the Philadelphia College and recommended it in his influential "Syllabus of a Course of Study" in 1858.[149] The scheme became a pattern for other teachers, who had the time and talent to break with the A-to-Z method, and was still much alive in the minds of teachers in the 1890's and a topic for discussion.[150]

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148 - William Procter, Jr., "Can Practical Pharmacy Be Taught Effectively by Lectures?" Amer. J. Pharm., 43: 98, 1871.

149 - William Procter, Jr., "Syllabus of a Course of Study...," Proc. Amer. Pharm. Assoc., 7: 134, 162 ff., 1858.

150 - Proc. Amer. Pharm. Assoc., 40: 322, 1892.

Procter's course arrangement followed the one used at the School of Pharmacy of Paris, as elaborated by Eugène Soubeiran,[151] to whom Procter gave full credit. The scheme had been modified, however, to make it "better adapted to the American pharmaceutist."[152]

Students in Procter's class of 1847 heard him outline the information he expected to impart: "The ground work of practical pharmacy is expert manipulation; hence the first object in this department is an acquaintance with the elementary operations required by the apothecary. These comprehend the processes and instruments used in effecting the mechanical division of drugs; the separation of solids from fluids; the solution of solids in liquids; the extraction of the solution from the insoluble ingredients of a compound; the evaporation of fluids and the recovery of solids from their solutions by evaporation; the distillation of liquids and the precipitation, fusion, sublimation, etc. etc. of substances. Weights and measures, specific gravity and a nice appreciation of quantities in general, are important features, and are constantly recurred to.

"The relations that vegetable drugs bear to the different menstrua, and the nature of the matter they cede to these liquids, together with the influences that light, heat, and air exercise on the solutions, by age or evaporation, constitutes one of the chief branches of the subject, including the preparation and characteristics of infusions, decoctions, tinctures, wines, syrups, extracts, etc..."[153]

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151 - French apothecary and teacher (1797-1858), author of two textbooks on pharmacy and one of the first to prepare and rather correctly identify chloroform (1831).

152 - Procter, "Syllabus of a Course of Study...," Proc. Amer. Pharm. Assoc., 7: 134, 1858.

153 - William Procter, Jr., "Introductory Lecture on the Course of Practical Pharmacy," Amer. J. Pharm., 19: 246 f., 1847.

A description of the pharmaceutical part of the course on materia medica and pharmacy at New York in 1859 shows a somewhat different orientation, with special emphasis on detecting adulteration. The prospective student read in an advertising circular that "This portion of the Course will treat of the various operations required in the preparation of medicines, illustrated by the most approved models, diagrams and apparatus. It will include, not only the preparations made by the Pharmaceutist himself, but a description of those produced on a large scale, for the purposes of commerce. Each class of preparations, as Tinctures, Extracts, Plasters, etc., will receive a full notice in its proper order. Specimens of adulterated drugs and chemicals will be exhibited, and tests for their detection pointed out. Experiments illustrative of the proximate organic principles, and modes of their detection, with the difference between genuine and spurious articles will be introduced whenever deemed interesting or important."[154]

At New York thirty years later the junior course in pharmacy dealt mainly with metrology and manipulative processes. The seniors studied inorganic pharmaceutical chemicals in the first part of the course, their sources, manufacture, quality, tests, uses and posology, with special emphasis upon pharmacopoeial products. The second part of the senior lecture series covered organic pharmaceutical preparations in groups, such as plant exudations, sugars, volatile oils, alkaloids, and animal drugs.[155]

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154 - From a reproduction of 1859-60 announcement in Wimmer, The College of Pharmacy, 52. A similar course was given at the Maryland College at this time, perhaps with more stress upon manipulations and processes, less on adulterations. (Fifth Annual Circular and Catalogue of Matriculants, Maryland College of Pharmacy, 1860-61, 6.)

155 - For sample examination questions for seniors in 1889 see "Examination Questions---Cincinnati College of Pharmacy, 1889," Pharm. Era, 3: 234-6, 1889. Students were asked, e.g., to write prescriptions illustrating types of incompatibilities; name official preparations obtained by various processes, explain why precautions were necessary in preparing certain compounds.

In addition the seniors, in 1889, were required to attend 22 laboratory sessions at which they practiced the various pharmaceutical processes (e.g., distillation, granulation), the preparation of forms of medication (e.g., infusions, pills), the exhaustion of drugs, volumetric analysis, water analysis, urine analysis, milk and butter analysis, proximate organic analysis, and the detection of adulterations.[156]

By this time at least half of the other schools of pharmacy probably offered laboratory work in pharmacy. Taylor found that among 25 chairs of pharmacy in 1887 thirteen had connected with them some form of laboratory instruction (ten in the junior year; eight in the senior year).[157]

These courses had all developed during the past seventeen years. Before the pharmaceutical laboratory opened at the Philadelphia College in 1870,[158] didactic and laboratory instruction in pharmacy nowhere had been fruitfully joined in American schools.

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156 - For more detail, see Appendix D, p.678. The laboratory was "open" three hours a day, although the Prospectus does not state specifically how much time students were required to spend there. Students were told that "The amount of work done in this department will depend upon the skill and application of the student; but it is expected that each one will cover practically all the ground embraced in the above examples..."

157 - H. L. Taylor, "Schools and Colleges of Pharmacy,II" Pharm. Era, 45: 262 f., 1912.

158 - See p.361 on the establishment of laboratories at Philadelphia and other colleges.

The earlier and unusual private "School of Practical Pharmacy" operated by the pharmacist Edward Parrish,[159] catered primarily to medical students. When the School opened (1849) at least a segment of American medicine recognized the possibility that an educated physician expecting to compound his own drugs might advantageously study under a qualified apothecary.[160]

Medical students heard 26 lectures by Parrish and had 23 practical lessons in the pharmaceutical laboratory at his shop during a period of 13 to 15 weeks. An abbreviated course seemed necessary, Parrish said, because the time of medical students was very limited and their "needs only extend to such a presentation of the subject as will prepare them for their dispensing office." The drugs students compounded were either "utilized in our business or bestowed upon charitable institutions..."

Parrish recommended the establishment of a laboratory school to other pharmacists "as a field of enterprise which can hardly fail to yield ample returns to the teacher as well as to the pupils," but few if any pharmacists followed his lead.[161]

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159 - See p. 362.

160 - F. C. Stewart, "Report," Transac. Amer. Med. Assoc., 2: 351, 1849.

161 - Edward Parrish, "A Systematic Course of Study and Manipulation for Students of Pharmacy," Proc. Amer. Pharm. Assoc., 12: 276-78, 1864. Parrish states that An Introduction to Practical Pharmacy, which became popular as a textbook in schools of pharmacy, was prepared originally for use in his course for medical students.

The fact that Parrish taught pharmaceutical technique to "nearly five hundred students" in fifteen years seems to indicate that his instruction supplied a need felt by medical students.[162] This was a larger number of students than graduated from the Philadelphia College of Pharmacy in the four decades before the Civil War. Among Parrish's students before 1859 were "some strictly pharmaceutical students" but the number must have been small.[163]

In 1859, however, a "practical department" opened at Parrish's "school" for the benefit of "pharmaceutists and physicians." Advertising now mentioned the pharmaceutist first, but it is uncertain how many such students appeared.[164]

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162 - Edward Parrish, "A Systematic Course...," Amer. J. Pharm., 12: 275, 1864.

163 - Proc. Amer. Pharm. Assoc., 7: 88, 1858.

164 - See the reproduction of an advertising leaflet in M. I. Wilbert, "John Michael Maisch, An Ideal Pharmacist," Amer. J. Pharm., 75: 357, 1903. For a discussion of the function and purpose of Parrish's school before 1859, see "Announcement and Catalogue of Edward Parrish's School of Practical Pharmacy for Medical Students...", Amer. J. Pharm., 25: 373, 1853. It is noteworthy that the editor of the American Journal of Pharmacy did not hesitate to "cheerfully recommend this useful private institution to the attention of medical students..."

Besides the previous instruction in practical pharmacy, students could now study practical and analytical chemistry, the proximate analysis of "crude vegetable bodies," and for advanced students it was expected that a course in toxicological analysis would be opened.[165]

This ambitious project was placed under the direction of John M. Maisch, able pharmacist and German political refugee. Only two years later we find Maisch in the chair of materia medica at the New York College, and it is uncertain to what extent Parrish's plans materialized.[166]

Parrish's laboratory offers a rough American counterpart of the European laboratories in apothecary shops, where eminent pharmacists taught pharmacy and chemistry—some of them continuing this practice even after being taken into a university faculty. Urdang states that "The Apothecary laboratories were, especially in Germany, undoubtedly the precursors of the later university laboratories."[167]

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165 - M. I. Wilbert, "John Michael Maisch, An Ideal Pharmacist," Amer. J. Pharm., 75: 357, 1903; see also "Maisch's School of Practical Chemistry and Pharmacy," Amer. J. Pharm., 32: 285, 1860. The editor now recommended the school to "Pharmaceutists desirous of perfecting themselves in the practice of the more difficult processes of their art, and medical students who wish to acquaint themselves with the elements of pharmacy, in view of a country practice..."

166 - England, The First Century, 405. There is room for a separate, more thorough, historical investigation of this early laboratory school in pharmacy.

167 - George Urdang, Pharmacy's Part in Society, 26.

The more extended program offered under the direction of Maisch likewise recalls the European schools in applied chemistry for students of chemistry and pharmacy, such as that of Justus Liebig at Giessen. There too was the example and model for the Pharmaceutical Society of Great Britain when in 1844 it opened the first laboratory in England for instruction of pharmacy students.[168]

It was not only in pharmacy that the first laboratory teaching started outside of the regular schools.[169] And up to the time John Maisch launched the program mentioned above, there were only about a half dozen chemical laboratories in the United States giving real instruction.

The same John Maisch was in charge when the Alumni Association opened its practical laboratory at the Philadelphia College in October, 1870. Work had been delayed, and the laboratory lay bare of apparatus and chemicals when the lecture season opened; but yet that year "eight young men took the course on Practical Pharmacy and seventeen that on Analytical Chemistry." Their work included such exercises as drying and powdering drugs, percolation, distillation, rolling pills and preparing pharmaceutical chemicals.[170]

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168 - Jacob Bell and Theophilus Redwood, Historical Sketch of the Progress of Pharmacy in Great Britain, 167, 175 and 307.

169 - H. S. Van Klooster, "The Beginnings of Laboratory Instruction in Chemistry in the U. S. A.," Chymia, vol. 2 (Philadelphia, 1949), 7-11; Struik, Yankee Science in the Making, 191 and 340.

170 - "The Practical School at the Philadelphia College of Pharmacy," Amer. J. Pharm., 43; 186, 1871.

The next year Procter wrote in the American Journal of Pharmacy about the new instruction: "All will agree," he said, "that no amount of tuition by lectures will be equivalent to that which the earnest student receives in the dispensing shop and practical laboratory, under the personal instruction of a well-qualified pharmaceutist, who takes an interest in his pupil; yet such opportunities are rare."[171]

The outlook for laboratory instruction in college schools, generally, did not seem very bright, which the Journal attributed to "a difficulty on the part of those engaged in pharmaceutical pursuits to get the time and means; and unless made obligatory, as a condition of graduation and consequently of apprenticeship, there seems no way of securing these branches a place in the curriculum."[172] For schools that could not have laboratory instruction, Procter urged the greatest possible use of demonstrations and other visual aids.[173]

Except at the University of Michigan, which offered practical instruction in pharmacy from 1868, the development in this field awaited the 1880's.

Work in the pharmacy laboratory at New York became obligatory in 1883-84, although Wimmer states that "the actual time that the student was to spend there was left to his convenience."[174] At first attendance on at least 13 days was expected, although by 1889 this had been advanced to 22 days, as

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171 - William Procter, Jr., "Can Practical Pharmacy Be Taught Effectively by Lectures?" Amer. J. Pharm., 43: 97, 1871.

172 - "Editorial Department," Amer. J. Pharm., 42: 377 f., 1870.

173 - Procter, loc. cit., 98.

174 - Wimmer, The College of Pharmacy, 77.

noted in the description of the laboratory course on page 678. In 1884-85 the Maryland College opened an elective laboratory course in pharmacy, which became obligatory in 1886, requiring two afternoons a week for two months. At the Massachusetts College an elective laboratory course introduced in 1886-87 was required from 1888-89 on.[175] In the late 1880's dispensing pharmacy became a more prominent part of the regular laboratory work, and in a few schools was taught separately.[176] By the 1890's some laboratory work in pharmacy had become obligatory in most schools.[177]

While laboratory instruction in the art and in the sciences underpinning pharmacy had become established, it did not sweep through education with the pervasiveness and vigor that it did in medicine. More noteworthy for medicine, in the 1880's, than the lengthening of the course or the perfection of the clinic, said Wellford Addis, writing for the Bureau of Education, was "the introduction of laboratory work in chemistry, physiology, and especially in normal and pathological histology, or, more generally, biology. Perhaps the introduction of laboratory work," he continued, "has played a great part in lengthening the course of medical

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175 - C. O. Lee, "The First Courses in Pharmacy," Amer. J. Pharm. Ed., 4: 56 and 58, 1940.

176 - Oscar Oldberg, "The Dispensing Laboratory," The Apothecary, 3: 74-77, 1893.

177 - "Colleges of Pharmacy of the United States," Western Druggist, 15: 55 ("extra"), 1893.

instruction, as it certainly has given it status as a course in science."178

In one corner of the educational system of pharmacy the development of the four-year curriculum brought a dignity "as a course in science" analogous to that which Addis observed enveloping medical education over a much wider area. These optional courses of the late 1890's opened new opportunities for a few students, laid the foundation for pharmaceutical education of the present century, and opened a new vista of what was possible (if not even desirable) in pharmaceutical education. At the same time such a program lay so far beyond the problems with which independent schools were grappling at the close of the century that it could hardly provide even the stimulus of a future goal.

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178 - Wellford Addis, "Curricula of Professional Schools" in Report of the Commissioner of Education for 1889-90, vol. 2, 890 f. As early as 1849 the American Medical Association had called for reform by the positive requirement of laboratory methods, but conditions were then too similar to those that persisted in pharmacy. There was only a weak response, mainly by making practical anatomy obligatory, which had previously been optional in even some of the better medical schools. (Transac. Amer. Med. Assoc., 2: 284 ff., 1849; Pharm. Review, 21: 360, 1903.

Thesis. In pharmacy, as in medicine, the writing of a thesis or "inaugural essay" ranked with the apprenticeship and the twice-repeated lecture courses as a traditional requirement for graduation. These essays ranged from feeble literary efforts to quite substantial reports of experimental work.

From almost the beginning of regular publication of the American Journal of Pharmacy (1828) the Philadelphia College proudly published quite a number of the theses of its graduates, and occasionally one produced at another college. While only the better theses were selected for publication,[179] the output was rather remarkable for the range and level of work in view of the lack of admission standards, limited instruction and absence of school laboratories.[180]

During the 1830's the theses of half the graduates of the Philadelphia College appeared in print (complete or condensed), of whom a large majority reported the qualitative proximate analysis of vegetable drugs. Although inorganic chemistry had advanced much farther and took first place in the chemistry lectures, vegetable chemistry must have seemed the exciting frontier.

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179 - "Editoriell. Oratio pro domo," Pharm. Rundschau, 1: 159, 1883.

180 - Naturally considerable help and guidance would be forthcoming from the faculty. (Hugo Blauch of the Pittsburgh College, letter of August 25, 1884, to P. S. Hayes, in Kremers Reference Collection.) The competency of presentation also probably was enhanced as the theses passed through the hands of the editor for condensation and editing; present impressions are based on the printed versions.

In 1838 a student, reporting that the indigenous Veratrum viride contained the same alkaloid as the European Veratrum album, felt that he was participating in "a new era in chemical research; and pharmacy has received an impetus from their introduction [i.e., the proximate principles], which has hardly been equalled at any period of its history."[181]

While the purification and identification of "proximate principles" was no easy task--and had only well begun in Europe--such substances could be extracted and crudely separated without much difficulty by solvents and other relatively simple methods, and the "active principles" inferred or demonstrated.[182] Pharmacy students sometimes [illegible] tested the effects of supposed active principles upon themselves, or obtained a clinical trial through the cooperation of one or two "medical gentlemen."

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181 - Henry W. Worthington, "On Veratrum Viride with Experimental Facts to Serve as a Chemical History of the Root of this Plant," Amer. J. Pharm., 10: 89, 1838. Thus the vivid emulation of German and French pharmacist-chemists in alkaloid chemistry, based on the discovery of the basic nature of these plant ingredients by the German apothecary F. W. A. Sertürner (1783-1841), found expression on American soil, the main inspiration coming from France. There the apothecary Vauquelin (1763-1829), together with the physician-chemist Fourcroy (1755-1809) had played prominent roles in the pioneer work with "proximate principles," and in the next generation the teaching of botanical pharmacy was organized around these substances by Soubeiran (1797-1858), whose system found an ardent American advocate in William Procter, Jr. (see p. 436 f.).

182 - Rusby stated that in the 1850's "almost any proximate principle, usually very impure," was called an alkaloid by eager experimenters. (H. H. Rusby, "Fifty Years of Materia Medica," Drugg. Circ., 51: 33, 1907.)

Thesis topics assigned or chosen placed heavy emphasis upon the indigenous materia medica, which may well have received an impetus from the botanico-medical movement of the second quarter of the century. Between 1828 and 1830 C. S. Rafinesque published his Medical Flora; or Manual of Medical Botany of the United States of North America, and sectarian medical practitioners gave new importance to indigenous plants of assumed medical virtue.

In 1854 Professor Robert P. Thomas wrote: "For many years past it has been the constant aim of the Professors in the Philadelphia College of Pharmacy to persuade the candidates for graduation to select as subjects for their theses, either articles of a chemical nature, or else those calculated to develope and bring into more general notice our indigenous medical plants. Of the success of these efforts, the pages of this Journal have afforded convincing proofs. It is true that, in many instances, the published analyses will not bear a strict comparison with the splendid results obtained in European laboratories from analogous subjects, yet, bearing in mind the difficulties under which the American Student of Pharmacy labors, there is much reason for being gratified with what has already been accomplished in the analytical study of our native plants."183

One of the most obvious differences at this time from the papers on vegetable chemistry coming out of Europe was that American pharmacy students rarely attempted quantitative work. From what we have learned of early pharmaceutical education, it might be unexpected that there was any at all.

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183 - "R. P. T." [Thomas] "On Gillenia Trifoliata—American Ipecacuanha," Amer. J. Pharm., 26: 490, 1854.

The first published attempt at quantitative proximate analysis appeared in 1843, when Edward Donelly presented his findings on Phytolacca decandra, the common "Poke Root" of the countryside; in the previous literature he had not "met with any analysis of the root of this plant."[184] The report of Benjamin R. Smith on Diospyros Virginiana (persimmons) three years later appears to be the first published student work to quantify the variation in proximate composition of a botanical drug harvested in different stages of development.

The question naturally arises, where did students conduct their experiments, since the school offered no facilities? We have no extensive evidence. Occasionally a student acknowledges the help of a preceptor;[185] and no doubt the shop actually served most frequently as the student's laboratory, especially for pharmaceutical problems. Probably the professors at least sometimes took students into their private laboratories, or into a better equipped institution with which they often were also affiliated. Students rarely acknowledged either the source of their topic or the site of their work. We do know that the best student thesis published before 1870 had its origin in a private teaching laboratory. T. Roberts Baker, the first American pharmacy student to publish a quantitative ultimate analysis, did his work with J. C. Booth in Philadelphia, who had one of the earliest

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184 - Edward Donelly, "On Phytolacca Decandra," Amer. J. Pharm., 15: 165-70, 1843.

185 - E. G., Oliver G. Sherman (an apprentice of Benjamin J. Crew), "On the Preparation of Collodion," Amer. J. Pharm., 30: 212-216, 1858; and Edward R. Fell (apprenticed at Bullock and Crenshaw), "On Formic Acid," Amer. J. Pharm., 30: 218-21, 1858.

commercial analytical laboratories in the United States (1835) offering competent practical instruction to private students.[186] The only other student before 1870 who acknowledged doing his work in a private teaching laboratory was Ferris Bringhurst, scion of a prosperous pharmaceutical family of Wilmington, Delaware. His quantitative study, one of the infrequent theses published on inorganic chemistry, showed that the calamine "of our shops is a worthless and inactive article..."[187]

If, on the average, the results of student analytical work were rather crude, the aim was ambitious for American pharmaceutical education of the time. Although work on proximate principles dominated the series of inaugural essays selected for publication, there were also many publications in other fields: checking the relative advantages of different methods of extracting a particular drug; comparative examination of assay procedures; evolving more elegant pharmaceuticals or more efficient methods of formulation; and comparing the composition of related varieties or species of botanical drugs.

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186 - H. S. Van Klooster, "The Beginnings of Laboratory Instruction in Chemistry in the U. S. A.," Chymia, vol. 2, 10; Struik, Yankee Science in the Making, 191 and 340; T. Roberts Baker, "An Analysis of Ergot of Rye," Amer. J. Pharm., 24: 99-106, 1852. It was Booth, rather than the College faculty, whom the student credited "for advice during the progress of my operations."

187 - Ferris Bringhurst, "On Lapis Calaminaris," Amer. J. Pharm., 29: 308-310, 1857.

Though the quality of published theses seemed to be improving in the 1860's, the meaning of this can hardly be assessed since now only one out of ten students could hope to win publication of his work, whereas in the early period there was space for one out of every two.[188]

After the 1870's there was doubt among teachers about the desirability of the thesis requirement for graduation, although the 1878 Conference of the Schools of Pharmacy had decided in favor of continuing the practice. Enrollments were becoming large enough so that the reading of the essays seemed onerous,[189] not to mention providing the personal help and guidance needed by the average, ill-prepared, student if worthwhile work was to be produced.[190]

In 1881 the Conference voted again to continue the thesis requirement, this time half-heartedly, and as the century wore on a number of schools discontinued it or made it optional. By 1892 only a third of 34 schools required students to write a thesis.[190a]

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188 - Student theses published before 1870, and some thereafter, have been abstracted in connection with the present study and are on file in the Kremers Reference Collection (University of Wisconsin) pending further study.

189 - Wimmer, The College of Pharmacy, 138.

190 - Arthur L. Green, "Theses in Colleges of Pharmacy," The Apothecary, 1: 5, 1891.

190a - C. S. N. Hallberg, The Pharmacal Calendar of 1892 (Chicago, n.d.), 16 f.

The publication of theses and other student investigations took on renewed vigor, however, with the opening of the pharmacy course at the University of Michigan and, later, at the University of Wisconsin. A steady stream of publications authored by students or based on their work flowed from these laboratories. The "Contributions from the Chemical Laboratory" of the former, and "Contributions from the Department of Pharmacy" of the latter, became familiar to readers of pharmaceutical and chemical journals, and were published for a time in special brochures as well.191

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191 - Contributions from the Department of Pharmacy of the University of Wisconsin, Nos. 1 and 2 (Madison, Wis., 1885 and 1886); see also "Index to Published Contributions of Original Work Done by Students and Graduates of the School of Pharmacy of the University of Michigan," in Annual Announcement of the School of Pharmacy, University of Michigan, 1881-82. In the period covered by this index 45 % of the pharmacy graduates had done work "reported in the chemical journals of this and other countries." (Joint Documents of the State of Michigan for 1880, vol. 1, 131.) Purdue University issued special publications, for a time, devoted to student investigations; see, e.g., Purdue University, School of Pharmacy, Bulletin No. 1 (Lafayette, 1886).

Other Curricular Subjects. In the latter part of the century specialized subjects branching off the old trio of omnibus courses had sounded a new note of emphasis on science: analytical and organic chemistry, physics, toxicology, physiology, pharmacology, botany and pharmacognosy. Among strong university schools some of these had emerged as full-blown courses. In most of the independent schools and some of the university schools they were recognized in principle, given a special place in one of the traditional courses, or set apart as a special series of ten or twenty lectures or laboratory periods. It was hard to do more, hemmed in by competition, restricted by low entrance requirements, and often lacking the support of a general institution of higher learning. Moreover, some pharmacists thought the educators already had gone too far in their scientific aspirations. In the mid-80's systematic instruction in analytical chemistry or botany apparently was not fully accepted by the rank and file, even on the rather modest basis then offered by the schools.[192] Joseph Jacobs, a leading exponent of the commercialized drugstore, complained that "not enough stress is laid upon practical experience and too much given to theoretical matters..."[193] Among objections arrayed against Alfred Dohme's proposal to add pharmacology to the curriculum were beliefs that there was already too much material in the usual course and that students were away from the drugstore for too long a time.[194]

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192 - F. B. Power, "The Problems of Pharmacy in the United States," Pharm. Rundschau, 3: 122, 1885.

193 - Joseph Jacobs, "The Practical Side of Training in Our Colleges of Pharmacy," Western Druggist, 17: 375 f., 1895.

194 - Alfred R. Dohme, "The Desirability of Incorporating Pharmacology in Courses at Pharmaceutical Colleges," Proc. Amer. Pharm. Assoc., 46: 483, 1898.

H. H. Rusby tried to take a frank and practical view of the curriculum problem. The goal of the student, he felt, was "to fit himself for a business, partly professional it is true, but largely commercial, where he is to engage in a fierce conflict for a livelihood, and where he cannot afford to sacrifice too much of the actual technical details of his business for the pursuit of the associated enjoyments of pure study. Bearing this thought, in connection with that of the short time at our disposal... we must eliminate from our course of instruction everything of a purely elevating nature..."[195]

Some other educators quite frankly conceded in the 1890's that the limited time students were able or willing to devote to education could not be ignored in planning elaboration of the curriculum at independent schools.[196]

Under the circumstances there could be little thought of broadening study to include general or cultural courses; instead, growing agitation for commercial instruction[197] began to make a place for subjects that met "practical needs." In 1899 the Philadelphia College introduced an optional course in commercial training (bookkeeping, commercial practices, etc.), which was probably the first instruction of its kind in American pharmaceutical education.[198] Other schools introduced similar courses after the turn of the century.

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195 - H. H. Rusby, "How May Pharmaceutical Work Be Made Practical," Proc. Amer. Pharm. Assoc., 38: 235 f., 1890.

196 - William Simon, commenting for a committee, in Proc. Amer. Pharm. Assoc., 42: 377, 1894; C. Schmidt, The Maryland College of Pharmacy, 9.

197 - E. G., Proc. Amer. Pharm. Assoc., 36: 179, 1888.

198 - England, The First Century, 189.

Some concern had been expressed from time to time about an "appalling ignorance of arithmetic" among matriculants, and in 1891 the New York College acted by inaugurating a special course in pharmaceutical arithmetic, for students found to be deficient in this subject.[199] This was one of the earliest courses of a type that found wide acceptance later on. The New York College likewise was one of the first to offer special instruction in pharmaceutical Latin, a transitory effort being made as early as 1872.[200] Shortly after 1892 a renewed effort to establish pharmaceutical Latin in the curriculum came with the appointment of Adelaide Rudolph, who had taught a separate course in the subject earlier at the University of Kansas College of Pharmacy. Besides the University of Kansas, the Scio College (department of pharmacy) was already listing a chair in Latin in 1892, and the Kansas City College had a joint chair in "Materia Medica and Latin."[201]

Law as applied to the practice of pharmacy began to emerge as an academic subject during the last decade, when Professor James H. Beal, who fathered the model state law of 1900 for the American Pharmaceutical Association, delivered such a course in several schools. Some of the university schools, such as the University of Wisconsin, called upon the law faculty to provide special instruction in this field.[202]

The two-year courses, even at university schools, left no room for subjects not directly related to the science and art of pharmacy. In the three-year courses of state schools electives began to appear that opened the way for some general education at the university level. The four-year optional course not only extended

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199 - Wimmer, The College of Pharmacy, 82.

200 - Ibid., 70.

201 - Ibid., 82; and C. S. N. Hallberg, The Pharmacal Calendar of 1892, 21, 24, and 30.

202 - "Editorial," Pharm. Review, 17: 99, 1899.

the opportunity for elective subjects but made English and modern foreign languages obligatory for the first time.[203]

Graduate Study. When the University of Wisconsin announced the first four-year course in pharmacy in the catalogue for 1892-93 the stated aim was to "accommodate those students who desire to obtain a general scientific education and to include in their course the pharmaceutical studies; and with the hope of stimulating a broader pharmaceutical education." A corollary of the greatest import for American pharmacy was that the Bachelor of Science degree opened the way for regular graduate work in the pharmacist's own field.

Until about the time of the Civil War ambitious pharmacists who wished advanced study on American soil usually turned to the "M. D." degree; and after mid-century a small but growing number of men with scientific and/or teaching ambitions journeyed to Europe for graduate instruction.

Several American universities offered post-graduate instruction beginning about the middle of the century, but no graduate degrees were awarded until Yale conferred the Ph. D. on three men in 1861. Leading universities began to organize

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203 - See, e.g., Catalogue of the University of Wisconsin for 1898-99, 271; Annual Announcement of the University of Michigan School of Pharmacy, 1898-99, 23. For comparative outlines of three university courses in 1887 see "Universitäts-Pharmacieschulen," Pharm. Rundschau, 5: 129 f., 1887.

graduate work in the 1870's, with such instruction receiving a strong impulse from Johns Hopkins University after 1876.[204]

Along with this development came "postgraduate" work in pharmacy, leading to such degrees as Master of Pharmacy and Doctor of Pharmacy. The requirements for such degrees varied from an approximate equivalent of the Master of Science degree in regular graduate departments to merely a few years of respectable professional practice and submission of a not-too-original thesis. Such work had to be built in pharmacy upon a foundation of the ten- to eighteen-month undergraduate courses, rather than the Bachelor of Science course or its equivalent, which had come to be a standard prerequisite for regular graduate work in American universities.[205]

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204 - Dexter, A History of Education in the United States, 294 f.; Thwing, Higher Education in the United States, 418 and 420; Report of the Commissioner of Education for 1889-90, 815-821.

205 - For a summary of general university requirements for graduate work in 1898 see the Report of the Commissioner of Education for 1898-99, 1565. For a description of postgraduate work open to pharmacy graduates at Michigan and Cornell in 1887, see "Universitäts-Pharmacieschulen," Pharm. Rundschau, 5: 131, 1887. No degree was offered at Ithaca; at Ann Arbor the Master of Pharmacy (based on the Ph. C.) required one year of advanced study and original research of one year leading to a thesis.

This prerequisite was offered in pharmacy by Edward Kremers at the University of Wisconsin in 1892-93 and by pharmacy courses in at least six other universities before the end of the century.[206] For ambitious men in American pharmacy, Urdang has pointed out, the "opportunity of such training and degrees in their own field and country was at least as important as the emancipation of the academic teaching in pharmacy from 'the store' concept by Prescott in 1868."[207]

Curiously, the first such graduate degree was awarded at the close of the same year that the first four-year course was inaugurated. At the spring commencement of 1893, the University of Wisconsin conferred the Master of Science degree on John Lockwood Mead, who had majored in pharmaceutical chemistry.[208] Mead's degree was possible only because he held a B. Sc. degree from Lawrence University as well as being a Graduate in Pharmacy from the University of Wisconsin. The first Master of Science (pharmaceutical chemistry) awarded on the basis of a B. Sc. degree in pharmacy at the University of Wisconsin went to Florence Meta Gage at the spring commencement of 1900.[209]

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206 - See p. 400, f.

207 - George Urdang, "Edward Kremers (1865-1941), Reformer of American Pharmaceutical Education," Amer. J. Pharm. Ed., 11: 650, 1947.

208 - Catalogue of the University of Wisconsin for 1893-94, 216.

209 - Catalogue of the University of Wisconsin for 1900-1901, 293.

The significance of this 19th-century beginning came to full fruition only after the turn of the century, when the first Doctor of Philosophy degrees were earned by pharmacists studying within their own field.[210]

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210 - It should be noted that "beginning" of graduate instruction in pharmacy does not necessarily date from the beginning of work based on the B. Sc. degree. The Master of Science in pharmacy at the University of Wisconsin was to be granted to "graduates of the Four Years' Course upon fulfillment of similar requirements" to those for the Master of Pharmacy (which was based on the Ph. G.). The thesis for the Master of Pharmacy had to be satisfactory to the Committee on Higher Degrees; and the Master of Pharmacy program was listed in the Department of Graduate Study along with that for the Master of Science. (Department of Graduate Study, University of Wisconsin, Bulletin No. 35, Series No. 3, Part II, March 1900, 9; Catalogue of the University of Wisconsin for 1894-95, 200.)

Teachers

Teachers in the early pharmacy schools were part-time, poorly paid, and better than might be expected. Many of those who held the "chairs" also occupied similar posts in one or two nearby institutions in other fields, perhaps with a private laboratory or medical practice on the side; for the professionalization of teaching was little developed in the United States until after the Civil War. Within pharmacy itself--which had only begun to develop professionally--there were few men prepared or willing to accept faculty duty.

Since need and custom made a place for courses in materia medica and pharmacy and in chemistry at the medical schools, the schools of pharmacy could draw upon physician-teachers well equipped to meet the classes of pharmacy students. Other teachers mainly interested in science also held the "M. D." as the only "higher" degree available on American soil before the Civil War. Thereafter some members, or future members, of pharmacy faculties joined those who swarmed into the European, particularly German, universities for graduate work.[211]

But until late in the century, it was the "M. D." who dominated pharmaceutical teaching, even though pharmacy had largely been able to avoid the administrative domination of its educational system by medicine.

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211 - In the first half of the century apparently less than 200 Americans had matriculated at German universities; in the last half of the century there were thousands--more than 2000 in the 1890's alone. (Thwing, The American and the German University; One Hundred Years of History (New York, 1928), 42.)

For some pharmacists this smacked of subordination to medicine, and they were impatient for a change that came only slowly. To Edward Parrish, it involved a question of self respect when in 1858 he wrote: "If we would reach the position to which we are entitled, we must cut loose from that vassalage to physicians, which has been too much encouraged and still keeps us down. Let us do our own teaching and wherein we are the equals or the superiors of our medical brethren, let us not fail to assert our claims."212

But as Albert E. Ebert pointed out in 1892, when the "M. D." in pharmaceutical education was still not a dead issue, this proved "to be one of the necessities in the evolution of pharmacy in this country, for we have had no trained teachers in times past..."213

That was certainly true up to the time of the Civil War; and still later, as George Urdang pointed out in an illuminating essay on "The Part of Doctors of Medicine in Pharmaceutical Education," there remained three kinds of "M. D.'s" in the schools of pharmacy:

"a. Those who were pharmaceutical as well as medical graduates;

"b. those, who by inclination and specialization, were chemists or pharmaceutical botanists (pharmacognosists) rather than medical men;

"c. those whose particular understanding of pharmaceutical problems in connection with administrative talents enable them to act successfully as heads of pharmacy schools."214

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212 - Edward Parrish, "American Pharmacy," Amer. J. Pharm., 26: 216, 1854.

213 - Albert E. Ebert, in Proc. Amer. Pharm. Assoc., 40: 318, 1892.

214 - George Urdang, "The Part of Doctors of Medicine in Pharmaceutical Education," Amer. J. Pharm. Ed., 14: 556, 1950.

It was in chemistry, as might be expected, that physician-teachers first began to be displaced. Up to 1840 at the two earliest schools of pharmacy (Philadelphia and New York) all of the chemistry teachers had been "M. D.'s". Most of these men by no means showed one-sided interests, and particularly at Philadelphia the chemistry teachers (Troost, Wood and Bache) were distinguished by their general scientific background and competence. Between 1840 and 1868 chemistry teachers who did not hold the M. D. degree began to infiltrate the faculties. At New York four of the five chemistry teachers were non-physicians (Reid, Mayer, Everett and Chandler), and the fifth (Doremus) obtained his M. D. some time after assuming his professorship. At Philadelphia a "Ph. G." (Fisher) appeared in the chemistry chair for a single year, then came the distinguished Robert Bridges, an "M. D." but a man of liberal education.

The changing background of the chemistry teachers undoubtedly mirrored a period when "America began for the first time to have an extensive group of professional scientists..."[215]

At six association schools and the University of Michigan between 1868 and 1880 we find at least half of the chemistry teachers still held the "M. D." as their only degree or as their only "higher" degree. The other teachers usually held an A. B. or other certificate from undergraduate scientific schools; and there were already several men giving distinguished service on pharmacy faculties who had returned from the chemical centers of Europe with a Ph. D.

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215 - Struik, Yankee Science in the Making, 341.

The last part of the century brought marked improvement in the formal scientific preparation of chemistry professors in pharmacy schools, on the average, and a somewhat greater degree of specialization as we have noted in viewing the length and kind of courses offered.

The "M. D." was now losing ground rapidly, representing only about a fourth of the total number of chemistry teachers. At the six independent schools studied there were only four "M.D.'s" between 1880 and 1900; and of three such men found at three university schools (Michigan, Wisconsin and Purdue) two also held the Ph. D.

The fact that the designation M. D. eventually disappeared from the listing of several teachers in school catalogues may be one expression of a growing pride in the independence of pharmacy from medicine.

During the final two decades chemistry teaching in pharmacy developed under the hand of more and more "Ph. D.'s." About 45 per cent of all chemistry teachers in the schools mentioned held this degree. At the six independent schools, which were largely outside the orbit of the American university community, three of the four chemists holding the Ph. D. (or perhaps all of them) had obtained the degree abroad, especially in Germany. At the three university schools, however, five of the nine "Ph. D.'s" in chairs of chemistry had taken their advanced study on American soil.

American pharmacy also had reached the point, at the close of the century, where at least part of the teaching and investigative work in pharmaceutical chemistry arose from within the profession, rather than being imported in specially diluted form from other

fields (i.e., medicine, chemistry, mineralogy). Twelve of the 29 professors (1880-1890) whose records were checked had made a start in the profession of pharmacy, or at least held a pharmaceutical degree, including five of the thirteen "Ph. D.'s."216

In materia medica physician-teachers found a congenial field that stood midway between the two professions and from which they were displaced more slowly than from chemistry. As long as the subject was taught in its traditional ill-defined, largely non-scientific sense, no insistent need arose for specialized, scientifically trained teachers. While a number of the professors of materia medica, particularly at Philadelphia, brought to the apprentices fully competent instruction, pharmacists voiced sporadic dissatisfaction with the medico-therapeutic stress in the courses.

This special domain of medical men began to give way around the 1860's largely to teachers arising from pharmacy. Perhaps the first break in the ranks came at New York, with the appointment in 1854 of pharmacist Benjamin Canavan to the chair of materia medica and pharmacy, a man who was "not prepared for such work" and "simply assigned reading courses."217

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216 - This summary of the educational background of chemistry teachers is based on a supplementary investigation made in connection with the present study, which has been reported and documented in more detail under the title, "The Scientific Background of Chemistry Teachers in Representative Pharmacy Schools of the United States During the 19th Century," vol. 4, Chymia, publication pending; a manuscript also has been deposited in the Kremers Reference Collection, University of Wisconsin.

217 - Wimmer, The College of Pharmacy, 50.

In 1850 when the Philadelphia College faced a choice between a man of only medical training (Thomas) and a man of only pharmaceutical training (Parrish), the decision was not in doubt since Parrish had not the training in medicine "believed to be requisite in one who should hold the chair of materia medica..."[218]

Upon the death of Thomas in 1864 there likewise was no hesitation in choosing his successor, this time in favor of the pharmacist, Edward Parrish. When Parrish transferred to the chair in pharmacy three years later another pharmacist was chosen, this time a man of wider but strictly non-medical background, John M. Maisch. Maisch was a German political refugee, who had attended a realschule but did not graduate because of failing health. On American soil he found in drugstores more congenial work than his first employment in a mattress factory, and there became an accomplished pharmaceutist. Although not even a pharmaceutical graduate he brought competence and knowledge to the chair, acquired during service in pharmacies, in a chemical plant and E. R. Squibb's laboratory, as a teacher of materia medica and pharmacy at New York and of chemistry in Parrish's practical school, and as organizer and director of the U. S. Army Laboratory for medical supplies at Philadelphia during the Civil War, and then as operator of his own pharmacy.[219]

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218 - England, The First Century, 141.

219 - "Professor J. M. Maisch," Amer. J. Pharm., 66: 1-9, 1894.



JOHN M. MAISCH

U. W. Neg. No. 51149-C

John M. Maisch (1831-1893), a German immigrant, became one of America's master pharmacists of the 19th century. The teaching facet of his career started in the private school of Edward Parrish and at the New York College of Pharmacy. After the Civil War he served as professor at the Philadelphia College of Pharmacy for twenty-seven years.

The slow shift to pharmaceutically-oriented teachers continued after the war, with the appointment (1870) of the pharmacist George M. Hambright at the newly reorganized Chicago College.[220]

There was now, as Hoch phrases it, "a growing away from the dominant influence of the medical viewpoint and it permitted the development of a kind of materia medica which placed more emphasis on pharmacognosy and less on therapeutics."[221] It was not this emphasis, but a shift in the direction of pharmacology that some educators and pharmacists had hoped for in taking the teaching out of medical hands. The personal predilections of teachers as to what should constitute the new materia medica brought renewed criticism late in the century. Here is Oscar Oldberg's diagnosis of what had happened:

"At least half a dozen schools have teachers of physiology and in many the Professor of Materia Medica devotes a small portion of his time to anatomy and physiology and considerable to pharmaco-dynamics," but elsewhere in pharmaceutical education, he observed, "a strong prejudice against pharmaco-dynamics has resulted from the unsatisfactory results of devoting nearly all the time in materia medica to the commercial history of drugs and their therapeutic properties and uses, to the serious neglect of pharmacognosy...But this defect in some schools was not remedied wisely. Instead of omitting extended reference to therapeutics while retaining an elementary course in pharmaco-dynamics, the study of pharmaco-dynamics was almost entirely dropped and pure pharmacognosy introduced in its place..."[222]

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220 - J. Hampton Hoch, "A Survey of the Development of Materia Medica...," Amer. J. Pharm. Ed., 12: 151, 1948.

221 - Ibid., 152.

222 - Oscar Oldberg, in The Apothecary, 2: 23-26, 1892, as cited by Hoch.

At this time there were still 18 "M. D.'s" in chairs of materia medica (or combination chairs) among 35 schools, but five of these also had pharmaceutical degrees. Twelve of the other teachers (all but two) came from the ranks of pharmacy without an additional medical degree, but two had a Ph. D. (Doctor of Philosophy?).[223]

Edward Kremers of Wisconsin felt that these figures "clearly show that medical materia medica receives an undue share of attention in the pharmaceutical schools." Naturally, Rusby and other teachers with medical degrees took strong issue with what they considered the implication that "because a man is an M. D. he is not competent to teach pharmaceutical materia medica." However, Albert E. Ebert of Chicago, holding a German Ph. D. like Kremers, felt that Kremers "has given us the true gist of the matter, for, invariably, when I saw the name of an M. D. in connection with a professor of materia medica, I would feel pretty well satisfied that in that college of pharmacy a great deal would be heard about materia medica related to medicine and the practice of medicine, instead of that applying to pharmacy."[224]

As the vivid debate continued it revealed the different backgrounds that incumbent professors brought to the teaching of materia medica, and it illuminated the fluid, divergent concepts of what their task should really be. In the 20th century a number of

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223 - Tabulated by Edward Kremers (Proc. Amer. Pharm. Assoc., 40: 310, 1892), from C. S. N. Hallberg The Pharmacal Calendar for 1892, 20 ff. Three schools that seem to be missing from the tabulation, which totals 32, are probably among the five that did not use the term materia medica in any of their chairs (Vanderbilt, Scio, Purdue, Ohio Normal and Michigan); see The Pharmacal Calendar of 1892.

224 - Edward Kremers, "Notes on Pharmaceutical Education: The Study of Materia Medica," Proc. Amer. Pharm. Assoc., 40: 309-317, 1892; followed by debate, to which reference is made at page 318.

these different concepts would come to fruition as separate courses under various titles and scientific specialists--until at last the teacher of materia medica, his grab-bag of instruction empty, himself would disappear from the pharmaceutical scene.

The separate chairs of pharmacy, from the beginning, were mostly filled by experienced and/or educated pharmacists. If physician-teachers were welcomed, with a rather uneasy politeness, in other departments, they were rejected on principle--it seems clear--in the pharmacist's private domain. True enough, physicians commanded the joint chairs of materia medica and pharmacy, but as previously noted these were primarily chairs of materia medica, pharmacy being appended to supplement the basic tutelage of the pharmacist's shop. When the preceptor was relieved of his presumed academic role, it was not always possible to find pharmacists who were able, as well as willing, to formalize such instruction in the schools.

In the report of the committee on establishment of a professor of practical pharmacy at the Philadelphia College, it was pointed out that in earlier years "few, if any, of the Apothecaries had so accustomed themselves to the systematic study of the several branches connected with the practice of our profession, as to be prepared to assume the office of teachers."[225] Now, in 1846, the

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225 - "Minutes of the Philadelphia College of Pharmacy," Amer. J. Pharm., 18: 149, 1846. The report also gives recognition to the inadequacy of the apprenticeship and to the assumption that no great amount of knowledge in pharmacy was to be gained from the joint chair: "...Students coming from such preceptors [of meager attainments] frequently manifest gross ignorance in regard to Pharmacy, though by the Lectures in the School they have acquired considerable knowledge of Materia Medica and general Chemistry" (Ibid., 149 f.).

trustees were ready to name a professor of pharmacy and were unanimously agreed on the man for the task: William Procter, Jr., a pharmacist whose formal education went little beyond the once-repeated course of lectures taken at the Philadelphia College. All the more impressive, then, that his subsequent record as teacher, investigator, editor and leader should earn for him the seldom-challenged appellation of "father of American pharmacy."[226]

While it is sometimes stated or implied that Procter was the first pharmacist to hold a chair in pharmacy, he was preceded in that role by a competent but far less influential man at the Maryland College of Pharmacy, David Stewart. The evidence seems convincing that Stewart's appointment did not rest on his M. D. degree, acquired a few weeks before. Stewart was known to the members of the Maryland College not only as a pharmacist but as one of their most competent and active colleagues. He was one of the fortunate few in pharmacy who had an academy education. He went to Baltimore as a youth to study chemistry and pharmacy, becoming--as he styled himself--a "Chemist and Pharmaceutist." At the meeting in 1840, where plans were laid for the founding of the Maryland College, Stewart sat among the eight "representative pharmacists" who met with three physicians.[227] When the first course was given--a rather informal affair in which the lectures were assigned among members of the college--it was Stewart who told the apprentices about chemistry.

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226 - For a competent biographical sketch, see Joseph P. Remington, "William Procter, Jr.," Amer. J. Pharm., 72: 255-67, 1900.

227 - Annual Catalogue of the Maryland College of Pharmacy, 1891-92, 10.



U. W. Neg. No. 51157-C

William Procter, Jr. (1817-1874) is pictured in his prime as teacher, editor, experimenter, and leader of American pharmacy. He held the chair in pharmacy for twenty-two years at the Philadelphia College.

In 1844 the College organized instruction on a more formal basis, creating a separate chair in the "Theory and Practice of Pharmacy," the first in the United States. Stewart was unanimously elected as the first occupant, but he served only two years.[228]

When the Chicago College opened its school in 1859 it was a druggist and M. D. who occupied the separate chair of pharmacy. Here again, however, it seems safe to place the emphasis upon Franklin Scammon's reputation as a druggist of broad knowledge and experience rather than upon his medical degree. Scammon had been a Chicago druggist for many years, although at the time of his appointment he seems to have been engaged primarily in the manufacture of linseed oil; in his later, varied activities he became better known, not in connection with medicine, but as a botanist. Indeed, the year after the pharmacy school closed because of the Civil War found Scammon in a chair of botany at the University of Chicago.[229]

Not all the colleges were so successful in finding the requisite practical pharmaceutist whose background offered the qualifications necessary for teaching. Samuel M. Colcord of Massachusetts went so far as to say in 1860 that one of the reasons there were so few prospering schools was "a want of practical professors of pharmacy of sufficient influence to secure the attendance of a remunerative class..."[230]

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228 - Some of the information not otherwise documented is taken from George M. Osborne, "David Stewart, Baltimore (1813-1899)," a highly competent paper presented, and distributed in mimeographed form, in the Section on Historical Pharmacy, American Pharmaceutical Association meeting, 1952.

229 - The Alumni Record of the University of Illinois, Chicago Departments, 1921, 431.

230 - Samuel M. Colcord, "President's Annual Report...," Amer. J. Pharm., 32: 488 f., 1860.

The Massachusetts College had reported earlier, after one of its sporadic attempts to start instruction: "Our College has long felt the want of some practical Pharmaceutists, with a thorough theoretical education, qualified to take the professorships, and it is believed that the limited success [i.e., failure] of our lectures this winter is owing to that cause."[231]

When the Massachusetts College launched regular instruction in 1867 there was an accomplished pharmaceutist ready for the separate chair of pharmacy: George F. H. Markoe. Markoe had graduated from grammar school; then became an apprentice in pharmacy, educating himself through the help of Procter's "Syllabus of a Course of Study, Intended as an Aid to Students of Pharmacy, Who Cannot Avail Themselves of Regular Instruction; Being a Report Made to the American Pharmaceutical Association."[232] With Charles T. Carney he had gained experience in chemical manufacturing and analytical work; this knowledge Markoe applied to pharmacy over many years as a practicing pharmacist.[233]

It was likewise an "old fashioned thoroughly qualified pharmacist," James O'Gallagher, who filled the separate chair of practical pharmacy when the St. Louis College opened its school in 1864.[234]

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231 - "Proceedings of the Massachusetts College of Pharmacy" (Ed. Dept.), Amer. J. Pharm., 26: 475, 1854.

232 - Published in Proc. Amer. Pharm. Assoc., 7: 103-168, 1858.

233 - "George Frederic Holmes Markoe," Western Druggist, 15: 45, 1893.

234 - E. Kremers, "The Teaching of Pharmacy...," Drugg. Circ., 51: 68, 1907.

Most of these American pioneers in the teaching of pharmacy were succeeded by other pharmacists, with "outsiders" appearing most frequently in departments at medical colleges and some university schools---although in most of these an "M. D." or other degree customarily was joined with a pharmaceutical background.

Some of the pharmacy professors did notable work, as the century wore on, perhaps not particularly impressive when measured against the best in science but certainly so in relation to the education upon which their work was based.

Israel J. Grahame, much admired teacher for many years at the Maryland College and remembered best for his work in percolation, did not, as far as we know, have any formal education beyond the public schools.[235] Peter W. Bedford, who held the chair of pharmacy for two decades at New York, attended an elementary private school, and for the rest was "practically self-educated" except for the course of lectures at the New York College of Pharmacy. He published at least 16 papers.[236]

Joseph P. Remington, professor of pharmacy at the Philadelphia College for the last quarter of the century, tallied a remarkable array of achievements, working on the foundation of only the College's course in pharmacy plus self-education and a wide range of experience. He was apprenticed to the competent Charles Ellis, worked for E. R. Squibb in New York under unusually

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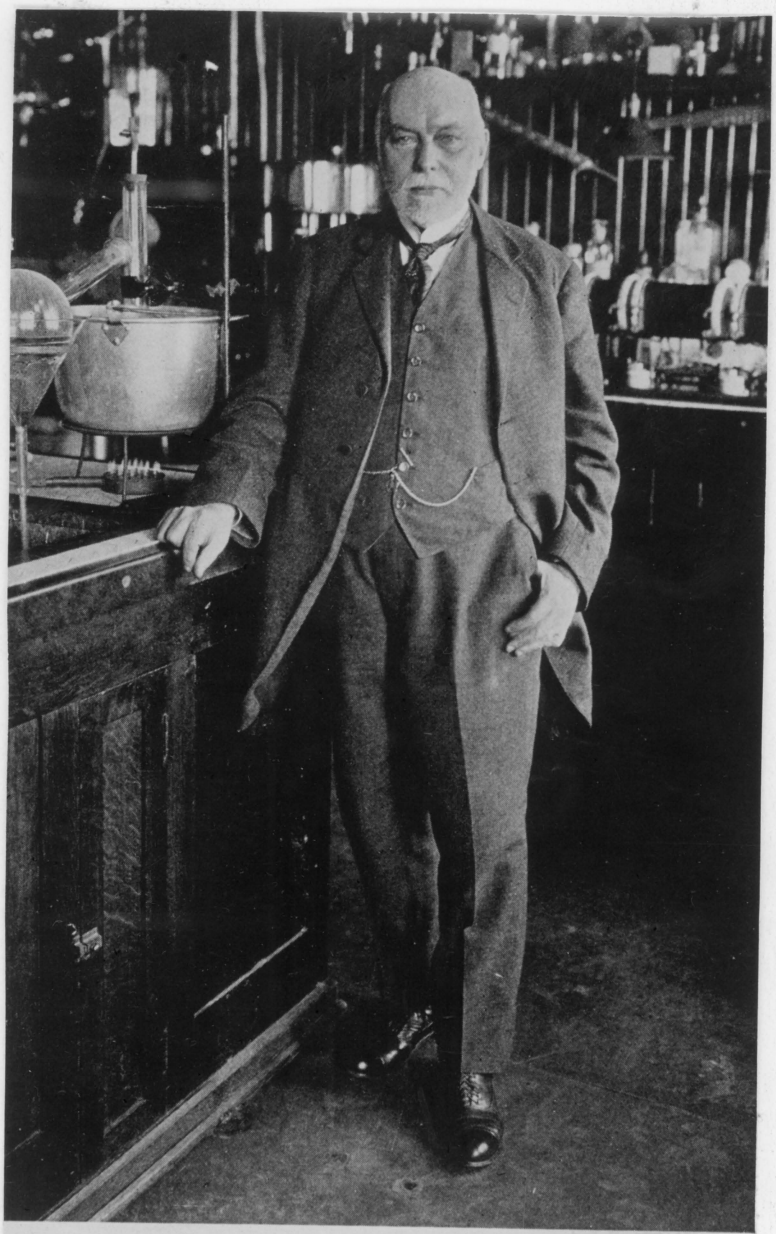
235 - "Israel J. Grahame," Proc. Amer. Pharm. Assoc., 48: 40, 1900.

236 - "Peter W. Bedford," Proc. Amer. Pharm. Assoc., 41: 18, 1893; and Appendix B.



FREDERICK B. POWER

U. W. Neg. No. 51143-C

Frederick B. Power (1853-1927), one of the most distinguished scientists coming from American pharmacy, organized the University of Wisconsin School of Pharmacy and directed it from 1883 to 1892. His phytochemical research and other achievements won him election to the National Academy of Science.

favorable conditions for development, returned to Philadelphia in the employ of Powers and Weightman, manufacturing chemists, then entered the practice of pharmacy in his own shop. By nature a cautious diplomat, rather than a bold innovator, he nevertheless left a monument of work as teacher, chairman and member of the Revision Committee of the U. S. Pharmacopoeia, reviser of the Dispensatory, author of the ubiquitous Practice of Pharmacy, and dogged worker in and for a list of local, national and international organizations.[237]

Among outstanding men who taught pharmacy in the university schools the two directors of the course at the University of Wisconsin both warrant special mention. Frederick B. Power, who organized the school, had graduated from the Philadelphia College, later receiving his Ph. D. at the University of Strassburg. His able teaching and research at Wisconsin portended the time when he would be one of the world's best known workers in the field of phytochemistry.[238] His successor, Edward Kremers, was likewise a pharmacist holding a German Ph. D. (Göttingen). His achievements at Wisconsin and his influence as a reformer in American pharmaceutical education, alluded to at several points, have been impressively documented and illuminated in the biographical study by George Urdang.[239] Kremers, like Power, published at least 19 scientific papers of merit before the end of the century.[240] His service as a leader of 19th-century education probably was

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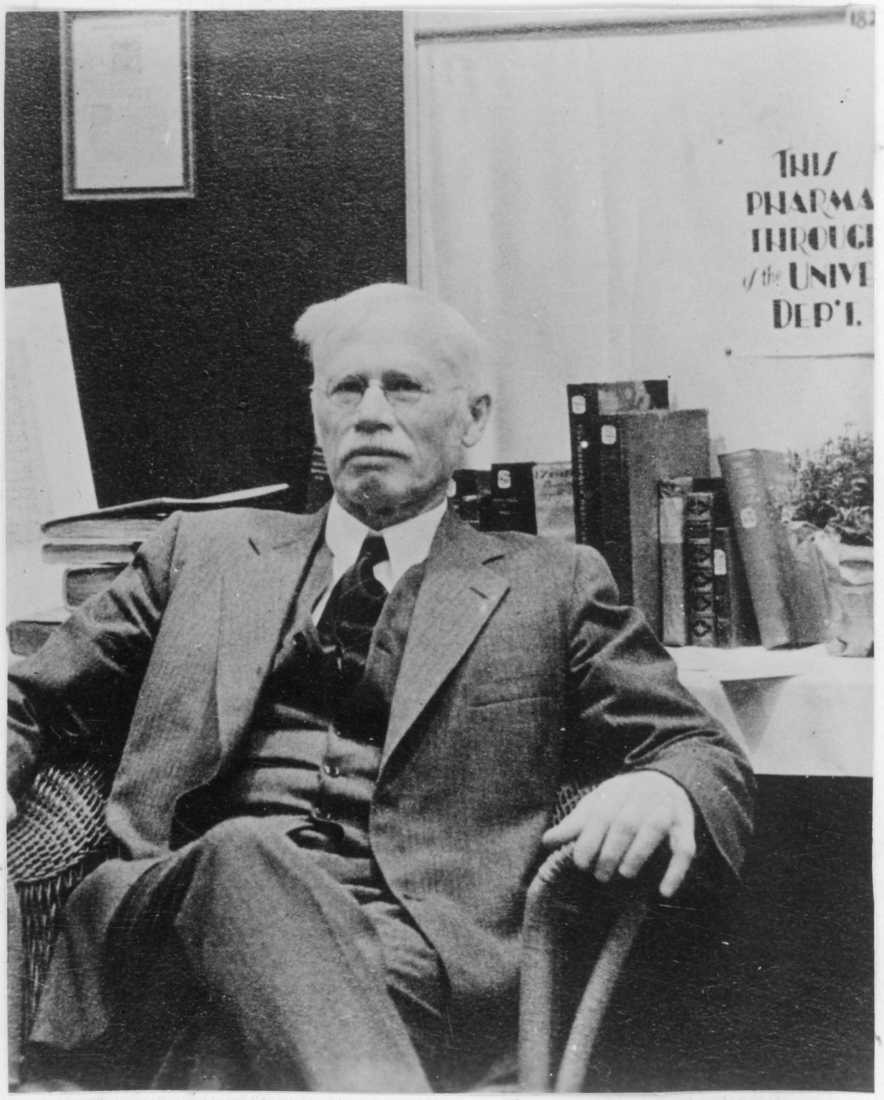
237 - A factual biographical sketch appears in England, The First Century, 407 f.

238 - See England, The First Century, 410.

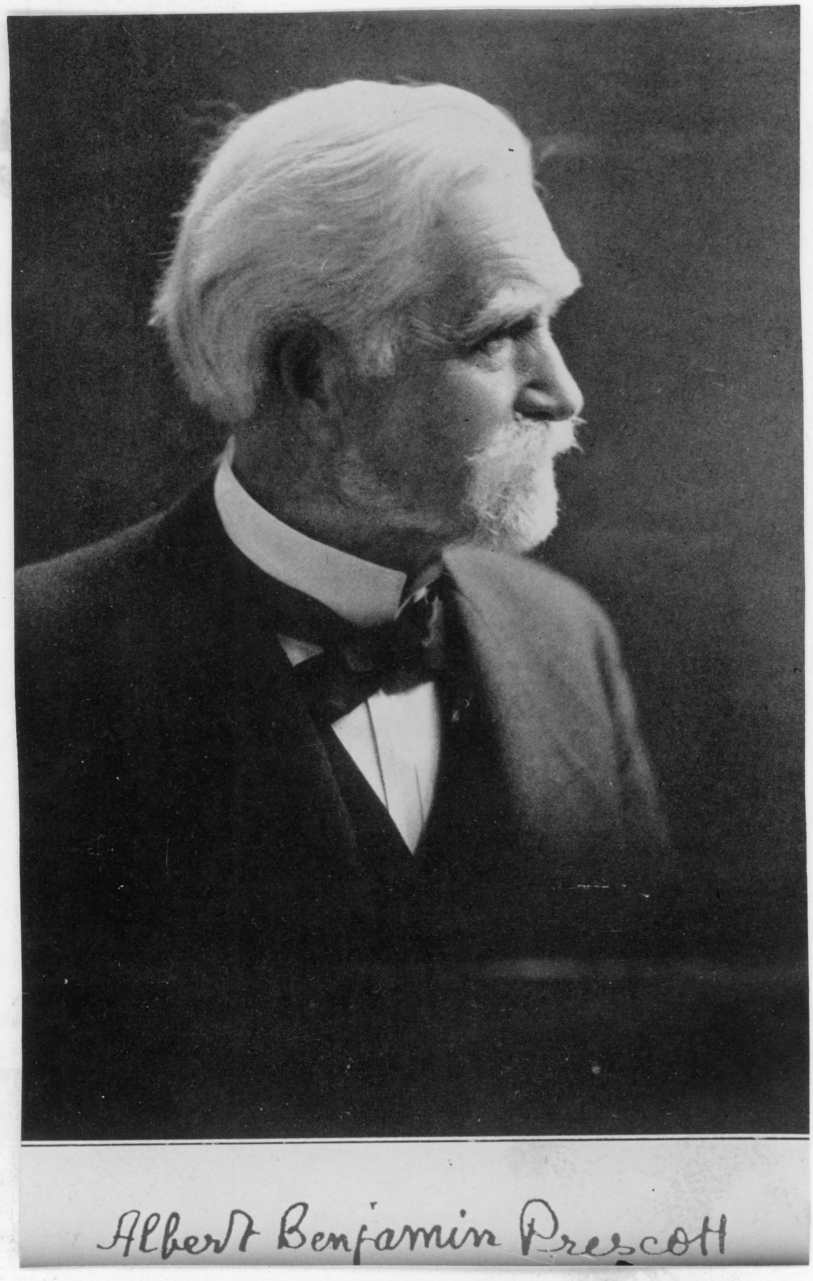
239 - George Urdang, "Edward Kremers (1865-1941), Reformer of American Pharmaceutical Education," Amer. J. Pharm. Ed., 11: 631-658, 1947.

240 - See Appendix B and C.



U. W. Neg. No. 51145-C

Edward Kremers (1865-1941), when a youth of 27, became the second director of the University of Wisconsin School of Pharmacy. From a German immigrant family, apprenticed with a German apothecary, and with a German Ph. D., Kremers zealously aimed at German standards of scientific pharmacy on American soil. He and his school pioneered the four-year undergraduate course and graduate work in pharmacy based on the B. Sc. degree. Himself a competent investigator in phytochemistry, he personally guided more than 50 graduates to the Ph. D. during a lifetime in teaching.



U. W. Neg. No. 51142-C

Albert B. Prescott (1832-1905) devoted his entire career to teaching and administrative work at the University of Michigan, except for a short period following graduation from medical school. Innovations of the Michigan pharmacy curriculum, coupled with personal qualities that softened enmities, made Prescott highly influential in changing the whole pattern of American pharmaceutical education.

exceeded in effectiveness only by that of Albert B. Prescott of Michigan, whose only earned degree appears to have been the M. D. from the University of Michigan. After a short stint as assistant surgeon in the Army following graduation, Prescott began the University affiliation that was to last throughout his professional career. Although a professor of chemistry, he also was in charge of pharmacy instruction after 1868, two years later becoming director of this first vigorous pharmacy school at a state university (dean after 1876). The 39 papers tabulated in Appendix B are only a fraction of his total output.[241] Although Prescott's attention was always divided between chemistry and pharmacy, he became deeply identified with the latter and what may well be called a revolution in pharmaceutical education. Dwarfing, in pharmacy, Prescott's work as teacher or researcher, there towers his contribution in setting a new course and goal for pharmaceutical education. That goal, a sound scientific education for pharmacists within the frame of general academic facilities and standards, he proclaimed and justified before an unwilling audience at the 1871 meeting of the American Pharmaceutical Association. A classic document in the present field of study, his address appears as Appendix E.

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241 - "Albert B. Prescott," National Cyclopaedia, XIII, 53; J. O. Schlotterbeck, "Dr. Albert B. Prescott," Bull. Pharm., 19: 141-46, 1905.

Size of Faculties. Until after 1870 all of the pharmacy schools had three or four professors on the faculty, corresponding to the number of evening lecture courses.[242] The faculties in allied professions, although also usually part-time, were considerably larger. In 1870 most of the dental schools reported eight to eleven professors; the medical schools, with some exceptions, seven to fourteen professors.[243]

Five years later the size of the staffs in some pharmacy schools apparently had taken an upward turn. Among 14 schools, the ordinary staff still numbered three or four men, but three schools had five or six and Michigan listed eleven. Medical and dental schools reported similar increases.[244]

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242 - Report of the Commissioner of Education for 1870, 525. Among eight schools only the University of Michigan and the Chicago College reported four faculty members in 1870.

243 - Ibid., 523; for lists of faculty members in association schools up to 1870, and at the colleges of New York and Philadelphia and the universities of Wisconsin and Michigan thereafter, see Appendix A; for single alphabetic list, see Appendix B.

244 - Report of the Commissioner of Education for 1875. Note that the school reports on which instructors were "resident" and "non-resident" should be disregarded. Only the strongest association school reported a non-resident faculty; yet, it seems safe to assume that the others were on the same basis. "Resident," while not defined in the Report, was perhaps intended to refer to instructors who were at the school full time or made the school their main task. Between 1870 and 1875 the faculty designation in the survey changed from "professors" to "professors and instructors"; this change in the basis for reporting probably had little significance at the time as far as pharmacy faculties were concerned.

Pharmacy schools expanded their faculties little until the early 1880's. Among 20 schools reporting the total number of instructors in 1885, more than half (12) still had three or four instructors; four schools had five or six; and four schools had between eight and sixteen. The latter were the universities of Michigan (11) and Wisconsin (9) and the colleges of Philadelphia (16) and New York (8).[245]

The teaching load at about this time (1887) has been studied by Taylor, based on averages of 25 schools.[246]

The schools employed nearly 60 per cent more teachers of chemistry than of pharmacy; and about 28 per cent more teachers of materia medica than of pharmacy. On the average, the student load was:

--for the teacher of pharmacy, 77 first-year students and 32 second-year students

--for the teacher of chemistry, 48 first-year students and 20 second-year students

--for the teacher of materia medica, 60 first-year students and 25 second-year students

Each school, on the average provided:

--a teacher of pharmacy for 40 hours of lectures and 36 hours in the laboratory to 77 first-year students; and 28 hours of lectures and 32 hours in the laboratory to 32 second-year students.

--a teacher of chemistry for 37 hours of lectures and 32 hours in the laboratory to 48 first-year students; and 35 hours of lectures and 34 hours in the laboratory to 20 second-year students.

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245 - Report of the Commissioner of Education for 1885-86, 559. In dental schools at this time staffs ranged from five to 42 men; in medicine, from six to 56. Possibly clinical tutelage accounted in part for some of the very large staffs and wide range.

246 - In some respects the averages will represent some distortion because of a few schools with unusually large staffs.

—a teacher of materia medica for 29 hours of lectures and five hours in the laboratory to 60 first-year students; and 36 hours of lectures and 12 hours in the laboratory to 25 second-year students.247

The growth of the staffs, during the previous fifteen or twenty years, it will be noted, had been mostly in the field of chemistry, to a somewhat less extent in the general area represented by materia medica.

Teachers of pharmacy faced the largest number of students and examination papers; chemistry teachers had the smallest classes. The average number of lectures delivered by a teacher was roughly the same in all three fields. On the average and bearing in mind that the data include university schools, it may be seen that the teacher of chemistry supervised laboratory work for about twice as many hours as the teacher of materia medica; about half as many hours as the teacher of pharmacy.

By 1890 staffs were slowly expanding. For 30 schools of pharmacy the numbers of resident instructors averaged 6.3; for 28 dental schools, 15 instructors; among 95 schools of regular medicine, 21 instructors. Among 23 independent schools and private institutions of higher learning the number of resident instructors on pharmacy staffs ranged from three to nine men, with a fairly uniform distribution curve in the number of faculties of various sizes lying between these two extremes. Among seven state university schools in 1890 three lay outside the above range: Ohio State University reported 16 resident instructors; the University of Michigan, 10; University of South Carolina, 10. The others reported

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247 - H. L. Taylor, "Schools and Colleges of Pharmacy,III," Pharm. Era, 45: 333, 1912.

as follows: University of Kansas, 6; State University of Iowa, 6; University of Wisconsin, 5; Purdue University, 4.[248]

How the instructors, in the schools reporting, were distributed at this time and during the subsequent four years (1890-95) by states and regions is shown in the following table:

State.	Schools.					Instructors.				
	1890-91.	1891-92.	1892-93.	1893-94.	1894-95.	1890-91.	1891-92.	1892-93.	1893-94.	1894-95.
United States	30	29	31	35	39	194	216	264	283	317
North Atlantic Division	6	6	6	7	7	39	53	54	61	64
South Atlantic Division	4	3	3	5	7	23	15	16	26	27
South Central Division	5	5	5	5	5	26	34	33	32	28
North Central Division	13	13	15	16	17	93	104	147	150	176
Western Division	2	2	2	2	3	13	10	14	14	22
North Atlantic Division:										
Massachusetts	1	1	1	1	1	9	11	12	11	11
New York	3	3	3	4	4	20	27	27	36	36
Pennsylvania	2	2	2	2	2	10	15	15	14	17
South Atlantic Division:										
Maryland	1	1	1	1	1	3	3	4	4	4
District of Columbia	2	2	2	2	2	10	12	12	13	10
Virginia	.....	.....	.....	1	1	.....	.....	.....	6	7
North Carolina	.....	.....	.....	1	1	.....	.....	.....	3	2
South Carolina	1	.....	.....	.....	.....	10	.....	.....	.....	.....
Georgia	.....	.....	.....	.....	2	.....	.....	.....	.....	4
South Central Division:										
Kentucky	2	2	2	2	1	11	20	16	13	4
Tennessee	2	2	2	2	2	12	11	12	14	12
Louisiana	1	1	1	1	1	3	3	5	5	5
Texas	.....	.....	.....	.....	1	.....	.....	.....	.....	3
North Central Division:										
Ohio	2	2	3	4	4	22	23	25	30	37
Indiana	1	1	1	1	1	7	6	8	7	7
Illinois	2	2	2	2	3	14	11	18	19	23
Michigan	1	1	2	2	2	10	11	22	22	21
Wisconsin	1	1	1	1	1	5	6	27	24	26
Minnesota	1	1	1	1	1	5	6	4	5	17
Iowa	2	2	2	2	2	13	15	16	16	17
Missouri	2	2	2	2	2	11	14	15	16	15
Kansas	1	1	1	1	1	6	12	12	11	13
Western Division:										
Colorado	1	1	1	1	1	4	.....	4	4	7
Washington	.....	.....	.....	.....	1	.....	.....	.....	.....	4
California	1	1	1	1	1	9	10	10	10	11

Report of the Commissioner of Education for 1894-95, 252.
U. W. Neg. No. 7533-B

248 - Report of the Commissioner of Education for 1890-91, 1430; see also, 875. Undoubtedly not all of the figures for staffs at state schools are comparable; policies varied as to which of the instructors that taught pharmacy students in basic (non-professional) studies were considered part of the pharmacy faculty. Note that a "resident instructor" now means a teacher residing in the city.

Pharmacy faculties were strengthened perceptibly during these years, it will be noted, each school on the average employing about 1.5 additional teachers.

The difference between association schools and state schools in the number of teachers designated as part of the faculty remained small, but teachers at association schools were more likely to be part-time. The private schools (medical colleges, normal schools and sectarian institutions) as a group had smaller faculties, by about two men, than the state and association schools.[249]

We note that regional differences are too small to have significance, except perhaps in the South. In 1890, for example, the size of staffs in North Atlantic and Western states corresponded almost precisely with the national average. Schools in the North Central region, as a group, had faculties about 10 per cent larger than the national average; those in the South Atlantic and South Central states together averaging about 15 per cent smaller.[250]

While there was some increase in pharmacy staffs, nationally, during the five-year period shown in the above table, the already great disparity between the average teaching corps and that found in dental and regular medical schools widened still more. The average dental school reported an increast of 6.5 teachers (totaling 21.5), the average medical school added three teachers (totaling 24, in 1894-95).[251]

At the end of the century schools or pharmacy present the following faculty picture:

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249 - C. S. N. Hallberg, "The Requirements for Graduation in American Colleges of Pharmacy," Proc. Amer. Pharm. Assoc., 41: 274, 1893.

250 - The size of faculties alone gives some indication of the development of American schools and offers one barometer of difference in strength among the schools, but of course it gains full meaning only in relation to student and teaching loads.

251 - Based on Report of the Commissioner of Education for 1894-95, 242.

School	Professors	Special or Assistant Instructors
Alabama Polytechnic Institute	1	1
University of Alabama Medical College	3	1
California College of Pharmacy	3	6
College of Physicians and Surgeons	5	7
Howard University	4	3
National College of Pharmacy	4	2
Atlanta College of Pharmacy	2	2
Chicago College of Pharmacy	4	4
Northwestern University	6	2
Purdue University	3	3
Notre Dame University	5	2
Northern Indiana School of Pharmacy	8	6
Highland Park College (Iowa)	9	6
Iowa College of Pharmacy	4	4
State University of Iowa	5	5
University of Kansas	6	6
Louisville College of Pharmacy	8	-
Tulane University	3	3
University of Maine	12	9
Maryland College of Pharmacy	4	2
Massachusetts College of Pharmacy	5	7
University of Michigan	11	6
Detroit College of Medicine	5	2
University of Minnesota	7	5
Kansas City College of Pharmacy	6	4
St. Louis College of Pharmacy	5	5
New Jersey College of Pharmacy	5	3
Albany College of Pharmacy	3	4
Brooklyn College of Pharmacy	5	6
Buffalo College of Pharmacy	5	12
New York College of Pharmacy	8	5
University of North Carolina	6	2
Shaw University	1	-
Ohio Normal University	4	2
Cincinnati College of Pharmacy	7	2
Cleveland School of Pharmacy	3	2
Ohio State University	11	20
Scio College	3	4
University of Oklahoma	1	1
Oregon Agricultural College	7	5
Medico-Chirurgical College	5	7
Philadelphia College of Pharmacy	5	6
Pittsburgh College of Pharmacy	5	3
Medical College of South Carolina	4	2
South Dakota Agricultural College	4	-
University of Tennessee	4	0
Central Tennessee College (Meharry)	3	1
Vanderbilt University	5	4
University of Texas	3	1
University College of Medicine (Virginia)	4	6
Medical College of Virginia	5	2
Washington Agricultural College	4	2
University of Wisconsin	20	10

(Report of the Commissioner of Education for 1899-1900, 2008 ff.)

These data are summarized below by regions, with a comparison of pharmacy, dentistry and medicine nationally:

Pharmacy	Schools	Professors	Special or Assistant Instructors
North Atlantic	10	58	62
South Atlantic	9	34	21
South Central	9	31	12
North Central	21	136	100
Western	4	19	20
Total U. S.	53	278	215
Dentistry, U. S.	54	569	549
Regular Medicine, U.S.	121	2,085	1,460

Twenty-four teachers now, at the end of the century, carried on the work at an "average" medical school. In a school of pharmacy the average staff, including special and assistant instructors, totaled about 9.3—roughly a three-fold increase since 1870. The average enrollment—for whatever that figure may be worth—had increased about 60 per cent over the number of students studying pharmacy in 1870.[252]

The size of the pharmacy faculties increased at about the same rate during the last five years, it will be noted, as in the previous five years.

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252 - In 1870, 512 students were enrolled in 10 schools reporting; in 1897, 3,426 in 43 schools.

Experimental Work by Teachers. The breadth and depth of experimental work carried on by the teachers in a professional field helps measure its level and its vigor of development. To what extent and in what way did American pharmaceutical education of the 19th century search out new knowledge about the medical armamentarium, or shove forward the pharmaceutical sciences concerned? There has been no serious attempt to assess the American contribution, historically; although we do find well-wrought fragments in studies of outstanding men or schools, and general impressions of the experimental work in certain periods.

At present, then, it seemed that a broader foundation should be laid for evaluating what teachers did in their laboratories, and at least a beginning made toward interpretation. If we try to sketch a fairly broad or complete picture of 19th-century contributions, several problems arise that can be solved only partially.

When a man serves on more than one faculty, for example,—so common in the early period—through which professional medium, or institution, has his published contribution arisen?

A perusal of the literature may also bog down in the 19th-century flow of prolix but uncriginal writings. Shall we count, much less evaluate, the host of accounts restricted to pharmaceutical art or gadgetry?

How such questions are met qualifies the meaning of a fairly systematic survey such as attempted in connection with the present study. Some statement of method therefore seems a necessary guide, and warning, in viewing Appendix C (also A and B) and the generalizations drawn from them.

Method of Surveying Experimental Work. As a useful tool in the survey of investigations and in exploring other facets of our story, faculty lists were compiled that appear as Appendix A (see p. 527). Sources and limitations of the charts are mentioned at that place. In the first section, faculties are charted up to 1870 for each association school founded prior to that date, plus the early course at the Medical College of Louisiana. From 1870 on, the charts show faculty members—and, within the limitations of a chart, their chairs—at two leading association schools and two leading state university schools. These schools are generally recognized as among the most outstanding schools of each type in the period concerned; hence they are not "representative" of pharmacy schools as a group, but are presumed to represent the best that was achieved from 1870 to 1900. This must be borne in mind in viewing the experimental work reported for that period.

To obtain information on faculty investigations and student theses, the American Journal of Pharmacy was searched systematically (i.e., by paging through the volumes) up to 1870. At this point the systematic search for student theses was discontinued;[253] in the continuing search for faculty papers it was felt that indices could be used. The faculty lists (Appendix A) were thus checked against the American Journal of Science and Arts, 1818 to 1900; The Chemical Gazette, or Journal of Practical Chemistry, 1842 to discontinuance in 1856; Proceedings of the American Pharmaceutical Association, 1852 to 1900; and the American Journal of Pharmacy (continuation) 1870 to 1880. It was now decided that for

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253 - The resulting abstracts of student work, and those from spot checks in the later period, are discussed on pages 447 ff.

completeness the faculty lists should be checked against the Catalogue of Scientific Papers...Compiled and Published by the Royal Society of London (Series I, 6 vols., 1800-1863; Series II, 2 vols., 1864-1873; Series III, 3 vols., 1874-1883; Supplementary Volume, 1800-1883; and Series IV, 7 vols., 1883-1900).

The search as a whole aimed, first, at identifying papers published by teachers while teaching at the schools and within the periods covered by Appendix A and that were "original contributions." All papers not shown by index titles to be outside this scope, in all probability, were read or scanned in the original publications, and abstracted.[254] These abstracts appear as Appendix C (see p. 556).

The basis for deciding which papers should be termed "original," for the present purpose, may be characterized mainly by negative criteria. The following types of faculty publications were not considered sufficiently "original" to abstract or to include in the summary data:

a) new or modified formulas (i.e., drug combinations) based only on trial and error methods, and using standard prescription drugs and procedures;

b) modified pharmaceutical processes involving no systematic experiment or theoretical consideration;

c) literature reviews or confirmation of observations by others, unless including significant critical comment or supplementation based on the reviewer's own work;

d) results of standard assays of common products; (however, reports involving new or improved assay procedures, or the use of old

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254 - Papers published during the year following a man's resignation from the faculty were abstracted on the ground that a substantial part of such work probably was done while still connected with the school.

procedures to analyze botanical or other drugs not hitherto well studied, were abstracted);
e) reports on manufacturing experiences or on modified use of pharmaceutical equipment, unless based on scientific knowledge or involving more than a craft skill.

Not the least of the disadvantages of this scheme is of course the difficulty of holding to a single standard or level of selection throughout the search. Then, too, the gradations in type and quality of papers are numberless. Any misjudgments may be expected on the side of inclusiveness. Because of these limitations, as far as the amount of experimental work may be considered, the numbers of "original contributions" should be viewed as relative magnitudes rather than precise figures.

The selective criteria do offer, however, a more meaningful and manageable array of data than would be produced by including the host of ephemeral comments, notes and reviews also reported by these teachers.

The further limitation of the scope to research conducted while teaching at a pharmacy school has yielded, I believe, more pertinent data for our purposes than a composite of life-time researches. The latter naturally offers a broader, more balanced, picture of the men, but would further distort possible relationships between the research and the schools. Some men, for example, severed their connection with pharmacy schools before reaching their full stature and research productivity.

And though we know what experimental work was done while teaching, it is even then not self-evident what the influences and relationships were concerning pharmaceutical education—especially in the earlier decades. There does emerge a clearer,

more confident impression of the stature of the teachers (as individuals and as faculty groups), of the direction of their scientific interests, of the changing type and quality of investigations at different periods in pharmaceutical circles, and the relative contribution made by different fields related to or applied to pharmacy.

The method used in compiling Appendix B should be mentioned before making a few comments on some of this material. Appendix B (p. 549) exhibits an alphabetic tabulation of all teachers as one group (who were charted by schools in Appendix A). The table shows, for each teacher, the school with which a man was affiliated, the span of years he taught, his total output of papers during the century (1800-1900), and whether or not abstracts of some of his papers may be found in Appendix C. The "total output of papers" excludes "such papers as were merely literary, technical or professional..."[255]

These data were obtained by checking the faculty charts against the four series of the Royal Society's Catalogue, without regard (in this part of the study) for the particular years that a man was connected with pharmaceutical education. Occasional discrepancies between my figures and the total shown in the Catalogue, at the last publication of an author, result from my inclusion of co-authored papers whenever the teacher concerned was the senior author. It may be noted that a majority of the papers had nothing to do with pharmacy.

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255 - A criterion used in Catalogue of Scientific Papers (1800-1863) Compiled and Published by the Royal Society of London, vol. 1 (London, 1867), vii.

The Royal Society's Catalogue began by abstracting what I estimate to be a list of about 1300 periodicals. With each succeeding series this list was enlarged. Thus we may assume that the Catalogue identifies most of the significant papers, excluding (as noted) the purely "literary, technical, or professional." This standard resembles the one applied in abstracting papers for Appendix C but is not so rigorous. The Catalogue compilers, like the present writer, tried to apply a standard "so as to admit rather than exclude any matter as to which there might be a doubt."256

After the first series of the Royal Society's Catalogue (ending with publications of 1863) its compilers no longer indexed the Proceedings of the American Pharmaceutical Association. It was found that this omission distorted the picture significantly. Therefore the totals have been adjusted by reference to the General Index to Volumes One to Fifty of the Proceedings of the American Pharmaceutical Association from 1852 to 1902 Inclusive. Under the name of each teacher those papers were counted, for the period not covered by the Royal Society's Catalogue, which in my judgment (based on titles alone) probably would have been listed by a Royal Society cataloguer. Although I believe the results are reasonably satisfactory, there may be some error on the side of inclusiveness. To reveal the magnitude of additions from the Association's Proceedings and to permit others to check the data if they wish, I have shown in parentheses (adjacent to the total for each teacher) the number of papers counted in the total that are not listed in the Royal Society's Catalogue.

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256 - Catalogue of Scientific Papers..., vii.

Comments on the Survey of Experimental Work. Although the investigations conducted tell us quite a bit about the teachers in spheres previously mentioned, their precise meaning for pharmacy and education remains rather elusive until well after 1870 because of the frequent casual relationship between teacher and school. The extent to which investigations related to pharmacy and/or appeared in pharmaceutical journals thus takes on special interest. That the teachers of the Philadelphia College, for example, closely identified themselves with pharmacy and the College--despite divergent backgrounds--is confirmed by the fact that up to 1870 only one paper out of nine was unrelated to pharmacy and did not appear in the pharmaceutical literature.[257] Moreover, all of the exceptions were authored by a single chemistry teacher, Gerard Troost, a highly competent man of pharmaceutico-medical background but whose interest had developed in the direction of geology and mineralogy.[258]

Although the publication output of Philadelphia teachers was exceeded at one or the other school in a particular decade, no other institution shows a comparable consistent and developing research effort on the part of the teachers. It is noteworthy that a third of the original papers published by Philadelphia teachers up to 1870 were not only in plant chemistry but dealt with indigenous drugs. This flow of papers began in the 1840's when Procter started to emphasize the importance of the proximate plant principles as a focus for both teaching and investigation.

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257 - Philadelphia teachers had a publication medium conveniently at hand, since the College founded and published the American Journal of Pharmacy, up to 1852 the only American periodical exclusively devoted to professional and scientific pharmacy.

258 - "Gerard Troost," The National Cyclopaedia of American Biography, vol. VII, 349.

In 1853 James C. Ayer voiced this point of view in the American Journal of Pharmacy. "Perhaps no subject within the range of their art," he said, "is better worth the attention of pharmaceutists at the present time, than the elimination of the curative proximate principles of medicine into purity, and their application to practical purposes...Since almost all the vegetable remedies do owe their activity to this cause [i.e., alkaloid or other proximate principle], it may be seen how large a proportion of all the medicines in use are as unskilfully given as would be the grinding of corn, cob, husk, stalk and root into meal, while the kernel only can nourish."259

This special task of the pharmacist had received ready recognition from the eminent physbian, George B. Wood, who once taught materia medica and pharmacy at the Philadelphia College, when he told his medical students at the University of Pennsylvania, "...Few medical men, and none who have not devoted an especial attention to practical chemistry, are capable of conducting successfully those complex and delicate processes which are essential to accurate analysis, especially of organic products. This part of the investigation may, therefore, with propriety be left to the pharmaceutical chemist..."260

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259 - James C. Ayer, "The Alkaloids and Proximate Principles," Amer. J. Pharm., 25: 407, 1853.

260 - George B. Wood, "Introductory Lecture to the Course of Materia Medica in the University of Pennsylvania," Amer. J. Pharm., 12: 320, 1840. All agreed on the importance of results to be achieved, but sometimes in different ways. The professor of chemistry at the Maryland College in 1859, Lewis H. Steiner, felt that "The discovery of these proximate principles has dealt a death blow to that form of quackery which has boasted of the minuteness of the dose in which it [i.e., homeopathy] administers its medicaments..." (Lewis H. Steiner, "The Pharmacy of Two Hundred Years Ago Compared with the Pharmacy of the Present Day...Valedictory Address...," J. and Transac. Md. Coll. Pharm., 1: 110, 1859.)

Concerning the chemical analysis of plants indigenous to the United States, Wood also pointed out that "We are indebted for them chiefly to the graduates of the Philadelphia College of Pharmacy, which appears to have afforded to its students the same stimulus, in their particular pursuit, which was exerted by our own school" at the University of Pennsylvania in an earlier period.[261]

The student George M. Hambright, who later became professor of materia medica at the Chicago College, offers a glimpse of the attitude of Philadelphia teachers when he says Professor Thomas told his class "that American practitioners, instead of employing our indigenous plants, prefer using those from a foreign country, which are not so good but much more expensive."[262]

Both teachers and students at Philadelphia took a long lead in this field, although after 1880 the pharmaceutico-botanical orientation given to the New York school brought an active emulation in the exploration of American flora.

The emphasis upon the chemistry of indigenous plants at Philadelphia in the period to 1870 overshadowed inorganic chemistry, only five papers being published in this field; another five were botanical studies.

The output in plant chemistry was nearly equalled by the twelve original contributions in applied pharmacy that appeared after Procter assumed the chair in pharmacy. Some of the other papers, as might be expected, also overlap this category.

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261 - Wood, loc. cit., 310 f.

262 - Quoted by George M. Hambright, "The Bark of the Root of Myrica Cerifera" (inaugural essay), Amer. J. Pharm., 35: 201, 1863.

Procter's first original paper in the year he began to teach describes work on "monardin," which reflects both his ability as a master pharmacist and his limitations. There he reports the physical constants and the reaction with various reagents of a crystalline deposit from the volatile oil of Monarda punctata (horsemint), which had been noticed by druggists. Procter then recognizes that "A careful ultimate analysis of the oil, and of the deposit would do much to throw light on this subject."[263] Therein lies a pivotal limitation of the experimental work of this kind; American limitations in both education and equipment blocked the carrying of analytical work to the conclusion expected and experienced by European colleagues.

This pervades Procter's well-known work identifying the volatile oil of Gaultheria procumbens with "salicylous" acid. He felt the need for ultimate analysis to confirm his conclusions, "which the want of accurate instruments has caused the author to defer to a future period."[264] It remained for the Frenchman Cahours to show by ultimate analysis that the oil probably did have the same composition as methyl salicylate.

Besides his scientific endeavors, Procter published many articles on practical, or applied, pharmacy that do not represent real experiment or significant original observations. While not within the scope of Appendix C, such contributions often were of the highest professional caliber. Representing this type of publication are his critical discussions of the process for reducing iron by hydrogen[265] and his description of a method for making French cucumber ointment based on his own professional experience.[266]

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263 - William Procter, Jr., "Observations on Monardin, a Peculiar Crystalline substance, Derived from the Volatile Oil of Monarda punctata," Amer. J. Pharm., 17: 89, 1846.
264 - William Procter, Jr., Amer. J. Pharm., 14: 221, 1843.
265 - Amer. J. Pharm., 19: 11-16, 1847.
266 - Amer. J. Pharm., 19: 16-17, 1847.

John M. Maisch likewise had a prolific, widely ranging pen. While 69 of his articles were within the scope of Appendix B, only 19 were abstracted for Appendix C. Maisch was fond of writing chatty notes about the medicinal plants he knew so well, identifying a specimen, noting new uses, commenting on reports in a wide range of literature.

The same may be said for the outstanding pharmacist-teacher at the Maryland College, Israel J. Grahame, whose work lay mostly outside of both Appendix B and C, only three papers being noted during the century. Yet, he contributed eleven articles to the American Journal of Pharmacy during his incumbency at the Maryland College, all of them on practical pharmacy---suggesting some change in menstruum, an alteration in procedure for greater elegance, or perhaps a "hitherto unpublished" formula for a medicament. A perusal of the short-lived Journal and Transactions of the Maryland College of Pharmacy (1858-1862) shows a similar focus of attention in the work of Grahame and other teachers. Indeed, the one paper from Maryland admitted to Appendix C is hardly within the defined scope (Steiner's critical discussion of disinfectants).

Critical discussion of the professional-scientific literature, exchange of information, and a stimulus to experimental work stemmed from the regular "Pharmaceutical Meetings" held by a number of the colleges of pharmacy as a supplement to the general meetings for the membership.

At the New York College there was little original investigation among the teachers until the 1860's, when experimental work flowered in the hands of John M. Maisch and particularly of the pharmacist-chemist Ferdinand F. Mayer. It was during this period that Mayer published his work on the use of iodohydrargyrate of potassium (Mayer's Reagent) for the quantitative determination of

vegetable alkaloids. Although this work rested upon preliminary studies abroad (see abstracts), Mayer cultivated the field of alkaloidal assays with considerable originality. Half the papers (10) issuing from New York before 1870 lay in the field of plant chemistry; three were classified as organic chemistry; there were five in inorganic chemistry; two in biology on the diatoms, but none in botany during this period. A fifth of the New York papers were unrelated to pharmacy; a majority (13 of 20) appeared in pharmaceutical journals.

Among other schools that began teaching pharmacy before 1870 only the staff at the Medical College of Louisiana showed much experimental activity. Pharmacy was a sideline for this institution, in which the professors simultaneously served students of both medicine and pharmacy. That their interests lay in the former field finds one expression in the ten experimental papers, none of which was related to pharmacy and none of which was published in pharmaceutical journals.

Only two papers were noted in this period that reported any clinical or pharmacologic testing. In the one trial a teacher tried the drug on himself; in the other, tests were made through the cooperation of medical friends.

After 1870 at the Philadelphia College research activity among the teachers continued at about the same pace as in the previous two decades; then in the 1890's there was an upsurge of activity, almost a four-fold increase over former decades. A similar, even greater, difference in the research output between the 1880's and 1890's occurred at the universities of Michigan and Wisconsin. The New York group showed no such development, the number of papers within the scope of Appendix C even falling off

somewhat during the final decade. During the 1890's—the only full decade during which both the university schools as well as the two association schools were operating—the Philadelphia staff published 40 original papers; the New York College, 8; Michigan, 50; and Wisconsin, 70.

The conscientious devotion of the Philadelphia College to work in and for pharmacy shows up strikingly in the number of papers related to pharmacy and published in the pharmacists' own journals. Of the two university schools and two association schools surveyed (1870-1900) only the Philadelphia teachers staked out a majority of their projects in fields defined as obviously related to pharmacy and published a majority of their reports in pharmaceutical journals.

Of the 22 papers from the New York College 14 were considered unrelated to pharmacy and only five were published in pharmaceutical journals. Of 75 papers from the University of Michigan pharmacy faculty 53 were considered unrelated to pharmacy and only 18 were published in pharmaceutical journals. Of 82 papers from the University of Wisconsin 68 were considered unrelated to pharmacy and only 8 were published in pharmaceutical journals. In the case of Wisconsin this is somewhat misleading, however, since 24 papers classified (but not abstracted) were from members of the pharmacy faculty who held chairs in mineralogy, geology and metallurgy; excluding these, a little more than half the projects of the Wisconsin faculty had an obvious relationship to pharmacy.

Plant chemistry continued to hold first place in the research interests at the Philadelphia College, with 39 (of 67) papers in this field. Most of the other papers at Philadelphia were botanical (23). Thirty-eight dealt with indigenous drugs.

In proportion to the total papers abstracted, New York placed even heavier stress on the study of indigenous drugs, most of them botanical studies (16 of 22 papers were botanical). This emphasis would appear stronger had the serialized reports by H. H. Rusby on the identification of plants collected during his South American expedition been listed separately rather than as a single contribution. Rusby published other papers that, although not included in Appendix C, were no less distinguished. For example, his "Comparison of the English and German Works on the Genera of Plants, with Special Reference to the United States Pharmacopoeia" led the chairman of the Scientific Section of the American Pharmaceutical Association to remark, following its presentation, that the paper "contains material that few of us have the mastery sufficiently to discuss it intelligently."267

Organic chemistry began to receive much attention at the university schools in the 1890's, 29 papers issuing in this field from the pharmacy faculty at Michigan (1870-1900) and 11 papers from Wisconsin; at New York and Philadelphia only four and two papers, respectively, were classed in this field. Inorganic chemistry received notable attention only at the University of Michigan, totaling 20 papers, while the other schools offered only one or two papers.

Physiological investigations held a significant place at Wisconsin toward the end of the century (18 papers), stemming mostly from the work of Rodney True and given a physico-chemical orientation by Louis Kahlenberg.

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267 - H. H. Rusby, "Comparison of the English and German Works on the Genera of Plants...," Proc. Amer. Pharm. Assoc., 46: 242-255, 1898.

Although a number of papers were related to or extended into applied pharmacy during the final three decades only five papers were noted that were sufficiently confined to this field, and original, to be tabulated as such: four at Philadelphia and one at New York.

Only four papers were noted that included reports on pharmacologic or clinical testing, all from the University of Michigan.

In general the difference in research level and momentum between the leading association schools and university schools seems clear, although the association schools offered many notable men and contributions. Only the university schools were prepared to enter the field of organic chemistry, burgeoning with promise for expansion of the drug armamentarium. On the other hand the association schools generally seem to have cultivated more faithfully fields closely identified with pharmacy's professional interests.

Highly specialized men, appointed by a university to the pharmacy faculty for teaching one of the supporting sciences, retained basic research interests that never developed any connection with pharmaceutical problems.

Even research on pharmaceutical problems, by the end of the century, could hardly hope to maintain contact with the professional practitioner. The day of the backroom laboratory and semi-amateur experimenter was largely past.

Researchers of pharmaceutical background in the schools continued to identify themselves with pharmacy, indeed as the highest expression of it. Those practicing pharmacists who continued to sit, conscientiously, through Scientific Section meetings of the American Pharmaceutical Association understood little of what was going on. They no longer felt at home and did

not especially like it.

To such protests H. H. Rusby of the New York College replied that scientific "conditions have so materially changed that the same class of work which could in the past satisfy the requirements of this section is no longer sufficient or even appropriate.

"We need not be reminded that a great body of pharmacists will be slow to recognize the reality of the new era and that many of them will never do so...People who clamor for something easy are in reality after something still easier than that for which they clamor...It is these same people who would deny Pharmacy a position among the learned professions, by holding open a sort of back-door for a surreptitious entrance to her halls without paying the price of a professional preparation.

"If then it is true that it is the highest and best which most truly represents American Pharmacy, surely it is in the Scientific Section of the American Pharmaceutical Association, its most characteristic representative, that we should look for the best that American Pharmacy can produce and for the highest ideals of which it can conceive. Here at least no expression should ever be found acceptable which implies that any scientific aspiration is out of place."

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268 - H. H. Rusby, "Chairman's Address," Proc. Amer. Pharm. Assoc., 47: 146 f., 1899.

IX. HOME STUDY

No discussion of pharmaceutical education in the 19th century would be complete without mentioning the "courses" of home study. While correspondence schools have covered a wide range of vocational endeavor in American life, similar attempts at more or less systematic study at home in pharmacy are rather unusual for two reasons: first, because of the casual and inherently inadequate method of dealing with a technico-scientific field where ignorance and incompetence suggests grave social consequences; secondly, because of the respectability and even active support gained by such attempts among men of the highest competence and aspirations in pharmacy.

The importance attached to home study methods in 19th-century pharmacy rested largely on the assumption that some systematic and guided study was better than none at all, since formal education was not compulsory. The growing popularity of home-study courses toward the end of the century was rooted in the examinations now required for licensure, however modest, and was bolstered by means of mass promotion.

As early as the 1850's when only four institutions were offering regular courses, the American Pharmaceutical Association, through a committee headed by William Procter, Jr., carried to its members suggestions and material encouraging home study among apprentices.[1]

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1 - William Procter, Jr., et al, "Syllabus of a Course of Study, Intended as an Aid to Students of Pharmacy, Who Cannot Avail Themselves of Regular Instruction, Being a Report Made to the American Pharmaceutical Association," Proc. Amer. Pharm. Assoc., 7: 103-168, 1858.

Still in 1870 Procter observed as editor of the American Journal of Pharmacy that "It is not to be expected that a large proportion of students of pharmacy can get the tuition they need in college schools, and it is time that some efforts should be directed by disinterested members of our profession towards encouraging this home effort among the present generation of apprentices and assistants."[2] He himself contributed to this aim three years later in an essay "Suggestions to Beginners in Pharmacy," which offered practical advice to the isolated apprentice who would become a pharmaceutist without entering the doors of a college.[3]

The pressing need for better informed pharmaceutical novices in a society where only a minority would obtain, or strive for, a formal education barred disdainful attitudes toward home study even in professorial chairs.

Not until the 1880's did the idea of home study emerge as a systematized, commercialized, consistently promoted venture. This development has been concisely and incisively viewed in the Kremers and Urdang History of Pharmacy.[4] The following discussion summarizes and supplements, and offers the interested reader a guide to some primary sources.

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2 - Editorial Department, Amer. J. Pharm., 42: 378, 1870.

3 - William Procter, Jr., "Suggestions to Beginners in Pharmacy," Proc. Amer. Pharm. Assoc., 21: 523-532, 1873.

4 - E. Kremers and G. Urdang, History of Pharmacy, 300-305.

The highly publicized home-study courses did not infuse American pharmacy with a flow of substandard practitioners. On the contrary the large majority of recruits had always entered through the door of apprenticeship and of casual self-education that was now made more convenient if not even more adequate. When state examinations were making uneducated apprentices uneasy, however, the new mail-order courses did undoubtedly implant confidence that there was an easier, cheaper way to education than the toilsome one offered by formal education.

The first widely patronized enterprise was the National Institute of Pharmacy, begun in 1885 and directed by C. S. N. Hallberg, after 1890 professor at the Chicago College of Pharmacy.[5]

An early announcement pointed out that while the apprentice aspired to "penetrate the mysteries of science...the opportunities for the realization of this ambition are with many persons necessarily limited; especially is this the case with those removed from the advantages of city life." Since "a great many druggists, clerks and apprentices are so situated as to render attendance at a college of pharmacy impracticable, the National Institute of Pharmacy has designed a course of instruction based primarily upon a series of lectures, to be mailed to the subscribers twice each month."[6]

At the end of each "term" the student answered a series of questions. Success earned for him a "Certificate of Graduation in the Institute." This was admittedly without "any legal force whatever...the great advantage in this respect to be derived from the lectures being to qualify members for passing Board of Pharmacy examinations."[7]

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5 - England, The First Century, 195.

6 - Announcement of the National Institute of Pharmacy. A Course of Instruction in Pharmacy, Chemistry and Materia Medica. Lectures by Mail (Chicago, 1886-87), 1 f.

7 - Ibid., 3.

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The National Institute of Pharmacy supplies a course of *Home* Study at once thorough, practical and inexpensive. It consists of

PRINTED LECTURES MAILED SEMI-MONTHLY

to students, there being two terms of twelve lectures each, the full course occupying therefore a period of one year.

In addition to the intrinsic value of the Lectures, which embody the utmost information in the most concise form, and which represent the work of experienced teachers in their respective departments, the Institute system has the unique advantage of frequent *individual examinations* in the form of questions regularly mailed to students, which serve to stimulate regular work and enforce experience in *reducing thoughts to writing.* These written examinations, therefore, afford training in careful reading, accurate habits of thought, exact and concise expression—in short, the very training needed for a Board examination, for scientific literary work in after life, or for work in the drug store.

OPINIONS BY BOARDS AND STUDENTS.

BY MEMBERS OF BOARDS.

"We have examined a number of your students and their ratings have been creditable to you and themselves."—W. C. JOHNSTON of Kansas Board, Manhattan, Kan.

"To the drug clerk, or apprentice, or even to the proprietor who desires to 'brush up,' the lectures of your Institute are invaluable."—CHAS. A. BUGBEE of Michigan Board, Cheboygan, Mich.

"The Institute has been of great benefit to a number acquaintances."—GEO. F. PAYNE, Member of Georgia Board, Prof. of Pharmacy, Atlanta Med. College, etc.

"I can honestly and heartily recommend the course."—H. M. DUDLEY, Woonsocket, Member Rhode Island Board.

"I have taken occasion to commend these lectures, and shall continue to do so, believing them to be invaluable."—R. H. GORDON, Pres. Tennessee Board.

"I am persuaded that the success of many applicants for license is made possible by the great advantage derived from your systematic course of instruction."—HARRY SHARP, Georgia Board, Atlanta, Ga.

"I can and do recommend the course of instruction of the National Institute of Pharmacy as a splendid method for home study."—FRANK FLEURY, Secretary Illinois Board of Pharmacy.

"To those who can afford neither the means nor the time for a regular course in a school of pharmacy this course is highly desirable."—Michigan Board of Pharmacy.

"I am clearly of the opinion that your method affords a means by which all can, if so disposed, acquire an absolutely correct and thorough knowledge of practical pharmacy."—H. M. WHITNEY, Lawrence, President Massachusetts Board.

"The Board believes these lectures will be of invaluable assistance to those who expect to become pharmacists."—From Annual Report of the Rhode Island Board of Pharmacy to the General Assembly.

BY STUDENTS.

"I passed the State Board examination here last month and attribute my success to the lectures."—GEO. S. LANDIS, Harrisburg, Pa.

"I must testify to having received much knowledge from the course."—F. W. WARWICK, Buckingham, Quebec.

"I can say truly the lectures have done me more good than four years' study of text-books."—FRANCIS M. WEAVER, Greeley, Kan.

"I have successfully passed an examination before the Nova Scotia Pharmaceutical Society."—F. A. RUDDERHAM, North Sidney, Nova Scotia, Can.

"Every man contemplating going before a board of pharmacy ought to take a course of your lectures."—C. J. SCHUDDE, Fort Lee, N. J.

"The lectures were a great help to me in passing the New York examination."—E. J. NICHOLS, Cincinnatus, N. Y.

"I would not, if I were offered, take $500 for what I have derived from your lectures."—G. B. MCC. HOWE, Evansville, Ind.

"I successfully passed the Pennsylvania Board of Pharmacy."—W. CLARK TAYLOR, Vineland, N. J.

"I passed the Massachusetts Board and also the New Hampshire Board."—N. M. DECHENE, Fitchburg, Mass.

"I certainly must confess that the Institute course has been a greater source of benefit to me than all text-books."—EMIL A. FALTYS, Schuyler, Neb.

"Permit me to express the wish that your work may be as helpful to very many others as it has been to me."—MARY A. GILMAN, 2 Myrtle street, Medford, Mass.

"I attended the recent examination of the Michigan Board of Pharmacy and easily passed. I have studied your lectures one year and can heartily recommend them."—JUDSON H. SCOTT, Carland, Mich.

All classes begin with Lecture I, Term I, and a new class is formed about every month, so that students may, as a rule, begin the course at the time best suited to their convenience.

Announcement giving full particulars of the method, course, lectures, cost, etc., mailed free upon application.

NATIONAL INSTITUTE OF PHARMACY, CHICAGO.
358-362 Dearborn Street.

From The Western Druggist
U. W. Neg. No. 7583-B

A typical advertisement of the late 19th century for one of the better known correspondence courses in pharmacy.

The lectures were arranged "to be as easily understood as the subjects treated will admit." Nevertheless a perusal of the lessons received by students shows a level and seriousness of purpose far above many other "courses" and "quiz compends" promoted later on.[8]

The course, designed for a year's study, cost $15. Curiously, pharmacy was studied first, then the more basic subjects of materia medica and chemistry.[9] This sequence may have stemmed from the circumstance that "of all of those who subscribe for the lectures, by far the largest number simply finish the first term--that is the lectures on pharmacy. Of these such as have the necessary experience usually pass the board of pharmacy examinations, and then not infrequently defer further study."[10]

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8 - C. S. N. Hallberg, National Institute of Pharmacy. The First Term, Presenting a series of twelve lectures on Pharmacy (Chicago, 1890), 3. See this and the following companion volumes for the material students actually studied: E. S. Bastin, Lectures on Botany and Materia Medica. National Institute of Pharmacy (Chicago, n.d.), 430 pp.; and C. S. N. Hallberg, Director [author?] Lectures on Chemistry. National Institute of Pharmacy (Chicago, n.d.), 246 pp.

9 - "The National Institute of Pharmacy Course of Home Study," The Western Druggist, 19: 243, 1897; and Announcement of the National Institute of Pharmacy, 1890, 8.

10 - "The National Institute of Pharmacy," Western Druggist, 20: 85 f., 1898. The Western Druggist, of which Hallberg was editor when the venture began, offered strong editorial support; and its publisher, G. P. Engelhard and Company, also published the Institute lectures.

Promotional efforts for the correspondence course were by no means directed only to pharmacists and their apprentices; the course was also "pre-eminently adapted to physicians who desire to qualify themselves for a Board of Pharmacy examination."[11]

Another course that gained prominence was conducted along similar lines by a journal, the Pharmaceutical Era. In the mid-nineties this journal published informative essays serially, authored by some of the best teachers in the regular schools of pharmacy. In 1897 its publishers decided to launch a more ambitious enterprise, "The Era Course in Pharmacy," consisting "of a graded and systematic series of lectures covering the subjects usually embraced in the curriculum of a standard college of pharmacy, delivered by teachers of long experience and wide reputation, and through the medium of the Pharmaceutical Era brought each week in printed form to the home student." Aside from the subscription price, the cost was ten cents a week for quizzes and examinations conducted by mail. Besides the written examinations students were urged to form local groups to discuss the "lectures" and quiz each other.[12]

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11 - "National Institute of Pharmacy" (advertisement), Western Druggist, 15: 46 (December 15), 1893.

12 - "The Era Course in Pharmacy," Pharm. Era, 17: 619 f. and 40, 1897. The Era made good on its promise to offer a "faculty" of "long experience and wide reputation"; included were such men as Virgil Coblentz of the New York College; Arthur L. Green of Purdue; George B. Kauffman of Ohio State; Edward Kremers of Wisconsin; John Uri Lloyd of the Eclectic Medical Institute of Cincinnati; E. A. Ruddiman of Vanderbilt, Wilbur L. Scoville of the Massachusetts College, and Frederick J. Wulling of the University of Minnesota. Hallberg's Institute had the cooperation of Frederick B. Power of Wisconsin as well as Edson S. Bastin of the Chicago College.

Students had "most gratifying success," it was claimed, "and have been enabled to obtain a thorough knowledge of pharmacy and pass State Board Examinations." This involved "a few hours' study each day...without interfering with the usual duties of the average drug clerk or apprentice."[13]

The development of "extension work" in general education, beginning around 1890,[14] may have offered inspiration to--or at least a means of justifying--such courses. Oscar Oldberg of the Northwestern University school said in 1891: "The application of the principles of University Extension to courses of study specially useful to pharmacists is destined ere long to arrest the thoughtful attention of the most intelligent and progressive members of the pharmaceutical fraternity of the United States." He felt that it was not an adequate substitute for college study and laboratory work, but better than no education and better than the poorer schools.[15]

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13 - [Advertisement], Pharm. Era, 21: 874, 1899.

14 - Report of the Commissioner of Education for 1899-1900, 303. The idea of extension study, apparently taken over from England, received early public discussion at the 1887 meeting of the American Library Association, was pioneered by the University of the State of New York beginning in 1891, and developed extensively by the University of Chicago.

15 - Oscar Oldberg, "The Principles of University and School Extension Applied to Pharmaceutical Studies," The Apothecary, 1: 3, 1891.

That same year Oldberg issued his popular book, A Course of Home Study for Pharmacists, which for $3 and between two covers offered material similar to courses previously mentioned. The student found therein 105 pages on pharmaceutical physics, 204 pages on chemistry, 101 pages on materia medica, and 84 pages on the elements of pharmacy.[16]

Upon publication of Professor Oldberg's book, his school, the Illinois College of Pharmacy (Northwestern University), offered "courses of preliminary study" by correspondence, using "this elementary work as a textbook" and conducting examinations by mail.[17]

The several courses mentioned usually suggested preliminary reading in standard texts and encouraged or helped students to conduct simple chemical experiments in the drugstore and use specimens in connection with the readings on botany and materia medica. Moreover, they did not ordinarily claim to be an adequate substitute for college education.[18]

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16 - Oscar Oldberg, A Course of Home Study for Pharmacists (Chicago, 1891, 523 pp). Kremers and Urdang point out that this volume had been preceded by Oldberg's Outline of a Course of Study in Practical Pharmacy, which offered recommendations for "students who are reading pharmacy without the aid of a teacher."

17 - "Courses of Home Study in Pharmacy," The Apothecary, 1: 28-30, 1891. The Apothecary, which favorably publicized this program and the book, was published (1891-97) by the Illinois College.

18 - E. g., Oldberg, op. cit., v.

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A COURSE

OF

HOME STUDY FOR PHARMACISTS

FIRST LESSONS

IN THE

STUDY OF PHARMACY.

BY

OSCAR OLDBERG, P. D.,

PROFESSOR OF PHARMACY AND DIRECTOR OF THE PHARMACEUTICAL LABORATORIES IN THE DEPARTMENT OF PHARMACY OF NORTHWESTERN UNIVERSITY (ILLINOIS COLLEGE OF PHARMACY); MEMBER OF THE COMMITTEE OF REVISION AND PUBLICATION OF THE PHARMACOPŒIA OF THE UNITED STATES.

WITH 150 ILLUSTRATIONS.

CHICAGO:

PUBLISHED BY THE APOTHECARIES' COMPANY.

U. W. Neg. No. 51155-C

Titlepage of first edition (1891) of a widely used book for home study. The author cautions apprentices that "The best way to acquire a pharmaceutical education is to attend a good college of pharmacy."

By no means all of such schemes maintained an aspect of respectability. Toward the end of the century the apprentice was confronted by a growing variety of cram schools, "quiz compends," and blatantly promoted correspondence courses. Although a large segment of drug journals did not hesitate to accept their advertising, some editors voiced disapproval.

In 1897 the Druggists Circular observed that self-styled teachers "whose chief business it seems to be to 'cram' a student full of answers to anticipated Board questions, have found a foothold..." The editor considered it "questionable whether a course of 'stuffing' with no other object in view than merely to 'pass the Board,' regardless of how or under whose auspices it is done, is not more harmful than beneficial."[19]

Forerunners of shady cram schools had become notorious in the 1870's, mainly through bogus medical schools although pharmacy was not untouched. Men like John Buchanan often by-passed educational formalities entirely and sold diplomas outright, through the device of buying up the charters of defunct schools. Sometime after obtaining a charter in 1867 for the "American University of Philadelphia" Buchanan had extended his operations to include a "College of Pharmacy."[20] At the end of the century enterprising diploma mills were still operating, although harried somewhat by the courts. A gentleman named Armstrong was forced by a supreme court decision in Illinois to abandon his "Independent Medical College" and

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19 - "Our Pharmaceutical Colleges," Drugg. Circ. and Chem. Gaz, 41: lxxx, 1897.

20 - Report of the Commissioner of Education for 1880, clxiii.

start anew as the "Metropolitan Medical College," also as the "Illinois Health University" and as the "Western University." Armstrong's operations, at least under the latter title, included a bogus college of pharmacy. The Western Druggist, in 1899, expressed confidence that a new statute passed would make it easier to prosecute "any corporation conferring degrees or diplomas in the sciences of medicine, dentistry or pharmacy, which conducts a fraudulent business or abuses its powers..."[21]

Although cram schools and diploma mills that required some time in residence did not strictly represent "home study," all shared the concept of helping youths to become pharmacists by the quickest and easiest path. If anything, the cram schools made less pretense or attempt toward imparting a systematic understanding of the subject than the correspondence schools.

A mail-order variant of the cram school that became popular toward the end of the century was the "quiz compend." These slender volumes set the student at the task of memorizing the answers to questions commonly asked by state boards. A representative and early example was the 184-page Compend of Pharmacy by F. E. Stewart, which emphasized nomenclature, definitions and synopses of pharmacopoeial monographs.[22] One ambitious author had collected more than 5,000

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21 - "More About the Illinois Diploma Mills," Western Druggist, 21: 542, 1899; also Western Druggist, 20: 194, 1898.

22 - F. E. Stewart, A Compend of Pharmacy (Philadelphia, 2nd ed., 1888), 184 pp.; said to be based on Remington's Practice of Pharmacy. The book went through many editions, like its counterparts in medicine and other fields which the publisher issued. Graduates and non-graduates alike paid their respects to such revelations of the collective mind of rather unimaginative state boards. Stewart's book, in a later edition, sold for a dollar; but one could get a "complete and systematic course" on How to Get Registered, by Charles L. Mason, for as little as fifty cents.

questions from "all over the Union...The success of any one is insured," the promoter claimed, "if he follows the instructions of this book, which are very plain."23

The whole gamut of courses by correspondence and cram schools continued to flourish until their position was gradually undermined in the 20th century by laws making formal education compulsory. The most that can be said, for the more serious endeavors, is that they simplified and systematized the self-education of probably thousands of youths for whom the schools of pharmacy were a world apart.

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23 - Quoted in "Factory-Made Pharmacists," Pharm. Era, 19: 816, 1898.

CONCLUSION

This thesis offers a view of American pharmaceutical education in its social context, particularly in relation to other professional schools and to general education. Two interrelated characteristics of the emergent vocation of pharmacy as a separate field in the United States, which have remained somewhat in the background, should be pointed to; for they help explain a drag and lag in the evolution of pharmaceutical education that otherwise only can be partially accounted for.

The first had its roots in the extent to which physicians continued to carry on pharmaceutical activities after a group identifying themselves with pharmacy separated out, the latter operating shops for which trade in British and American patent medicines was the economic backbone. This kind of beginning has been conceptualized and underscored by Kremers and Urdang as follows: "The origin and development of European pharmacy was, in general, parallel with professional medicine, as a profession concerned with public health, the non-professional aspects being incidental. To a very great extent, nonprofessional medicine was responsible for the development of American pharmacy as an independent calling, the professional aspects being incidental."[1]

The second and correlative characteristic is perhaps always recognized within American pharmacy but not often frankly faced:

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1 - Kremers and Urdang, History of Pharmacy, 229.

The apothecary supplied qualitatively a necessary social function, recognized as such in perhaps all matured or maturing societies; but the average American apothecary was called upon for an amount of pharmaceutical service that satisfied only a segment of his occupational and economic needs. This circumstance was intensified by a completely free enterprise system (in pharmacy only lightly modified late in the century), wherein the number of practitioners rapidly increased without any direct relationship to the educational system.

These characteristics slowed the process of professionalization and influenced the evolution of pharmaceutical education that we have observed. Our analysis of that evolution permits the summarizing statements that follow:

1. Continental pharmaceutical education reached a stage of rapid development by the early 19th century, based upon an assumption that academic study was necessary for the tasks expected of pharmacy. But the rich texts, active schools and scientific rivalry could not be transferred to America. The British homeland offered the most convenient and adaptable pattern, stressing the practical rather than the academic side of education.

2. Interest in pharmaceutical education arose particularly among the "druggists" of Eastern cities (wholesalers and manufacturers as well as practitioners), who felt some need for more education than that supplied by an apprenticeship lacking whatever system and controls it had had. Outside of this group there was less functional need for systematic or theoretical instruction. And in the public at large, the value attached to free enterprise

more than counterbalanced any desires for educational standards that would assure a greater margin of pharmaceutical safety and competence.

3. The actual beginnings of an educational system were related to the developing educational consciousness of America in the 1820's, which also may have been reflected in the interest of medicine in establishing education for pharmacists. There is some evidence that there were more divergent reactions to such proposals among apothecaries, particularly in connection with the founding of the first school, than commonly recognized.

4. The extent of pharmaceutical education, both in the number of schools and graduates, was more limited than often assumed: Only four of the pioneer colleges (i.e., associations) established systematic instruction before the Civil War, and only two became firmly rooted and showed any vigor; in 1860 not more than 514 pharmacists had graduated from a course in the United States, among about 11,000 who functioned as apothecaries and druggists for 31 million people. Outside of Philadelphia the combined graduation rolls totalled 122 or less.

5. Accidental poisonings sometimes had a tonic effect on the early schools or on efforts to found new ones; dissatisfaction with the pharmaceutical circumstances such tragedies implied found a medium of expression through the American Pharmaceutical Association after 1852.

6. A comparative investigation of all available sources concerning 19th century schools provides more extensive and accurate data than previously available with regard to the founding of schools, their changes of name, affiliations, mergers, location, and demise or present status. In the founding of 83

identified schools, there was an upsurge following the Civil War, a leveling off in the 1870's; then the foundings doubled in the 1880's, and tripled in the 1890's (compared with the 1860's). (This development is shown in relation to population and urban trends.) In the growth of different types of schools between 1860 and 1900 state and private universities shared almost equally in the endeavor. About a fifth fewer schools were founded by the pharmacy colleges; about two-fifths fewer schools arose within medical institutions. Intrusion of the medical schools into pharmaceutical education came mainly in the 1890's and was related to an over-extension of the system of medical education. The founding of state schools received a stimulus from the enactment of state pharmacy laws.

7. The pioneering course at the University of Michigan reflected the tempo and temper of the University as a whole.

8. Between 1860 and 1900 the largest number of schools was founded in the North Central region, closely followed by the South; there were only a fourth as many opened in the West; about two-fifths as many in the Northeastern region. (Regional comparisons of school mortality and population trends are shown.)

9. Although the founding of schools continued at an accelerating pace late in the century, it followed the pattern of development in other professions, both regionally and nationally.

10. Administrators in state schools, unlike the association schools, did not face the problem of combatting intrusion from related fields but rather the problem of gaining their recognition and cooperation within the university community. Association schools were linked closely with the "practical side of the business"

because administrative power centered in apothecary-trustees. Few independent schools were very profitable financially, although there is room for further investigation. Most schools that were "affiliated" with universities exhibited the characteristics of association schools.

11. Teachers were rarely well paid, especially before the Civil War. Salaries at new state universities were not much better than at strong independent schools.

12. Student fees did not rise sharply after the Civil War, being about $30 to $36 a year, rising to $50 to $100 by the end of the century.

13. There were no well-endowed schools, nor endowed chairs, a dramatic difference in this respect appearing between pharmacy and medicine in the 1880's. There were a few scholarships established by the 1880's, over objections concerning their "pauperizing tendencies." Few if any schools received aid from a state or municipality except those usually classed as state schools.

14. Most independent schools operated in meagerly equipped rented rooms until after 1880, when an average real estate valuation of $47,000 compared favorably with the average medical school. At the end of the century just three schools in the North Atlantic states (where there were fewest schools in relation to population) held more than half the total dollar value of property reported by independent schools of the United States.

15. Until 1880 most independent schools granted only the modest title "Graduate in Pharmacy," which originally stemmed from an aversion to showy degrees or "aristocratic titles."

16. This pattern broke up late in the century, and a variety of degrees was adopted, without standardized requirements for them. It became common for schools to offer two, three or even four different degrees for courses of different length and requirements.

17. Although licensure became required in most states during the last three decades, formal education was never required; and the enforced legal standards were too low to stimulate any dramatic increase in enrollments.

18. Informal relationships among association schools in the early period crystallized into a Conference of the Schools of Pharmacy (1870), stimulated by the threat of change and challenge attributed to the University of Michigan course, which ignored the customary apprenticeship requirement for graduation. An earlier associative attempt among medical schools perhaps offered some stimulus for the founding of the Conference. Although the Conference reportedly died at various times, it had a lively, but rather ineffectual existence up to 1884. The ineffectiveness of the Conference may be attributed to the delegates' lack of power to act (decisions resting with the boards of trustees), to the absence of sanctions to enforce standards, and to competitive relationships.

19. Importance is attributed to the Section on Education and Legislation (f. 1887) of the American Pharmaceutical Association as a bridge between the old Conference and the new conference of schools established at the end of the century; the function of and differences between the two bodies are discussed.

20. Thought concerning a new association of schools began to crystallize in the early 1890's, drawing inspiration from the founding of the new Association of American Medical Colleges (1890)

and from the gradually growing acceptance of the Michigan ideas. There was an abortive attempt to create an organization in 1894, centering around James H. Beal. Beal, Henry P. Hynson and others apparently continued to work behind the scenes, being blocked until 1900 mainly by rivalry among schools and their administrators.

21. Beginnings toward admission standards were made by new state schools, and by the mid-80's independent schools also were making some progress in this direction (grammar school), probably stimulated by action taken by the Conference in 1883 and by the Section on Education and Legislation in 1889. By the end of the century about a half dozen schools claimed a high-school standard for admission, the remainder grammar school or less. Hesitant progress may be attributed largely to an assumption that the place for selection (hinging upon preliminary education) was upon entrance to apprenticeship (prior to entering school), without, however, devising or attempting any means of control. At the end of the century the traditional apprenticeship requirement for graduation was disintegrating, although association schools conceded only reluctantly that the preceptor and his shop were often poorly fitted to play a primary role in the modern educational process.

22. Only a small percentage of those entering pharmacy in the 19th century received any formal education (about 12 percent), and only a minority of those who did enter a school ever remained to graduate. Up to 1870 not more than five to six per cent of the apothecaries and druggists were American graduates. Between 1870 and 1897, the average number of students per school rose from 51 to 79, (the latter figure representing a decline from the 1880's). Comparable data for medicine suggests that competition for students among schools may have been keener in pharmacy than in medicine. In 1887 about half of all pharmacy students in the United States

were enrolled in just three cities. State universities had relatively small pharmacy enrollments. The number of students in pharmacy remained remarkably small compared with other professions, the vigorous development of schools in the last two decades having little relation to the number of students seeking an education.

23. Women students entered pharmacy along with the general influx of women into higher institutions of learning in the last quarter of the century, but never exceeded 2.5 per cent of enrollments.

24. Up to 1870 only the Philadelphia and Chicago Colleges had sizable libraries; although New York and Cincinnati made extensive accessions shortly thereafter. Many schools probably had very scanty collections. But pharmacy libraries, in the mid-80's, appear to have been at least as extensive as medical libraries.

25. Only in university laboratories, beginning at Michigan in 1868, did laboratory work become a dominant part of the curriculum. Early laboratories were opened in the 1870's, markedly expanded in the next decade. The value of scientific apparatus varied widely among association schools at that time ($350 to $20,000).

26. The length of course was well standardized in the 1870's at 40 to 44 weeks, three or six evening lectures a week, divided into two terms or "years." The addition of a chair in pharmacy (to those in chemistry and materia medica) did not extend instruction as much as might be supposed, since the number of lectures per week was reduced.

27. The Massachusetts College took the lead among independent schools in establishing graded courses, but the former amount of instruction was merely split into two parts, rather than doubling

instruction when different material was presented in each of the two terms. In 1879 at least two other schools followed this lead in splitting the course into junior and senior parts. A year later Philadelphia and St. Louis took the first firm step by grading instruction and retaining the same length of term and number of lectures per week. But with notable exceptions little real progress was made during the next decade in extending the amount of instruction. By the 1890's the student could choose between courses requiring one to four years and ranging from five or six hours of instruction per week to five or six hours a day.

28. Associative and legislative regulation in medicine and dentistry revolutionized education in those fields during the 1890's, leaving pharmacy far behind. Besides the effective regulatory support, other advantages offered to medical education not found in pharmacy were the number of heavily endowed schools and a remarkably large number of students wanting to enroll, which smoothed the way for high standards.

29. Ohio State University offered an example for more than a decade by operating nothing but a three-year course, but the university schools followed the example of Wisconsin instead, in the 1890's, offering a four-year optional course and a two-year required course.

30. Throughout the century instruction was divided into three departments. Until near the end of the century, only chemistry among the sciences received emphasis, stemming from its ready application in practice, for which European pharmacy had already provided an example and a model by taking the lead in chemical work. Materia medica, originally an omnibus c ourse, fragmented toward the end of the century, without any general agreement on the new balance or content of courses in this general

field. The organization of the courses in pharmacy was given a strong orientation toward the proximate plant principles, under the influence of Procter, whose system rested on the Paris school, particularly Soubeiran. Laboratory work in dispensing pharmacy began to enter the schools in the 1880's.

31. Teachers were acutely aware of the lack of room in the curriculum for elective or general courses. Additions to the old trio of subjects toward the end of the century were pharmaceutical arithmetic, Latin and law, and commercial subjects. Electives were offered only in the three- and four-year university courses.

32. An increasing amount of the teaching and investigative work arose from within pharmacy in the later period. Prior to that time teachers with medical backgrounds dominated the schools. Already in mid-century they began to be displaced in chemistry; materia medica was the forte of physician-teachers, where they were displaced more slowly after the Civil War; the "M. D." without a primary background in pharmacy was never accepted in principle and seldom in practice for the separate chairs in pharmacy.

33. Until after 1870 all schools had three or four teachers (part-time). Staffs expanded little until the ninth decade. Growth was mostly in chemistry, to a somewhat less extent in materia medica. Slow expansion continued into the 1890's. There was little difference in the size of staff, on the average, between state and association schools, but in the latter teachers were more likely to be part-time.

34. A survey was made of original experimental work by the faculties. The Philadelphia College was outstanding in this respect among independent schools, its teachers closely identifying their work with pharmacy and pharmaceutical publications. Research in plant chemistry received heavy emphasis at Philadelphia, particularly

on indigenous drugs. After 1870 research activity continued at about the same pace as in the previous two decades; then came a sudden upsurge at several schools. Botanical investigations gained importance only in the last quarter of the century. Emphasis on experimental work in organic chemistry arose at university schools in the 1890's. Schools largely neglected inorganic chemistry, among the faculties studied, except the University of Michigan. Men teaching basic science courses on pharmacy faculties in universities maintained highly specialized interests in their own field without making connection with pharmaceutical interests. By the end of the century experimental work, now professionalized and specialized, had largely lost contact with the practitioners of pharmacy.

35. Home study in pharmacy, widely accepted because of persistently small patronage of established schools, emerged as a commercialized and systematized venture in the 1880's. The development of extension work in general education probably offered some stimulus to the movement, or at least a basis for justifying it. More serious efforts of this type began to be overshadowed toward the end of the century by cram schools and their mail-order counterparts.

APPENDIX A

The charts identify faculty members of a school or department of pharmacy according to subjects in the title of chairs. N. B.: See footnotes for qualifications. Tabulations cover all association schools offering regular instruction before 1870, plus the early pharmacy course offered at the Medical College of Louisiana (later Tulane). Thereafter, the faculties are charted for two of the leading independent schools and two of the leading (and earliest) state university schools:

Before 1870

Philadelphia College of Pharmacy (f. 1821)*
Massachusetts College of Pharmacy (f. 1823)
New York College of Pharmacy (f. 1829)
University of Louisiana (f. 1838)
Maryland College of Pharmacy (f. 1841)
Chicago College of Pharmacy (f. 1859)
St. Louis College of Pharmacy (f. 1865)

1870-1899

Philadelphia College of Pharmacy (f. 1821)
New York College of Pharmacy (f. 1823)
University of Michigan (f. 1868)
University of Wisconsin (f. 1883)

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* Dates indicate first regular instruction.

FACULTY OF THE PHILADELPHIA COLLEGE OF PHARMACY, 1821-1870[1]

	PHARMACY	MATERIA MEDICA	BOTANY	CHEMISTRY[2]
1821	Samuel Jackson			Gerard Troost
1822	"			George B. Wood
1823	"			"
1824	"			"
1825	"			"
1826	"			"
1827	Benjamin Ellis			"
1828	"			"
1829	"			"
1830	"			"
1831	George B. Wood			Franklin Bache
1832	"			"
1833	"			"
1834	"			"
1835	Robert E. Griffith			"
1836	Joseph Carson			"
1837	"			"
1838	"			"
1839	"			"
1840	"			"
1841	"			William R. Fisher
1842	"			Robert Bridges
1843	"			"
1844	"			"
1845	"			"
1846	William Procter	Joseph Carson		"
1847	"	"		"
1848	"	"		"
1849	"	"		"
1850	"	Robert P. Thomas		"
1851	"	"		"
1852	"	"		"
1853	"	"		"
1854	"	"		"
1855	"	"		"
1856	"	"		"
1857	"	"		"
1858	"	"		"
1859	"	"		"
1860	"	"		"
1861	"	"		"
1862	"	"		"
1863	"	"		"
1864	"	Edward Parrish		"
1865	"	"		"
1866	John M. Maisch	"		"
1867	Edward Parrish		John M. Maisch	"
1868	"		"	"
1869	"		"	"
1870	"		"	"

Footnotes will be found on following page.

1 - Tabulated from Joseph W. England, The First Century of the Philadelphia College of Pharmacy (Philadelphia, 1922), 343-44. For biographical sketches, see ibid., 396-458.

2 - "Pharmaceutical and General Chemistry" from 1821 to 1846, when a separate chair in "Pharmacy" was established. Thereafter the chair held by Bridges was in "Chemistry." For information on chemistry teachers in various schools see Glenn Sonnedecker, "The Scientific Background of Chemistry Teachers in Representative Pharmacy Schools of the United States During the 19th Century," in Chymia, Vol. 4, publication pending.

FACULTY OF THE MASSACHUSETTS COLLEGE OF PHARMACY, 1867-1870[1]

	PHARMACY	MATERIA MEDICA	BOTANY	CHEMISTRY
1867-68	George F.H. Markoe	Cyrus M. Tracy		E. L. Stoddard
1868-69	"	"		"
1869-70	"	"		James F. Babcock
1870-71	"	"		"

1 - Taken from "Historical Sketch," Twenty-Fourth Annual Catalogue of the Massachusetts College of Pharmacy, 1890-91 (Boston), 7. Short series of lectures on chemistry had been given in 1826, 1830, 1853-54, and 1858, but these were attended primarily by pharmaceutists rather than their apprentices. Apparently this was the only instruction sponsored by the College prior to the regular lecture courses that began in 1867 (ibid., 6).

FACULTY OF THE NEW YORK COLLEGE OF PHARMACY, 1829-1870[1]

	PHARMACY	MATERIA MEDICA	BOTANY[5]	CHEMISTRY
1829		Stephen Brown		John Torrey
1830		"		William H. Ellet
1831		J. Smith Rogers		"
1832		"		Lucius D. Gale
1833		"		"
1834		"		"
1835		"		John H. Griscom
1836		"		"
1837		"		"
1838		"		"
1839		"		"
1840		"		"
1841		"		"
1842		Benjamin W. McCready		Lawrence Reid
1843		"		"
1844		"		"
1845		"		"
1846		"		"
1847		"		"
1848		"		R. Ogden Doremus
1849		"		"
1850		"		"
1851		"		"
1852		"		"
1853		"		"
1854		"		"
1855		Benjamin Canavan[2]		"
1856		"		"
1857		George Thurber[3]	6	"
1858		"		"
1859		"		"
1860		"		Ferdinand F. Mayer
1861		John M. Maisch		"
1862		"		"
1863		Ferdinand F. Mayer[4]		Alexander H. Everett
1864	Peter W. Bedford	George Thurber		Ferdinand F. Mayer
1865	"	"		"
1866	"	Ferdinand F. Mayer		Charles F. Chandler
1867	?	"		"
1868	?	Francis E. Englehardt		Arthur M. Edwards[7]
1869	Edward R. Squibb	Walter DeF. Day		Charles F. Chandler
1870	"	"		"

Footnotes will be found on following page.

1 - Taken mainly from "Courses of Study and Faculty" in Curt P. Wimmer, The College of Pharmacy of the City of New York, 307-308. This tabulation is not entirely reliable, and some changes have seemed desirable as explained in footnotes.

2 - Wimmer does not include Canavan in his tabulation (ibid.) but describes his appointment and service in the text, p. 50.

3 - Wimmer's statement (ibid., 153) that Thurber served as "Professor of Botany and Materia Medica" does not mean that a chair was then so titled. A circular of the College for 1859-60, reproduced by Wimmer (ibid., 52) shows that he was professor of "Materia Medica and Pharmacy" and that "A portion of this series will be devoted to Botany..."

4 - Apparently Mayer began to teach materia medica in 1863 (ibid., 60), although Wimmer's faculty list places the date in 1862 (ibid., 307).

5 - At no time during this period was botany required for graduation as a separate course. Several lecturers offered some optional instruction from time to time, however, besides the botanical material given in the materia medica course.

Wimmer (ibid., 44) and Rusby (Henry H. Rusby, The College of Pharmacy of the City of New York) agree that summer lectures, by unnamed instructors, were given as early as 1841.

"In the summer of 1848, Dr. J. F. Holton, a Professor of Botany, delivered a lecture course to a few students." The next year Professor McCready's "hour was taken over by Professor Holton, lecturer on botany, during the months of January and February." A separate lecture series in botany apparently was intended to be an annual event, but ticket sales for 1850 show "none whatever for Dr. Holton's Botany lectures. A resolution was thereupon passed to make a full course in Botany a requisite for the College of Pharmacy" (Wimmer, op. cit., 47 and 49). Neither Wimmer nor Rusby makes clear what the consequences of this action was, but there seems to be no evidence that a separate course in botany was actually required until much later. In 1868-69 George Thurber "gave voluntarily six lectures on Botany..." (ibid., 62). School catalogs in the 1870's still described botanical instruction as part of the materia medica course.

6 - See footnote 3.

7 - Wimmer gives both 1867 and 1868 as the date of Edwards' appointment (cf. ibid., 61 and 307); it seems more probable that it was 1868.

FACULTY OF THE COURSE IN PHARMACY, MEDICAL DEPARTMENT, UNIVERSITY OF LOUISIANA (NOW TULANE)[1]

	PHARMACY[2]	CHEMISTRY	MATERIA MEDICA AND THERAPEUTICS[3]
1838-39	John L. Riddell		J. Monroe Mackie
1839-40	"		Edward H. Barton
1840-41		John L. Riddell	S. W. Ruff
1841-42		"	"
1842-43		"	W. M. Carpenter
1843-44		"	"
1844-45		"	"
1845-46		"	"
1846-47		"	"
1847-48		"	"
1848-49		"	"
1849-50		"	Gustavus A. Nott
1850-51		"	"
1851-52		"	"
1852-53		"	"
1853-54		"	"
1854-55		"	"
1855-56		"	"
1856-57		"	"
1857-58		"	"
1858-59		"	"
1859-60		"	"
1860-61		"	"
1861-62		"	"
1862-63[4]			
1863-64			
1864-65			
1865-66			
1866-67		J. W. Wallet	Gustavus A. Nott
1867-68		"	"
1868-69		"	Frank Hawthorn
1869-70		Joseph Jones	"
1870-71		?	?

Footnotes will be found on following page.

1 - From manuscript notes in the Edward Kremers Reference Collection, University of Wisconsin. Before affiliation in 1847 the institution was called the Medical College of Louisiana.

2 - It is not clear from the notes left by Kremers (loc. cit.) whether there was any instruction after 1839-40 specifically identified as "pharmacy." It seems unlikely; still in 1888 the Catalogue did not promise any special lecture course in this branch, but only the opportunity "also to attend the instruction in Practical Pharmacy, given in the excellent Pharmaceutical Laboratory, established in 1887" (Medical Department of the Tulane University of Louisiana. Catalogue for 1887-88. Circular for 1888-89. With Notice of the Course in Pharmacy of the Medical Department (New Orleans, 1888). The student was required to have "at least two years' practical experience, under the instruction of a competent pharmacist," however, as a prerequisite to getting his degree, "Master of Pharmacy." More specialized instruction in pharmacy before 1870 undoubtedly was also discouraged by the scarcity of students. In the 32 years (1838-1870) there were only 21 graduates, not more than two in any single year, and none at all in 16 years of this period. (Data from a letter by Dr. C. C. Bass, Dean, September 12, 1930, in the Edward Kremers Reference Collection.)

3 - The uncommon appearance of the term "therapeutics" in a course title here reflects the fact that instruction was given within the Medical Department. Students working for a pharmacy diploma probably attended the lectures together with the regular medical students. This is implied in Medical Department of the Tulane University of Louisiana. Catalogue for 1887-88...With Notice of the Course in Pharmacy of the Medical Department (p. 4), which is the earliest catalog currently available to the writer.

4 - Instruction was suspended 1862-65 due to the Civil War.

FACULTY OF THE MARYLAND COLLEGE OF PHARMACY, 1841-1870[1]

	PHARMACY[2]	MATERIA MEDICA	BOTANY	CHEMISTRY
1841-42				
1842-43[3]				George W. Andrews[5]
1843-44				
1844-45	David Stewart	William S. Reese	and David Stewart	William E. A. Aikin
1845-46	"		"	"
1846-47[4]	(?)			
1856-57	Israel J. Grahame	Charles Frick	and Frank Donaldson	Lewis H. Steiner
1857-58	"		"	"
1858-59	"		Frank Donaldson	"
1859-60	"		"	"
1860-61	L. Phillips		"	"
1861-62	J. Faris Moore		"	"
1862-63	"		"	Alfred M. Mayer
1863-64	"		J. R. Winslow	"
1864-65	"		"	"
1865-66	"		"	Lewis H. Steiner
1866-67	"		Claude Baxley	John C. Carter
1867-68	"		"	Thomas Helsby
1868-69	"		"	"
1869-70	"		"	M. J. DeRosset
1870-71	"		"	"

Footnotes will be found on following page.

1 - Taken from "Historical" pages, Annual Catalogue of the Maryland College of Pharmacy. Session 1891-92, Semi-Centennial Edition (Baltimore, 1891), p. 13.

2 - C. Schmidt states that the College was the first in the United States to have a separate chair in the "Theory and Practice of Pharmacy" (Maryland College of Pharmacy (1841-1894), MS in Kremers Reference Collection). On the first occupant, see George E. Osborne, David Stewart, Baltimore (1813-1899), (mimeograph, 1952; publication pending).

3 - Apparently no courses were given in 1842-43 because of the small number of students. During the years 1841-42 and 1843-44 the teaching was "divided in alternation, between seven of the College members..." (Annual Catalogue, 1891-92, 13; and Schmidt, The Maryland College of Pharmacy (1841-1894), 3.)

4 - Teaching was discontinued due to "lack of interest" and lack of members. According to one statement this occurred in 1848 (Annual Catalogue, 1891-92, 11), but the lectureships are all listed as terminating in 1846. Schmidt (loc. cit.) states that the last course of lectures was delivered in the winter of 1846-47. Professor Stewart resigned earlier, April 28, 1846 (Annual Catalogue, 1891-92, 13). The statement that "the rolls [of graduates] of 1848 to 1856 were destroyed" (Ibid., 49) cannot be credited.

5 - In an unpublished biographical sketch of Andrews, written by John F. Hancock of Baltimore in 1905 (Edward Kremers Reference Collection, University of Wisconsin School of Pharmacy), it is said that "He was the first pharmacist in the United States to be elected a professor of pharmaceutical chemistry in a pharmaceutical college--the Maryland College of Pharmacy in 1841." He was apparently one of the seven members among whom the teaching was alternated in 1841-42 and 1843-44. Schmidt says that David Stewart lectured on chemistry; possibly he alternated with Andrews.

FACULTY OF THE CHICAGO COLLEGE OF PHARMACY, 1859-1870[1]

	PHARMACY	CHEMISTRY	BOTANY	MATERIA MEDICA
1859-60	Franklin Scammon	James Van Zandt Blaney		John H. Rauch
1860-61	?	"		"
1861-62	Frederick Mahla			James Adams Allen
1862-63[2]				
1863-64				
1864-65				
1865-66				
1866-67				
1867-68				
1868-69				
1869-70				
1870-71	N. Gray Bartlett	James Van Zandt Blaney	John H. Rauch	George M. Hambright

1 - Extracted from W. B. Day, "The School of Pharmacy" in the Alumni Record of the University of Illinois, Chicago Departments, Colleges of Medicine and Dentistry, School of Pharmacy (University of Illinois, 1921), xxv-xxvii; see also "Faculty, School of Pharmacy," ibid., 429-432; and The Pharmacist, 3: 89 (April), 1870.

2 - The school was discontinued because of the Civil War. Although the College was reorganized in 1867, the school was not reopened until September, 1870. (W. B. Day, loc. cit.)

FACULTY OF THE ST. LOUIS COLLEGE OF PHARMACY, 1865–1870[1]

	PRACTICAL PHARMACY	MATERIA MEDICA	BOTANY	CHEMISTRY
1864–65	James O' Gallagher	J. S. P. Allyne (-eyne)	A. Wadgymier[2] (-mar)	A. Wadgymier
1865–66	"	"	"	"
1866–67	Hubert Primm	"	"	F. M. McArdle[3]
1867–68	"	Potter[4]	?	"
1868–69	"	?		"
1869–70	5			

1 – Mainly from data in the Edward Kremers Reference Collection (University of Wisconsin); based on excerpts from the book of minutes of the executive board of the College supplied by Professor Leo Suppan, letter to Edward Kremers, October 15, 1930. See also Proceedings of the American Pharmaceutical Association 14: 200, 1866, and Meyer Brothers Druggist, 13: 356–8, 1892.

2 – On March 21, 1865, Wadgymier is said to have received "authority to lecture on botany" (Suppan, loc. cit.).

3 – Wadgymier reportedly resigned on December 18, 1866.

4 – Allyne is reported to have resigned on December 17, 1867.

5 – On September 6, 1869, a motion was adopted to suspend lectures for the ensuing year.

FACULTY OF THE PHILADELPHIA COLLEGE OF PHARMACY, 1871-1899[1]

	PHARMACY	MATERIA MEDICA	BOTANY (and, after 1896, Pharmacognosy)	CHEMISTRY	ANALYTICAL CHEMISTRY
1871	Edward Parrish		John M. Maisch	Robert Bridges	
1872	William Procter		"	"	
1873	"		"	"	
1874	Joseph P. Remington		"	"	
1875	"		"	"	
1876	"		"	"	
1877	"		"	"	
1878	"		"	"	
1879	"		"	Samuel P. Sadtler	
1880	"		"	"	
1881	"		"	"	Frederick B. Power
1882	"		"	"	"
1883	"		"	"	Henry Trimble
1884	"		"	"	"
1885	"		"	"	"
1886	"		"	"	"
1887	"		"	"	"
1888	"		"	"	"
1889	"		"	"	"
1890	"		"	"	"
1891	"		"	"	"
1892	"		"	"	"
1893	"		Edson S. Bastin	"	"
1894	"		"	"	"
1895	"		"	"	"
1896	"		"	"	"
1897	"	Clement B. Lowe	Henry Kraemer[2]	"	"
1898	"	"	"	"	Samuel P. Sadtler
1899	"	"	"	"	Frank X. Moerk
1900	"	"	"	"	"

1 - Taken from England, The First Century, p. 344.

2 - Kraemer's title became "Professor of Botany and Pharmacognosy."

FACULTY OF THE NEW YORK COLLEGE OF PHARMACY, 1871-1899[1]

	PHARMACY	MATERIA MEDICA	BOTANY	PRACTICAL BOTANY	PHARMACOGNOSY
1871-72	Edward R. Squibb	Walter DeF. Day			
1872-73	Wm. Manlius Smith	"		P. V. LeRoy[4]	
1873-74	Peter W. Bedford	"		Charles Froebel[5]	
1874-75	"	"		"	
1875-76	"	"		August Koehler[6]	
1876-77	"	"		"	
1877-78	"	"		"	
1878-79	"	"		"	
1879-80	"	"		Alphonso Wood	
1880-81	"	"		"	
1881-82	"	"		"	
1882-83	"	"		Joseph Schrenk	
1883-84	"	"		"	
1884-85	"	"		"	
1885-86	"	"			
1886-87	"	"		Joseph Schrenk[7]	
1887-88	"	"		"	
1888-89	"	"		"	
1889-90	"	Henry H. Rusby		"	
1890-91	"	"[3]		"	
1891-92	Virgil Coblentz	"		Henry H. Rusby	
1892-93	"	"		"	
1893-94	"	"		"	
1894-95	"	"		"	
1895-96	"	"			
1896-97	George C. Diekman[2]	"		?	Smith Ely Jelliffe[8]
1897-98	"	"			"
1898-99	"	"			"

Footnotes will be found on following pages.

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(ORGANIC) CHEMISTRY	ANALYTICAL CHEMISTRY	PHYSICS AND CHEMISTRY
Charles F. Chandler[9]		
"	Isador Walz[12]	
"	Charles Froebel	
"	"	
"	"	
"10	"	
"	"	
"	"	
"	"	
"	"	
"	"	
"	"	
"	Charles W. Parsons	
"	"	
"	"13	———
"	"	Arthur H. Elliott
"	"	"
"	———	"
"11	14	"
"		"
"		"
"		"
"		"
"	———	"
"	George A. Ferguson[15]	"
"	"	Virgil Coblentz[16]
"	"	"
"	"	"

1 - From the Prospectus of the College of Pharmacy of the City of New York for the respective years. Wimmer's tabulation for this period is not entirely accurate and has the limitation that faculty members are not designated as to the exact chair held but rather listed under the old trio of subjects: pharmacy, materia medica and chemistry. Rusby presents a somewhat more detailed table, but perhaps in some respects it is a less accurate table than my own, unless the college catalogs are in error. Differences are mostly of a few years in the tenure of several professors. Rusby's table makes the curriculum appear more diversified than seems to have been the case. (See Henry H. Rusby, The College of Pharmacy of the City of New York (New York, n.d.), p. 41.)

2 - When Elliott retired Coblents moved over to fill his chair, and Diekman succeeded Coblentz in the chair of pharmacy. This shift involved some transitional titles. Coblentz, who had held the chair of "Theory and Practice of Pharmacy," now (1896-97) filled a chair of "General and Pharmaceutical Chemistry," which the next year became a chair of "Chemistry and Physics." Diekman came to a chair in "Applied Pharmacy," which became "Theoretical and Applied Pharmacy" in 1897-98, with the same scope as during the incumbency of Coblentz.

3 - In the Prospectus of 1890-91 (p. 4) Rusby's title appeared for the first time as "Professor of Physiology, Botany, Pharmacognosy and Materia Medica" (instead of "Materia Medica and Botany"). Under him was one instructor in the same fields.

During the 1880's a number of instructors (usually Ph. G.'s) were appointed for the various disciplines. Their service was often rather short-lived and only the teachers achieving a professorial rank are here tabulated. (An "Instructor in Latin" appeared for the first time in the Prospectus of 1892-93, p. 3.)

4 - The 1872-73 Prospectus announced that arrangements had been made with P. V. LeRoy for optional, semi-monthly botanical excursions during the summer and autumn.

5 - Froebel became "adjunct instructor" in both analytical chemistry and practical botany. In the next Prospectus (1873-74) he was listed only as "professor of analytical chemistry;" however, the inside front cover gave notice that he would hold weekly classes in botany, free to "full students" of the College.

6 - Koehler gave the summer practical course, while DeF. Day included systematic botany in his materia medica lectures.

7 - The Prospectus of 1885-86 indicates (p. 5) that pharmacognosy now received greater stress and appeared in the title of Schrenk, along with practical botany. At this time Schrenk also introduced the first course (optional) in practical microscopy.

8 - An entirely separate chair for pharmacognosy was now created, and the subject was dropped from the elaborate title of Rusby.

9 - At this time there was still only the single chair of "Chemistry."

10 - The Prospectus now began to describe Chandler's field under the heading "Chemistry and Toxicology."

11 - The Prospectus of 1889-90 changed Chandler's title from professor of "Chemistry" to "Organic Chemistry."

12 - The 1872-73 Prospectus announced arrangements for optional study of analytical chemistry in the laboratory of Isador Walz, Ph. D. Alternatives listed were laboratory work at the Columbia College School of Mines and home experimentation based upon reading and the regular lectures.

13 - Parsons' title changed from "Professor of Analytical Chemistry" to "Professor of Analytical and Pharmaceutical Chemistry" (Prospectus, 1885-86, p. 5).

14 - Analytical chemistry undoubtedly was taught by Elliott after Parsons left. However, the chair of "Analytical Chemistry" disappeared until 1894-95. For the purpose at hand we have tabulated professors by official title, rather than trying to indicate by column heading the exact nature of the curriculum. The previously published tables of Wimmer and of Rusby (op. cit.) are still more misleading with regard to curriculum subdivisions, each in a different direction.

15 - For Ferguson, the old title of "Professor of Analytical Chemistry" was revised, with "and Mathematics" significantly appended. When Elliott retired the next year "Physics" became part of Ferguson's title and responsibility.

16 - See note 2.

FACULTY OF THE UNIVERSITY OF MICHIGAN SCHOOL OF PHARMACY, 1868-1899[1]

	PHARMACY	MATERIA MEDICA (Also Physiological Chem.)	BOTANY	PHARMACOGNOSY
1868-69	Silas H. Douglass	Henry S. Cheever		
1869-70	"	"		
1870-71	Albert B. Prescott	"		
1871-72	"	"		
1872-73	"	"		
1873-74	"	"	?[4]	
1874-75	"	"	?	
1875-76	"	"	?	
1876-77	"	George E. Frothingham	?	
1877-78	"	"	Volney M. Spalding	
1878-79	"	"	"	
1879-80	"	"	"	
1880-81	"	"	"	
1881-82	"	"	"	
		Also: Victor C. Vaughan		
1882-83	"	"	"	
1883-84	"	Victor C. Vaughan[3]	"	Volney M. Spalding
1884-85	"	"	"	"
1885-86	Also: Theo. J. Wrampelmeier	"	"	"[6]
1886-87	"	"	"	" (?)
1887-88	Albert B. Prescott	"	"	" (?)
1888-89	"	"	"	" (?)
1889-90	"	"	"	" (?)
1890-91	"	"	"	" (?)
1891-92	Alvise B. Stevens[2]	(Julius O. Schlotterbeck)	"	" (?)
1892-93	"	"	"	" (?)
1893-94	"	"	"	" (?)
1894-95	"	"	"	(Charles H. Williams)
				Frederick C. Newcombe
1895-96	"	Frederick C. Newcombe	"[5]	Julius O. Schlotterbeck
1896-97	"	Julius O. Schlotterbeck	"	"
1897-98	"	"	"	"
1898-99	"	(George B. Wallace)	"	"

Footnotes will be found on following pages.

CHEMICAL PHYSICS & INORGANIC CHEM.	GENERAL CHEMISTRY	ORGANIC CHEMISTRY	QUALITATIVE ANALYSIS	QUANTITATIVE ANALYSIS	CRYSTALLOGRAPHY
?	?				
?	?				
?	?				
?	?				
?	?				
?	?				
?	?				
?	?				
?	?	?			?
John W. Langley	"	Albert B. Prescott			Wm. H. Pettee
"	"	"			"
"	"	"			"
"	"	"	Otis C. Johnson[9]	Byron W. Cheever[10]	"
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"
"	"	Also: Theo. J. Wrampelmeier	"	"	"
"	"	"	"	"	"
"	(y)	Albert B. Prescott	"	"	"
(George W. White)[7]	"	[8]	"	"	"
( )	"	"	"	(David H. Browne)[11]	"
Paul C. Freer	"	"	"	Edward D. Campbell	"
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"

1 - Taken from the annual University of Michigan Catalogue of the Officers and Students through 1879-80 (from 1871-2 called Calendar of the University of Michigan); thereafter from the Annual Announcement of the School of Pharmacy of the University of Michigan for the respective years.

It should be emphasized that this chart (and the following one on the University of Wisconsin) was prepared as an adjunct to some assessment of faculty research activity—not to reflect accurately the development of curricula. For example, until there was a separate School of Pharmacy at Michigan the individual lecture courses were not even specifically identified in catalogs. The instructional areas tabulated prior to that are inferred from general descriptions of the "Course in Pharmacy." Courses taught to pharmacy students by other departments are not listed. The main chairs are indicated in the column headings, based on the catalog titles of the pharmacy faculty. Some of the more significant changes in specific courses they taught are mentioned in footnotes, without fully tracing the fragmentation and reintegration of courses in the later period. The main discussion of curricula changes will be found in the text proper.

Beginning in 1876-77 pharmacy was no longer a "branch of the Polytechnic School," but was "now organized as a distinct school..." (Calendar, 1876-77, p. 80). The next year a specific pharmacy faculty and a curriculum of separately identified courses were listed for the first time. Theretofore the general University Catalog or Calendar sometimes left room for doubt as to which professors taught the students who followed the "Course in Pharmacy."

For the purpose at hand, only those teachers of pharmacy students are listed who (a) had a professorial rank, and (b) had an appointment on the pharmacy faculty itself; a few exceptions are indicated by names in parentheses, instructors who later became professors or were temporarily in charge of a department.

Toward the end of the period faculty lists ceased to indicate the rank or precise responsibilities of the teachers; from other evidence the professors in charge of various departments have been identified with a high but not final degree of certainty.

2 - Prescott dropped "Pharmacy" from his faculty title at this time, whereupon an "Assistant in Pharmacy" was added to help Mr. Stevens, the instructor who became assistant professor the next year.

3 - When Vaughan succeeded Frothingham he became professor of physiological chemistry as well as of materia medica. At this time, for example, the School of Pharmacy gave courses in both urinalysis and toxicology.

4 - By this time "botany by recitations and practical studies" was required; the Calendar for 1874-75 (p. 69) indicated that the first-year studies extended only from about the first of April to the latter part of June, but that a full semester of pharmaceutical botany was given the second year.

5 - In 1895-96 Spalding's title changed from "professor of botany" to "director of the Botanical Laboratory," as Schlotterbeck took over more and more of the instruction. After 1895-96 "Botany and Cell Morphology, and Pharmacognosy and Materia Medica" were all listed under Schlotterbeck's jurisdiction.

6 - Pharmacognosy disappeared from Spalding's title after only two years, but it seems probable that he remained in charge of this developing field (besides botany). In faculty lists, however, pharmacognosy appears only in the titles of frequently changed assistants until Schlotterbeck joined the faculty as instructor in materia medica. He apparently became increasingly responsible for pharmacognosy, and after a year abroad was listed in course descriptions as the "professor" in charge.

7 - A "lecturer" who temporarily took over the post vacated by Langley.

8 - In 1889-90 Moses Gomberg joined Prescott in teaching organic chemistry, beginning as an assistant and apparently taking over an increasing share of the responsibility during the decade.

9 - Previously in charge of laboratory instruction but now given professorial rank.

10 - See note 9.

11 - An instructor who temporarily filled the post of the late Professor Cheever.

UNIVERSITY OF WISCONSIN SCHOOL OF PHARMACY, 1883-1900[1,2]

	PHARMACY	MATERIA MEDICA	BOTANY	PHARMACEUTICAL BOTANY	PHARMACOGNOSY	
1883-84	Frederick B. Power[3]	Frederick B. Power[5]	William Trelease			Willi
1884-85	"	"	"			
1885-86	"	"	"			
1886-87	"	"	(Arthur B. Seymour)			
1887-88	"	"	(Frederick L. Sargent)			
1888-89	"	"	Charles R. Barnes			
1889-90	"	"	"			
1890-91	"	"	"			
1891-92	Edward Kremers Pharmaceutical and Pharmacognostical Chemistry	"	"			
1892-93	Edward Kremers[4]	(none)	"	6	7	
1893-94	"		"			
1894-95	"		"			
1895-96	"		"	Lellen S. Cheney	Rodney H. True	
1896-97	"		"	"	"	
1897-98	"		"	"	"	
1898-99	"		R. L. Harper	"	"	
1899-00	"		"	"	"	

Footnotes will be found on following pages.

CHEMISTRY	ANALYTICAL CHEMISTRY	AGRICULTURAL CHEMISTRY	PHYSICAL CHEMISTRY
m W. Daniells	Charles R. Van Hise[8]		
"	"		
"	(Homer W. Hillyer)[9]		
"	"		
"	"		
"	"		
"	"		
"	"		
"	"		
"	"		
"	"		
"	"		
"	"		(Louis Kahlenberg)[10]
"	"	F. W. Woll	"
"	"	"	"
"	"	"	"

PHYSICS	ZOOLOGY	BIOLOGY	BACTERIOLOGY
John E. Davies			
(none)			
(none)			
(none)			
(none)			
(none)			
(none)			
(none)			
(none)			
John E. Davies	Edward A. Birge	Clifton F. Hodge	(none)
"	"		
Benjamin W. Snow 93-94	"	(none) 11	Harry L. Russell
Louis W. Austin	"		"
"			"
Benjamin W. Snow 95-96	"		"
Louis W. Austin	"		"
"	"		"
"	"		"
Benjamin W. Snow	"		"
"	"		

MINERALOGY AND METALLURGY	GENERAL AND GEOGRAPHIC GEOLOGY	HYGIENE AND SANITARY SCIENCE
William H. Hobbs	Rollin D. Salisbury	Almah J. Frisby
"	Charles R. Van Hise	"
	Julius M. Clements	
"	"	
"	"	(none)
"	"	
"	"	
"	"	
"	Charles R. Van Hise	
"	"	

1 - Taken from "Faculty of the Department" lists in the Annual Announcement of the Department of Pharmacy of the University of Wisconsin for the respective years, up to 1893-94, and from the General Catalogue of the University of Wisconsin thereafter. Only teachers holding a professorial rank are listed, for present purposes, except where a junior staff member was temporarily in charge of a department or was later promoted (indicated by names in parentheses).

2 - Professors on the pharmacy "Staff of Instruction" in fields other than pharmacy or the biological and physical sciences are not tabulated for the present purpose.

3 - Although not indicated in his title Power taught pharmaceutical chemistry as part of the course in pharmacy.

4 - No faculty title contained the term "pharmacy" after Kremers succeeded Power as director of the school in 1892. Kremers chose for his title "Professor of Pharmaceutical and Pharmacognostical Chemistry," emphasizing in the Annual Announcement of 1892-93 (pp. 25 and 26) that "the arbitrary distinction between the chemistry of Pharmacy and of Pharmacognosy has been removed..." Materia Medica also disappeared as a course title. The "Anatomy of Drugs" was taught by the professor of botany.

5 - The "Professor of Pharmacy and Materia Medica" listed "Pharmacognosy" as a subtitle for his separate course in "Materia Medica."

6 - See note 7.

7 - In 1893-94 the Catalogue of the University noted that an "instructor" was "to be appointed." The 1894-95 Catalogue listed only an "Assistant in Pharmacognosy," Alfred Vivian, Ph. G. Some work in pharmacognosy, listed differently than the regular course descriptions, was to be "supplemented by lectures by members of the faculty" (p. 209). At this time pharmacy students were studying, besides botany, the "Anatomy of Drugs" under Mr. L. S. Cheney of the botany department, who was later named to pharmacy's official "Corps of Instruction."

8 - In 1884-85 the title of Van Hise changed from "Professor of Analytical Chemistry" to "Professor in charge of Qualitative Chemical Laboratory," since Professor Daniells was in charge of quantitative analysis.

9 - Besides being in charge of qualitative chemistry Hillyer had the additional title of "Lecturer in Organic Chemistry;" qualitative chemistry was later dropped from his title.

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10 - Louis Kahlenberg was listed first in 1896-97 as "Instructor in Physical Chemistry," although his name appeared in the 1895-96 Catalogue as "Lecturer on Pharmaceutical Technique." It was stated (p. 239, under School of Pharmacy) that "In the absence of regular courses in physical chemistry, Dr. Kahlenberg has during the present year, 1895-1896, given substantially the courses [in physical chemistry] on pp. 232, 233. The appointment of Dr. Kahlenberg as instructor in physical chemistry for the year 1896-1897 and the transfer of this work to the General Chemistry Laboratory, where it properly belongs, will tend to increase the importance of this branch of chemistry at the University." Kahlenberg continued to be listed also on the roster of the pharmacy faculty, as "Assistant Professor in Physical Chemistry" beginning in 1898-99.

11 - There was now only an instructor in "Biology" listed, and with the 1894-95 Catalogue the old broad title disappeared altogether.

APPENDIX B

Identification of Columns

The numbers on the following notes correspond to the respective column numbers below.

(1) The number indicates the total of papers (including those as senior co-author) published by each teacher during the 19th century, as shown by the Catalogue of Scientific Papers Compiled and Published by the Royal Society of London, four series and supplementary volume, plus the papers tabulated in Column 2. An asterisk preceding the number means that the designated teacher published one or more papers within the scope of Appendix C (for criteria see p.490).

(2) A number in parentheses [e.g., (3)] indicates papers published in the Proceedings of the American Pharmaceutical Association, 1863-1900, that I believe (judging only from titles) would have been listed in the Royal Society's Catalogue had the Proceedings been catalogued beyond the First Series (1800-1863). These papers have been included in the totals shown in Column 1.

(3) All teachers tabulated under the schools included in Appendix A are here listed in one alphabetic group.

(4) The abbreviation indicates the school with which a teacher was associated, as follows:

C - Chicago College of Pharmacy
Md - Maryland College of Pharmacy
Mi - University of Michigan
Ms - Massachusetts College of Pharmacy
NY - New York College of Pharmacy
P - Philadelphia College of Pharmacy
St.- St. Louis College of Pharmacy
T - Tulane University of Louisiana
W - University of Wisconsin

(5) The numbers indicate the span of years during which a man engaged in teaching (e.g., 44-6 = 1844-1846 inclusive). When the figures end with double zero, it ordinarily may be assumed that his teaching period continued into the 20th century.

Column 1	Column 2	Column 3	Column 4	Column 5
3		Aikin, William E. A.	Md	44-6
		Allen, James A.	C	61-2
		Allyne, J. S. B.	St.	64-7
• 8		Austin, Louis W.	W	93-8
		Babcock, James F.	Ms	69-71
2		Bache, Franklin	P	31-41
•31		Barnes, Charles R.	W	88-98
3	(1)	Bartlett, N. Gray	C	70-1
		Barton, Edward H.	T	39-40
•18	(2)	Bastin, Edson Sewell	P	93-6
		Baxley, Claude	Md	66-70
16	(16)	Bedford, Peter W.	NY	64-66 73-91
10		Birge, Edward A.	W	92-00
		Blaney, James V. Z.	C	59-61 70-1
• 3	(3)	Bridges, Robert	P	42-70 71-8
		Brown, Stephen	NY	29-30
•24		Campbell, Edward D.	Mi	91-99
		Canavan, Benjamin	NY	55-6
• 7		Carpenter, W. M.	T	42-9
• 8		Carson, Joseph	P	37-49
		Carter, John C.	Md	65-6
•17		Chandler, Charles F.	NY	66-7 69-70 71-89
• 6		Cheever, Byron W.	Mi	80-90
		Cheever, Henry S.	Mi	68-76

Column 1	Column 2	Column 3	Column 4	Column 5
• 7		Cheney, Lellen Sterling	W	95-00
• 5		Clements, Julius Morgan	W	93-8
• 6	(3)	Coblentz, Virgil	NY	91-9
1		Daniells, William W.	W	83-00
• 8		Davies, John Eugene	W	83-4 92-3
		Day, W. DeF.	NY	69-70 71-89
		DeRosset, M. J.	Md	68-70
		Diekman, George C.	NY	96-9
10		Donaldson, Frank	Md	56-63
		Doremus, R. Ogden	NY	48-59
		Douglass, Silas H.	Mi	68-70
•81		Edwards, Arthur Mead	NY	68
• 1		Ellet, William H.	NY	30-1
10		Elliott, Arthur H.	NY	86-96
2		Ellis, Benjamin	P	27-30
1		Englehardt, Francis E.	NY	68
		Everett, Alexander H.	NY	63
		Ferguson, George A.	NY	95-9
		Fisher, William R.	P	41-2
•26		Freer, Paul Caspar	Mi	91-9
• 2		Frich, Charles	Md	56-8
		Frisby, Almah J.	W	92-4
1		Froebel, Charles	NY	72-82
		Frothingham, George E.	Mi	76-81
• 5		Gale, Lucius D.	NY	32-4

Column 1	Column 2	Column 3	Column 4	Column 5
		Gallagher, James O.	St.	64-7
3	(3)	Grahame, Israel J.	Md	56-60
		Griffith, Robert E.	P	35
1		Griscom, John H.	NY	35-41
1		Hambright, George M.	C	70-1
		Harper, R. L.	W	98-00
		Hawthorn, Frank	T	68-70
		Helsby, Thomas	Md	66-9
•33		Hobbs, William H.	W	92-00
•15		Hodge, Clifton F.	W	92-3
4		Jackson, Samuel	P	21-6
1	(1)	Jeliffe, Smith Ely	NY	95-9
3		Johnson, Otis C.	Mi	80-99
13		Jones, Joseph	T	69-70
•17		Kahlenberg, Louis	W	96-00
		Koehler, August	NY	75-8
•21	(11)	Kraemer, Henry	P	97-9
•19	(12)	Kremers, Edward	W	92-00
•15		Langley, John Williams	Mi	77-89
		LeRoy, P. V.	NY	71-2
1	(1)	Lowe, Clement B.	P	97-9
		McArdle, F.	St.	67-9
		McCready, Benjamin W.	NY	42-54
		Mackie, J. Monroe	T	38-9
• 6		Mahla, Fr.	C	61-2
•69	(23)	Maisch, John M.	NY P P	61-2 66-70 71-92

Column 1	Column 2	Column 3	Column 4	Column 5
13	(13)	Markoe, George F. H.	Ms	67-70
62		Mayer, Alfred M[arshall-?]	Md	61-4
*18	(5)	Mayer, Ferdinand F.	NY	60-7
*20		Meerk, Frank Xavier	P	99-00
1	(1)	Moore, J. Faris	Md	61-70
*11		Newcombe, Frederick C.	Mi	95-6
		Nott, Gus A.	T	49-62
9	(7)	Parrish, Edward	P	64-71
		Parsons, Charles W.	NY	83-8
		Pettie, William H.	Mi	77-99
		Phillips, L.	Md	60-1
*19	(4)	Power, Frederick Belding	P W	81-2 83-92
*38	(13)	Prescott, Albert B.	Mi	70-99
		Primm, Hubert	St.	67-9
*40	(6)	Procter, William	P	46-65 72-3
		Rauch, John H.	C	59-61 70-1
		Reese, William S.	Md	44-6
1		Reid, Lawrence	NY	42-7
10	(10)	Remington, Joseph P.	P	74-99
* 9		Riddell, John L.	T	38-62
		Rogers, J. Smith	NY	31-41
		Ruff, S. W.	T	40-2
*23	(1)	Rusby, Henry Hurd	NY	89-99
*16		Russell, Harry L.	W	93-00
*20	(1)	Sadtler, Samuel Philip	P	79-00
		Salisbury, Rollin D.	W	92-3
		Scammon, Frank	C	59-60

Column 1	Column 2	Column 3	Column 4	Column 5
• 9	(6)	Schlotterbeck, Julius O.	Mi	91-9
•16		Schrenk, Joseph	NY	82-9
		Smith, William Manlius	NY	72-3
• 5		Snow, Benjamin Warner	W	93-00
• 4		Spalding, Volney Morgan	Mi	77-99
43	(19)	Squibb, E. R.	NY	69-70
• 1		Steiner, Lewis H.	Md	56-61
• 9	(8)	Stevens, Alvise Burdett	Mi	91-9
1		Stewart, David	Md	44-6
		Stoddard, E. L.	Ms	67-9
• 4		Thomas, Robert P.	P	50-63
2		Thurber, George	NY	57-60 64-5
25		Torrey, John	NY	29
1		Tracy, Cyrus M.	Ms	67-70
•71		Trelease, William	W	83-6
•42	(6)	Trimble, Henry	P	83-97
•29		Troost, Gerard	P	21
•11	(1)	True, Rodney Howard	W	95-00
•36		Van Hise, Charles Richard	W	83-6 93-00
• 19		Vaughan, Victor Clarence	Mi	81-91
		Wadgymier, A.	St.	64-7
		Wallet, J. W.	T	66-9
•11		Walz, Isador	NY	71-2
		White, George W.	Mi	90-2
		Winslow, J. R.	Md	63-6
6		Woll, Fritz Wilhelm August	W	97-00
8		Wood, Alphonso	NY	78-81
1		Wood, George B.	P	22-34
		Wrampelmier, Theo. J.	Mi	85-6

APPENDIX C

Abstracts of Investigative Papers Published by Teachers

The following abstracts were prepared from original papers as a basis for comments in the text concerning the scope and nature of investigative work by faculty members while they were teaching in schools of pharmacy. Under each school the abstracts are listed chronologically by decades.

	Page
Philadelphia College of Pharmacy	558
College of Pharmacy of the City of New York	570
Maryland College of Pharmacy	579
Medical College of Louisiana (Tulane)	579
Chicago College of Pharmacy	583

From 1870 on the abstracts cover the contributions at two leading independent schools and two leading university schools:

	Page
Philadelphia College of Pharmacy	585
College of Pharmacy of the City of New York	605
University of Michigan	613
University of Wisconsin	637

The abstracting is sufficiently complete for purposes of evaluating the quality, type and approximate quantity of investigative work reported in the literature that was not entirely of a craft or empirical nature. For a further explanation of the criteria, scope and method of this part of the present study, see page 489.

Up to 1870 the abstracts cover the teachers at all association schools founded prior to that date, plus the early pharmacy course at the Medical College of Louisiana (later Tulane). (Note that no experimental papers within the defined scope were identified with the St. Louis and Massachusetts Colleges during their few years of teaching prior to 1870).

Fifty-six journals were used as publication media; 43 American, eight German, and five British, which may be categorized as follows:

Biology (including botany and agriculture)	13
Chemistry (and physics)	13
Science (general, including natural history)	12
Pharmacy	7
Medicine	4
Other	7

Some additional journals utilized by teachers of geology, mineralogy and crystallography are not included in the above figures (the papers being listed but not abstracted; see explanation, page 643).

Certain symbols used as an aid in analyzing this material have been left appended to the individual abstracts, since a few of the abstracts could be classified, by different readers, into a category other than that chosen. The symbols have the following meanings:

B - botany and pharmacognosy
CI- inorganic chemistry
CO- organic chemistry
CP- plant chemistry
I - indigenous and naturalized plants of North America
JP- journal of pharmacy as publication medium
O - other (i.e., not specifically classified)
P - physiology (plant and animal)
PA- applied pharmacy
T - therapeutics or pharmacology
UP- unrelated to pharmacy (or without obvious relationship)

ABSTRACTS TO 1870

Philadelphia College of Pharmacy (f. 1821)

1820-1829:

Troost, Gerard, "Description of a Variety of Amber and of a Fossil Substance Supposed to be the Nest of an Insect Discovered at Cape Sable, Magothy River, Ann Arundel Co., Maryland," Amer. J. Science, 3: 8-15, 1821. The author reviews the geology of the area and varieties of amber found there, describing particularly a specimen which "possesses all the properties of the amber of the Baltic..." Differences between the usual Cape Sable amber and Baltic amber are discussed. The author's discovery in a lignite stratum is interpreted as a nidus made by insects, and he postulates the probable kind of insect and how the comb was formed and used. It is suggested that amber is nothing but "altered resin." The author apparently considers sulfur a compound. (O/UP)

Troost, Gerard, "Description of a New Crystalline Form of Quartz," Journ. Acad. Natural Science (Philadelphia), 2: 212-14, 1821. Describes hitherto unknown type of quartz by diagrams of crystals and degrees of angularity of faces. (O/UP)

Troost, Gerard, "Description of some New Crystalline Forms of the Minerals of the United States," Jour. Acad. Natural Science (Philadelphia), 2: 55-8, 1821. Microscopy and chemical tests on a variety of phosphate of lime. Instances of modification of known forms of zircon are also described. This is

considered important since "As yet but little attention has been paid to the crystalline forms of the minerals of this country..." (O/UP)

Troost, Gerard, "Description of Some Crystals of Sulphate of Strontian from Lake Erie," Jour. Acad. Natural Science (Philadelphia), 2: 300-302, 1821. Physical and microscopical appearance, including angular measurement. The author stresses the importance of the goniometer and complains of the vagueness of Cleaveland's treatise on mineralogy. (O/UP)

1830-1839

1840-1849:

Bridges, Robert, "Observations on the Action of Ether on Galls," Amer. J. Pharm., 14: 40-45, 1843. Experiments and theoretical basis for preferring ether and water as menstruum. The brown coloring matter is deposited in the oleaginous layer. The author discusses how to manipulate solvents to obtain pure tannin from gall constituents. (CP-I/JP)

Procter, William, Jr., "Observations on Monardin, a Peculiar Crystalline Substance, Derived from the Volatile Oil of Monarda punctata," Amer. J. Pharm., 17: 86-9, 1846. Reports forms and properties of what he calls "monardin," a crystalline deposit from the volatile oil of horsemint that had been noted by druggists. After giving solubility, fusing point, boiling point and reaction with various reagents, the author notes (p. 89)

that "A careful ultimate analysis of the oil, and of the deposit would do much to throw light on this subject." Four years earlier, before becoming a teacher, Procter suggested ultimate analysis to clarify the relation between oil of gaultheria and "saliculous acid," ..."which the want of accurate instruments has caused the author to defer to a future period." (Amer. J. Pharm., 14: 221, 1843) Similarly, when Procter reported his well known work indicating that the volatile oil of Gaultheria procumbens was closely allied to "salicylous acid," it remained for the Frenchman Cahours to show by ultimate analysis that the oil probably did have the same composition as "salicylate of methylene." (Amer. J. Pharm., 15: 241-250, 1844) (CP-I/JP)

1850-1859:

Procter, William, Jr., "On Hydrargyrum cum Creta Changed by Oxidation," Amer. J. Pharm., 22: 113-117, 1850. Experiments show an off-color sample to contain 4.21% protoxide of mercury and 22.8% deutoxide of mercury, confirming the author's hypothesis that variable therapeutic effect is caused by "the per oxidation of the mercury." He postulates that rancid fatty matter and resins, added to help subdivide mercury, "may act by slightly oxidizing as well as staining the minute particles of mercury, and commence a process which is subsequently carried on by the oxygen of the air." (CI/JP)

Procter, William, Jr., "Observations on Copaiba," Amer. J. Pharm., 22: 289-296, 1850. Suggests from his own and other analyses for volatile oil (variation, 31 to 80%) that the oiliness of tree juices varies with the age of trees. Hence the author questions the common practice of extracting juices from older trees. Experiments confirm those of others that copaivic acid is a natural product and not produced by oxidation after extraction of oil. (CP/JP)

Procter, William, Jr., "On Some Pharmaceutical Preparations of Manganese," Amer. J. Pharm., 22: 297-303, 1850. Refers to Hannon, whose paper assumes that the apothecary has pure manganese sulfate and "does not give very eligible processes for several of the preparations recommended." Starting with native black oxide, the author offers eligible procedures, which appear to be based on his own experiments. (CI/JP)

Procter, William, Jr., "On a New Solvent for Extracting Cantharidin, and on the Existence of that Principle in Cantharis Vitata and Mylabris Cichorii," Amer. J. Pharm., 23: 124-26, 1851. Cantharidin is isolated for first time from potato flies (Cantharis vittata), using chloroform as the solvent. The author also demonstrates the presence of cantharidin in Chinese flies. Cerates are tested on his own arm, showing equal vesication. (PA-I/JP)

Procter, William, Jr., "On Solution of Citrate of Magnesia," Amer. J. Pharm., 23: 214-217, 1851. A stability study showing that sediment is caused by too little acid to keep the tri-basic salt from being precipitated. (CI (PA)/JP)

Procter, William, Jr., "On Liquor Ferri Nitratis U.S.P., 1850; and on a Formula for Syrup of Proto-Nitrate of Iron," Amer. J. Pharm., 23: 312-15, 1851. A stability study leading to alterations in procedure. (CI(PA)/JP)

Procter, William, Jr., "On Tannate of Alumina," Amer. J. Pharm., 25: 25-7, 1853. An attempt to duplicate the product mentioned in the London Medical Gazette, concluding that it is an amorphous, water-insoluble salt formed by direct combination. (PA/JP)

Thomas, Robert P., "On Texas Sarsaparilla," Amer. J. Pharm., 27: 7-11, 1855. A root that a student wants to analyze for a thesis is identified as Menispermum Canadense (Moonseed). Microscopic studies showed no structural differences between this and "Texas Sarsaparilla" and "Virginia Sarsaparilla," all of which had been marketed as sarsaparilla substitutes. (B-I/JP)

Procter, William, Jr., "Test for the Presence of Alcohol in Chloroform," Amer. J. Pharm., 28: 213, 1856. Confirms presence of alcohol as cause of levity in specific gravity test. "...It occurred to me that an oxidizing mixture of bi-chromate of potassa and sulphuric acid would indicate its presence without being interfered with by the chloroform." (PA/JP)

Procter, William, Jr., "On Valerianate of Ammonia," Amer. J. Pharm., 29: 27-8, 1857. A good example of the author's work in practical pharmacy, which is often not considered within the scope of the present abstracts. "Having been applied to for

this substance, [at his apothecary shop] and having studied the subject to some extent, the following remarks bearing on the preparation and properties of the salt are offered to those desiring the information." A medical report on the use of valerianate of ammonia had created need for pharmaceutical information. (PA/JP)

Procter, William, Jr., "Remarks on Ergot," Amer. J. Pharm., 29: 540-4, 1857. Isolates "Secalin," a volatile alkaloid, from 10,000 grs. of ergot by separating oil of ergot by ether extraction, secalin by aqueous extraction, precipitation of gummy matter by alcohol, and purification by redistillation. Two vials were placed with "two medical gentlemen" to learn whether secalin has the same utero-stimulant power as ergot itself, but their report had not been received at the time of publication. Never-the-less, the author gives a "formula for a fluid preparation of ergot which should fully represent its activity." Since commercial ether removes some secalin with the fixed oil--attributed to contamination with alcohol--the author suggests washing the oil with acidulated water to preserve all of the presumed active principle. (CP/JP)

Procter, William, Jr., "On the Existence of Nicotina in Green Tobacco," Proc. Amer. Pharm. Assoc., 7: 295-301, 1858. Refutes Liebig's statement that nicotina does not exist in the growing plant, but relative amounts in green and cured tobacco not determined. The author concludes that seeds, if poisonous, contain some principle besides nicotina. He finds that seeds are one-third fixed oil. (CP-I/JP)

1860-1869:

Procter, William, Jr., "On Liquor Ferri Peracetatis," Amer. J. Pharm., 32: 309-10, 1860. Another example of a type of work showing Procter primarily as pharmaceutist par excellence. "To give greater permanency, and a more agreeable taste," he says, "I have, after a variety of experiments, adopted the following formula as worthy of acceptance." (PA/JP)

Thomas, Robert P., "On Garlic (Allium Sativum)," Proc. Amer. Pharm., Assoc., 9: 178-280, 1862. Attempts to resolve conflicting opinion as to whether garlic varieties in Philadelphia are modifications of the same plant or distinct species. "Not being able to find in any of the standard works on botany the proper authority for considering the two plants as representatives of distinct species, and being satisfied from my own observations that they are not the same, I am led to the conclusion that the large plant may be justly esteemed as a hybrid, partaking of the nature of the garlic and the leek." (B-I/JP)

Thomas, Robert P., "On the Culture of the Elaterium Plant," Proc. Amer. Pharm. Assoc., 10: 198-9, 1862. Fragmentary cultivation experiments to see if the yield and quality compare with the British drug. Not sufficient yield for assay, and the study interfered with by "service in the Army of the Potomac." (B/JP)

Thomas, Robert P., "On the Color-Tests of Strychnia, as Modified by the Presence of Morphia," Amer. J. Pharm., 34: 227-236, 1862, and Chemical News, 5: 341-2 and 352-4, 1862 (reprinted from Amer. J. Med. Science, April 1862). Answers question of whether strychnia is actually decomposed when treated with test reagents in the presence of morphia, or its presence merely masked. The author "performed more than a hundred experiments, of which an account of a few of the most valuable and satisfactory is now submitted." "This experiment proves conclusively that strychnia in minute quantities can be retained from organic mixtures, notwithstanding the presence of three times its weight of sulphate of morphia." The author believes that diverse results previously reported are due to diverse methods of procedure, hence he gives a precise account of his "Mode of Testing." He also gives practical advice, based on own experiments, to those who may be asked to work in connection with poisoning trials. (CP/JP)

Thomas, Robert P., "On the Therapeutical Properties of Sanguinaria, and Its Acetate and Sulphate," Proc. Amer. Pharm. Assoc., 11: 214-222, 1863. Describes careful tests on self, giving sensations and changes in pulse. Dosage was 1/20 gr. and 1/10 gr. four times per day. Then, clinical observations were made on others. The author concludes that sanguinaria is expectorant; emetic in larger doses. "The reputed effects of bloodroot upon the liver, and as an alterative, have not been produced by sanguinaria or its salts upon myself or others subjected to experiment." (T-I/JP)

Procter, William, Jr., "Note on Some Properties of Berberina," Amer. J. Pharm., 36: 10-12, 1864. Previous writers are criticized for treating the substance from Berberis vulgaris "by the agency of neutral solvents, and which, as Berberin is an alkaloid, must be a natural salt of that substance." The author concludes that no one therefore has described "the properties of pure berberina." "The best process for isolating berberina is that hinted at by William S. Merrill, (Amer. J. Pharm., 34: 503, 1862) based on the separation of the sulphuric acid from the sulphate by either baryta or oxide of lead." Describes procedure and gives solubilities and reaction with various reagents. (CP-I/JP)

Procter, William, Jr., "On a Test for the Resin of Cannabis Indica," Amer. J. Pharm., 37: 23-27, 1865. Experimental results show that the extract may be identified by solubility in caustic alkali and by the small amount of resinoid it yields with nitric acid. (CP/JP)

Bridges, Robert, "On Southern Prickly Ash Bark," Proc. Amer. Pharm. Assoc., 36: 270-272, 1864. Establishes "true botanical source" of an unknown as "Z. tricarpum, Catesby" by comparing specimens with recorded descriptions of Zanthoxylum species. (B-I/JP)

Procter, William, Jr., "On a Test for the Resin of Cannabis Indica," Proc. Amer. Pharm. Assoc., 36: 244-8, 1864. A series of tests is devised to determine genuineness of the extract, noting differences of reactions of adulterants. The author states that to establish validity the tests must be studied further on a series of extracts of known origin and therapeutic powers. (CP/JP)

Procter, William, Jr., "Remarks on Dialysis," Proc. Amer. Pharm. Assoc., 36: 264-270, 1864. An attempt to extend the applications of dialysis to pharmacy. The author believes this process can be used for concentrating preparations of the active ingredients of opium and cinchona, although "further experimenting is needed." (PA/JP)

Procter, William, Jr., "On Liquidambar Styraciflua and Its Balsamic Resin," Amer. J. Pharm., 38: 33-38, 1866. Attempts unsuccessfully to answer question "whether the Liquidambar of the United States will yield a product similar to storax, if treated like the Liquidambar orientale, the source of that drug." Information from his own and other experiments is reviewed. Using sweet gum from New Jersey (Southwestern supply cut off by Civil War), the author found that "little if any real benzoic acid exists and that Mr. Creecy's experiment with the sublimed acid, testing by chlorinated lime, must have been imperfect, as a sublimate obtained in these experiments instantly developed oil of bitter almonds, in contact with permanganate of potassa. It is also evident that the earlier observers, Bonastre and Hodgson, mistook cinnamic for benzoic acid." (CP-I/JP)

Procter, William, Jr., "On the Removal of Cincho-Tannic Acid from Liquid Preparations of Cinchona," Proc. Amer. Pharm. Assoc., 14: 223-4, 1866. Gelatin was selected for experiments to remove cincho-tannic acid, so the alkaloids could be prepared in permanent liquid form. The author was partially successful in developing a method and reports fragmentary results for the guidance of future experimenters. (CP/JP)

Maisch, John M., "On the Specific Gravity of Medicinal Chloroform," Proc. Amer. Pharm. Assoc., 14: 264-7, 1866. Examines relation of moisture and light, and variation in specific gravity, to stability. "The practical results of these experiments are the proof that chloroform, to keep it from getting acid, should be reduced in specific gravity to about 1.475" by adding 95% alcohol. (PA/JP)

Maisch, John M., "On a Permanent Solution of Pyrophosphate of Soda and Iron," Amer. J. Pharm., 39: 388-395, 1867. Experiments to avoid precipitate that forms upon storage. Two formulas are offered, with the conclusion that pure pyrophosphate of iron, dissolved in pyrophosphate of soda, will be a permanent solution only if kept slightly alkaline or neutral. The author finds that boiling temperature promotes chemical change to ordinary phosphate or some insoluble modification of pyrophosphate, the reaction being hastened by presence of acids, alcohol and certain salts. (PA-CI/JP)

Maisch, John M., "On Colchicia," Amer. J. Pharm., 39: 97, 1867 (also in Chemical News, 15: 245-6, 1867). Experiments were undertaken to clear up "the contradictions in the statements of different authors." Reactions of various test reagents are checked. The minimum amounts of colchicia in water that may be detected by Mayer's test is 1:27,700; by Sonnenschein's test, 1:20,778; and by tannic acid, 1:4,156. The author concludes that undoubtedly colchicia is an alkaloid, whose salts decompose, with the formation of colchicein, either upon storage in aqueous solution or upon evaporation. It is hinted that colchicia and colchicein may have the same composition. (CP-I/JP)

Maisch, John M., "On the Milky Juice of Lactuca Elongata, Muhlenberg," Proc. Amer. Pharm. Assoc., 16: 405-409, 1868. A comparison of the "lactucarium" (Wild Lettuce) with European species, pharmaceutically and (with cooperation of "medical friends") therapeutically. The indigenous plant presents a greater stability problem in syrup form. Two physicians reported the same results from both L. elongata and L. virosa, and the author concludes that the drug is not "quite inert," as stated in the U. S. Dispensatory. (PA-T-I/JP)

Maisch, John M., "On Lycopodium Clavatum, Lin., and other North American Species as a Source for Lycopodium," Proc. Amer. Pharm. Assoc., 17: 368-9, 1869. Observations on the yield of "sporules" by various species. The yield was found to be too small to compete with the greater yield and cheaper labor of European drug collectors. (B-I/JP)

Procter, William, Jr., "Formulae for the Fluid Extracts in Reference to Their More General Adoption in the Next Pharmacopoeia," Proc. Amer. Pharm. Assoc., 8: 265-281, 1859. A well-conceived and comprehensive project that resulted in dividing drugs into six groups--based on analogy of composition or behavior with solvents--with a type process for each group. In working out the processes for fluidextracts "it has not been designed to retain in solution all the matter dissolved by the menstruum from each drug, as suggested by some; nor to reject all not usefully medicinal as sought by others; but to extract as far as possible all the valuable ingredients and to condense them into the required bulk..." (PA/JP)

College of Pharmacy of the City of New York (f. 1829)

1829-1839:

Ellet, William H., "Extract from an Unpublished Essay Upon the Compounds of Cyanogen," Amer. J. Science, 18: 329-337, 1830. Comparison of experimental results with those of other chemists concerning the constitution of Prussian Blue, a much disputed point. The author also discusses critically, and doubts, the view of Liebig and Gay Lussac that fulminic acid is analogous to the supertartrates. Few experimental data are given, but the paper reveals a critical mind and considerable understanding of the chemistry of the time. (CO/UP)

Gale, L. D., "Description of a Newly Modified Apparatus for Obtaining Potassium accompanied by remarks on the Redistillation and Preservation of this Metal," Amer. J. Science, 21: 60-64, 1832. Reports improvement of part of the apparatus, especially the receiver, which others had devised in the laboratory of the College of Physicians. The mechanical problems of re-distilling potassium are also discussed. The author maintains it is wrong to use the essential oil of copaiva in which to preserve potassium, since a series of experiments proved that the oil is oxidized quite rapidly; he concludes that naphtha is still best for preserving potassium. (CI/UP)

Gale, L. D., "Remarks on Professor Mitchell's Method of Preparing Carbonic Oxide, free from Carbonic Acid," Amer. J. Science, 27: 129-130, 1835. Not a significant contribution but a critical discussion and analytical check of the method reported by Mitchell. When the author tried to use the method to demonstrate before a class of the College of Pharmacy "the gas obtained was perfectly incombustible." Gale made a complete gas analysis to show that carbonic acid was formed. The residue was found to be sulphate of ammonia rather than sulphuric acid. The author discusses probable experimental conditions that led Mitchell to believe that sulphuric acid was the residue. (CO/UP)

1840-1849

1850-1859

1860-1869:

Maisch, John M., "On the Chemical Constituents of Coca Leaves," Amer. J. Pharm., 33: 496-500, 1861. Confirms and supplements Niemann's experiments, including isolation of the newly-discovered alkaloid. The author expresses regret at the limitation on his experiments caused by the small supply of coca leaves, a few ounces given to him by William Procter, Jr. (CP/JP)

Maisch, John M., "On the Conversion of Monohydrated into Common Phosphoric Acid," Amer. J. Pharm., 33: 385-89, 1861. Critically discusses formation of phosphoric acid and its three hydrates, stating that standard texts add nothing to Graham's statement of 30 years ago. Experiments on conversion of monohydrate convince him that density of solution is influential but that presence of nitric acid is most important in converting either concentrated or dilute solutions. The author believes nitric acid acts as a catalyst, but suggests more careful experiments to determine its exact role. (CI/JP)

Maisch, John M., "On the Volatile Oil of Myrcia Acris," Amer. J. Pharm., 33: 296-98, 1861. The author believes he has found a certain test for adulteration in the fleeting greenish hue produced by nitroprusside of copper. The reactions of various reagents that are used in testing for volatile oils have been checked in verifying the new test. (CP/JP)

Maisch, John M., "On the Preparation of Hydrobromic Acid," Chemical News, 6: 279-80, 1862. Processes recommended by various chemists have been compared, experimentally. The author comments on difficulties encountered, provides practical hints on technique, and describes the apparatus he has found most satisfactory. (CI/)

Mayer, Ferdinand F., "On Alkaline Iodides and Bromides," Amer. J. Pharm., 34: 289-295, 1862. Shortens the process for preparing iodides and bromides and removes necessity of using caustic alkalies. (CI/JP)

Mayer, Ferdinand F., "Some Remarks on a Systematic Quantitative Testing of Alkaloids," Proc. Amer. Pharm. Assoc., 10: 238-41, 1862. The first paper in which the author reports on his experiments with a solution of mercuric chloride in potassium iodide (Mayer's Reagent) as a quantitative test for alkaloids. The proportion of mercury in the precipitates has been determined for various alkaloids. It has not been possible to devise a suitable test from the iodine remaining in solution. Credit is given to A. Von Planta-Reichenau (1846) for the qualitative test and mention is made of the earlier quantitative work by Thomas B. Groves (1858), "but with results differing." This volumetric process (and difficulties encountered) is discussed, although not in a detailed or very precise manner. (Later--see below--the author acknowledges that F. L. Winckler had described the qualitative use of iodohydrargyrate of potassium as early as 1830.) (CP/JP)

Mayer, Ferdinand F., "Assay of Alkaloids,—Pure and in Preparation," Amer. J. Pharm., 35: 20-29, 1863. Reports successful adaptation of the qualitative reagent of F. L. Winckler (1830), iodohydrargyrate of potassium, for quantitative determination of "all vegetable alkaloids." The method is discussed generally, then with specific regard to the assay of atropia and preparations of stramonium and belladonna. (CP/JP)

Mayer, Ferdinand F., "Assay of Opium and Its Preparations," Amer. J. Pharm., 35: 384-401, 1863. A further extension of his method for "titration of the alkaloids by a graduated test liquor, a solution of mercuric chloride in an excess of iodide of potassium." An entirely volumetric method that "embraces many leading points of the assays from time to time recommended by members of our profession, and, as do all the others, turns upon the ultimate elimination of the morphia out of the complex material represented in this vegetable juice." Much less time and equipment is required than by other means. Mayer himself states that the quantitative application of Winckler's reagent was made at the suggestion of Thomas B. Groves (England), and that Alfred Valser (France) reported quantitative as well as qualitative use of the reagent in a thesis dated a month before Mayer presented his paper at the 1862 meeting of the American Pharmaceutical Association; however, Valser's work was not made public until some months later (E. Baudrimont in Journal de Pharmacie, XLiii, p. 49). (CP/JP)

Mayer, Ferdinand F., "On the Active Principles of the Strychnaceae," Proc. Amer. Pharm. Assoc., 11: 248-53, 1863. Caustic baryta is recommended as the alkali of choice for assays of the type first suggested by F. L. Winckler. A known portion of mixed-alkaloidal solution is precipitated with baryta in the author's method; the brucia is then separated from strychnia by dilution, taking advantage of different solubilities. Assay results are presented from eight experiments, comparing the alkaloidal content of different preparations and the different methods of extracting nux vomica, with competent discussion of the chemistry involved. (CP/JP)

Mayer, Ferdinand F., "Chemical Notes on Some Scrophulariaceae," Amer. J. Pharm., 35: 289-300, 1863. Claims to have noticed the alkaloid in digitalis, but "from want of time and material to isolate it this has been accomplished by Engelhardt" (Zeitschrift für Chemie und Pharmazie, 1862, p. 722). The author gives "some notes of my own experience on the properties of some proximate principles of this plant, and of Veronica and Gratiola officinalis, in connection with a preliminary investigation of one of our indigenous medicinal plants, the Veronica Virginica of Linné, or Leptandra Virginica of Nuttall." The experimental aim was mainly to determine "the presence of a saponacious principle, and the origin of the substances precipitable by tannin." Results are inconclusive. (CP/JP)

Maisch, John M., "On the Alkaloids of Menispermum Canadense," Amer. J. Pharm., 35: 301-303, 1863. In experiments started a year previously, the author became convinced of "the presence of an alkaloid in the roots of some plants [including Menispermum Canadense] in which it has since been discovered" by others. Since "my other engagements not only forced me to give up the investigation of the other constituents, but have also delayed my examination of the alkaloids...I think it better to state the few facts proved so far..." His preliminary results are given. (CP-I/JP)

Mayer, Ferdinand F., "On Tobacco," Proc. Amer. Pharm. Assoc., 12: 223-30, 1864. Reaffirms that nicotina is the "active principle in all parts of the plant before and after curing"--a recurrent question. Concludes that at least while fresh "the plant or its parts contain no trimethylina, nor any ammonia while fresh." Differs from Buchner. (CP-I/JP)

Mayer, Ferdinand F., "A Fly-Leaf to My 'Assay of Alkaloids'," Amer. J. Pharm., 37: 5-16, 1865. Discusses and answers with some acrimony the chemical objections by Thomas B. Groves (England) on the iodohydrargyrate of potassium method--an "attach which is alike unsound and unfair." (The author had previously acknowledged that his development of the assay method was stimulated by a suggestion made by Groves.--Amer. J. Pharm., 35: 384-401, 1863.) The previously unpublished results of further work with the method are used in refutation of Groves, whose research was devoted to "three modes of conducting an assay, and to two abortive propositions. The three

first named are all founded on the precipitation of alkaloids by iodohydrargyrate of potassium, for which I published before all others a systematic procedure...Instead of a proposal to substitute something better for this method of mine, Mr. Groves converts by far the greater part of his pages into an effort to bring my statements into discredit..." (CP/JP)

Squibb, E. R., "Note of Correction; Permanganate of Potassa," Amer. J. Pharm., 37: 22, 1865. An important practical error in a previous paper is corrected. Recrystallization is not advisable to eliminate free potassium, since it appears that "Permanganate of Potassa cannot exist in hot solution under ordinary circumstances, without the presence of a definite, though small, proportion of free potassa." (CI/JP)

Edwards, Arthur M., "Note on a Point in the Habits of the Diatomaceae and Desmidiaceae," Proc. Boston Society of Natural History, 11: 361-3, 1866-68. The author, for the first time, formally presents and supports his conviction that the accepted "division of the Diatomaceae into free and attached genera does not exist in nature..." Unlike most writers, he holds that all species are at some period of their existence in an adherent or attached condition, growing upon, for the most part, aquatic vegetation of a larger size. This condition is considered temporary and conditional. Observations of supposed free species in attached state and supposed attached species in free and mobile state are described. The conclusions regarding Diatomaceae also apply to Desmidiadeae. (P/UP)

Edwards, Arthur M., "On the Occurrence of Living Forms in the Hot Waters of California," Amer. J. Science, 45 (2nd series): 239-41, 1868. An examination of specimens from hot, saline geysers reveals only Diatomaceae, and the author cannot be certain that they actually grew there. The probabilities as to species are discussed. A literature review on diatoms from thermal water is included, along with a disclaimer of having found animal as well as vegetable forms of life, which had been attributed to him by "Prof. Brewer." (O/UP)

Walz, Isidor, "On the Oxidation of Diamylene with Chromic Acid," Amer. J. Science, 45: 57-61, 1868. Amylene was polymerized by the method of Erlenmeyer, under whom this work was done at Heidelberg, yielding the monobromid of diamylene bibromide. This, as well as the green oil resulting from oxidation, was subjected to ultimate analysis. The author hesitates, however, to assign a formula. The tarry residue and acid distillate were also analyzed. (CO/UP)

Maryland College of Pharmacy (f. 1841; suspended 1846-56)

1841-1846

1856-1859:

Steiner, Lewis H., "Disinfectants," J. and Transac. Md. Coll. Pharm., 1 (n.s.): 289-300, 1859-60. A critical but non-experimental review of the properties of some common disinfectants, comparing them with two preparations proposed in France that employ plaster of Paris and coal tar. (O/JP)

1860-1869

Tulane University of Louisiana, Medical Department (Pharmacy Course, f. 1838)

1838-1839:

Riddell, J. L., "Observations on the Geology of the Trinity Country, Texas, Made during an Excursion There in April and May, 1839," Amer. J. Science and Arts, 37: 211-17, 1839. The field report covers probable age of the land, kinds of earth, special formations, springs (including data on analyses), salt marshes, mineral and coal deposits (with tests on samples), opalized wood, et cetera. (O/UP)

1840-1849:

(Carpenter, William M.), "Notice of an Interesting Fossil," Amer. J. Science, 42: 390-1, 1842. Description of a molar tooth found in digging a well, "without doubt the fifth molar of the left lower jaw of a Tapir..." An editor's addendum states: "We are happy to learn from Prof. William M. Carpenter, of Jackson College, Louisiana, that he has for some time past been engaged in making, by direction of the legislature, a geological examination preliminary to a complete survey of that state...we rejoice that the legislature of Louisiana have had the wisdom to select" him. (O/UP)

Carpenter, William M., "Some Remarks on the Methods in Common Use of Obtaining the Mean Temperature of Places, and on the Supposed Difference between the Temperature of the Air and that of the Earth," Amer. J. Science, 44: 50-53, 1843. The author emphasizes errors arising from the common practice of taking the mean of three daily temperature readings, including the "Army Meteorlogical Register, and in those of most of the meteorlogical societies..." Extensive own data is used to show that hourly observations give lower temperature means for every season of the year, at least in a southern climate. Results can be approximated by readings at 6 and 7 a.m., 12 M., 2 p.m., sunset and 9 p.m. Variations from the kind and location of thermometers is also discussed. Includes observation on the relation between atmospheric temperature and the temperature of springs. (O/UP)

Carpenter, William M., "Remarks and Observations on the Formation of Fogs," Amer. J. Science, 44: 40-50, 1843. Eight general conclusions are given about conditions for the occurrence of fogs over the Mississippi River, using own data and other evidence. The data tend "to render it probable that other influences (than the mixture of masses of air of different temperatures) may, under favorable conditions, give rise to the same phenomenon; and also to show that the prevailing opinions respecting the conditions requisite to its production, are in some measure erroneous." The views of Sir Humphry Davy, among others, are refuted. (O/UP)

Carpenter, William M., "Abstract of a Meteorlogical Register, Kept at Jackson, (Louisiana)...," Amer. J. Science, 44: 49, 1843. It is shown that (contrary to a common assumption) the temperature of the coldest springs is the same as the five-year mean atmospheric temperature. (O/UP)

Carpenter, William M., "Description of a Peculiar Arrangement of Muscles in the Glass Snake," Amer. J. Science, 2 (2nd series): 89-95, 1846. The author analyzes the muscular and bony structure that causes fragility--especially of the tail--of several species of Ophisaurus (Glass Snake). Apparently from careful observations on both dissected and living snakes, it is concluded that "muscular cones of the successive bones, mutually invaginate into each other, where they are retained, not by fibrous attachments, but merely by fitting nicely into each other, and by the harmony of their contractions..." (P/UP)

Carpenter, William M., "Remarks on Some Fossil Bones Recently Brought to New Orleans from Tennessee and from Texas," Amer. J. Science, 1 (2nd series): 244-50, 1846. The author reports on the skeleton of a young mastadon that had been widely publicized, before his identification, as the remains of a man eighteen feet high. The structural details and state of preservation are described. Fossils from Texas are also described and figured, including remains of an ox, a tapir, and assorted fragments upon which the author comments as to the possible species. (O/UP)

1850-1859:

Riddell, J. L., "Notice of a Binocular Microscope," Amer. J. Science, 15: 68, 1853. The author has invented and constructed a combination of glass prisms permitting use of both eyes and maintaining correct perspective of length, depth and breadth (except for opaque bodies). (O/UP)

Riddell, J. L., "On a New Method of Illuminating Opaque Objects, for the High Powers of the Microscope:—and on a New Achromatic Condenser," Amer. J. Science, 15: 69, 1853. A front combination of the objective lens is designed to condense light upon the opaque object, using light from behind, which passes through the marginal border of the lens. The invention is considered especially useful when the objective has a very short focal distance, and the nearness of the object does not permit other illumination. (O/UP)

Riddell, J. L., "Fish-rod Balance and Spheroidal Evaporation," Amer. J. Science, 26: 71, 1858. A type of micro-balance made of glass is described, which the author states he invented in 1840. Readings are taken with the aid of a microscope and micrometer scale. Delicate but unreliable, being affected by moisture and temperature. (O/UP)

Chicago College of Pharmacy (f. 1859; suspended 1862-1870)

1860-1862:

Mahla, F., "A Note on the Polarization of American Oil of Turpentine," Amer. J. Science, 32 (2nd series): 107-8, 1861. It is concluded from experiments that American oil of turpentine consists of two or more different hydrocarbons, which are probably polymeric to each other. The author finds that rotation of commercial spirits of turpentine is variable (rather than the 18°.6 to the right usually cited in the literature); that distillation yields two oils of different rotating power, and that the readings are further changed by re-distillation. (CP-I/)

Mahla, F., "Berberin in Hydrastis Canadensis," Amer. J. Science, 33 (2nd series): 43-46, 1862 (also reprinted in Amer. J. Pharm., 34: 141-44, 1862). The substance in "Yellow Puccoon" assumed to be hydrastin is precipitated from solution by mineral acid, hence the author considers its basic nature improbable. Reagent reactions coincide with those of the muriate of Berberin, but to "quiet all doubts" the author undertook an ultimate analysis. He concludes that the substance is berberin, "as far

as I am aware, the first instance that this interesting body has been found in a plant which belongs to the Ranunculaceae". To the reprint of this paper in the American Journal of Pharmacy the editor (Procter) stated: "It is to be regretted that Dr. Mahla did not consult the paper of Mr. Alfred B. Durand...who first isolated a distinct crystalline alkaloid from the Hydrastis. I have a sample of Mr. Durand's hydrastin, and it is not berberin, but crystallizes in light yellowish crystals of considerable size. The yellow coloring matter noticed by Mr. Durand is probably berberin." In 1863,--after Mahla's single term of teaching at the outbreak of the Civil War--he published another paper "On Hydrastia," in which he discusses the ultimate analysis and gives the empirical formula of berberin (Amer. J. Pharm., 35: 433-6, 1863; and Amer. J. Science, July, 1863). (CP-I/).

* A paper was not tabulated as contributed to a journal of pharmacy ("JP") unless originally published there.

Abstracts from 1870 to 1900

(from two independent schools and two university schools)

Philadelphia College of Pharmacy

1870-1879:

Maisch, John M., "Note on Hydrocyanate of Morphia," Amer. J. Pharm., 43: 258, 1871. A prescription incompatibility led to experiments showing that neutral cyanide with neutral solution of morphia salt (as dilute as 1:1500) produces a hydrocyanate of morphia, which has not previously been reported. The author recommends that cyanide not be prescribed with morphia salts, unless slightly acidulated. (PA-CP/JP)

Maisch, John M., "Detection of Turmeric in Powdered Rhubarb and Yellow Mustard," Amer. J. Pharm., 43: 259, 1871. A delicate test is devised to detect turmeric, an adulterant used to restore color of deteriorated or insect-infested lots. It is based on liberation of boracic acid, which imparts a characteristic color to curcumin. (CP/JP)

Maisch, John M., "On the Precipitation of Quinia by Iodide of Potassium from Acid Solutions," Amer. J. Pharm., 43: 51-53, 1871. Typical of the author's better short studies on practical problems of dispensing, which commonly fall outside the scope of the present abstracts. The precipitate observed in a prescription is believed to result from the reaction observed by Righini between quinine sulfate and potassium iodide. The precipitate has been examined qualitatively, and the explanation of Righini is critically discussed. (PA-CP/JP)

Maisch, John M., "On Monobromated Camphor," Amer. J. Pharm., 44: 337-46, 1872. A critical comparative discussion of the literature on processes for manufacturing monobromated camphor on a small scale. The author's own process and equipment are then described. Analyses are reported on samples crystallized from petroleum benzine, from alcohol, and from petroleum benzine after the oily compound of the first mother-liquor has been heated to 260°. (PA-CP/JP)

Maisch, John M., "Chinese Blistering Bugs: Mylabris cichorii," Pharmaceut. J., 3: 726-8, 1873. The determination of species in a commercial sample shows intermixture with M. phalerata. Analysis shows that Mylabris contains two-and-a-half times more cantharidin than the normal content of commercial cantharides. Differences in analytical reports in the literature, the author suggests, are probably due to differences in age and deterioration of samples used. In the present analyses the "worm dust" is included in the sample, since the mites feed on soft parts of the flies and hence they themselves become rich in cantharidin. (B/JP)

Maisch, John M., "The Asserted Presence of Tannin in Gentian Root," Amer. J. Pharm., 48: 117-21, 1876 (reprinted in Pharmaceut. J., 6: 775-6, 1876). Workers, except for E. L. Patch of Boston, had analyzed gentian without finding tannin. The present author believes the reaction observed by Patch was due to tannic matter in the orange peel present in the Compound Tincture of Gentian, and not in gentian itself. Experimental results and a critical discussion are presented to support this

view. Later, upon receiving an actual transcript of Patch's paper, Maisch conceded (Amer. J. Pharm., 48: 188-9, 1876) that he had been misinformed, that Patch had not failed to take orange peel into account, and that their findings were essentially the same. (CP/JP)

Remington, Joseph P., "On Hydrobromic Ether," Proc. Amer. Pharm. Assoc., 25: 454-7, 1877. Disadvantages are found in both the manufacturing process of De Vrij (produces some common ether) and of Serullas (danger of explosion). A chemical process is reported supposed to have fewer disadvantages and yielding a purer product. (PA-CO/JP)

Maisch, John M., "The Supposed Alkaloid of Podophyllum," Amer. J. Pharm., 51: 580-3, 1879. As early as 1869 the author's experiments failed to demonstrate the presence of an alkaloid as reported by F. F. Mayer. The present report is considered proof "that the rhizome of podophyllum contains no alkaloid at any period of its growth." (CP-I/JP)

Sadtler, Samuel P., "Abietene, a New Hydrocarbon, as Type of a New Group of Terpenes," Amer. J. Pharm., 51: 176-80, 1879. Professor William Wenzell of the California College of Pharmacy had described a new variety of oil of turpentine, which he called abietene. The present author reports a similar compound in Pinus ponderosa, which is considered "a type of a new group of terpenes." A comparative study has been made on optical rotation, reactions with acids and nitrosyl chloride, and the formation of hydrates, and will be studied further. The

analytical work was done for the author by Miss Flanigen at the University of Pennsylvania. (CP-I/JP)

Sadtler, Samuel P. and McCarter, H. C., "Preliminary Notice of an Investigation of 'Petrocene', a Product of the Destructive Distillation of Petroleum," Amer. Chem. J., 1: 30-32, 1879-80, and Proc. Amer. Philos. Soc., 18: 185-6, 1880. The quinone and the alizarine derived from the hydrocarbon (Petrocene), which fuses at 200° C., indicate a probable empirical formula of $C_{16}H_{14}$. This would be a dimethyl-anthracene, but it does not agree with the dimethyl anthracene discovered by Van Dorp and studied by Wachendorf and Zincke. A further investigation is promised. (CO/UP)

1880-1889:

Maisch, John M., "On the Presence of Tannin in Gentian," Amer. J. Pharm., 52: 1-4, 1880. Ville, Patch, Maisch and Davies all had been working on the question of whether there was any tannin in gentian root, with conflicting results. Several others had made a proximate analysis of the root. From further experimental work with the cooperation of a student, the author concludes that "commercial gentian is free from tannin." In discussing the previous literature, probable sources of error are pointed out. This apparently closed a matter of lively interest among pharmaceutists concerned (see, e.g., Amer. J. Pharm., 48: 117, 188, and 486, 1876). (CP/JP)

Sadtler, Samuel P. and Rowland, William L., "Preliminary Notice of a New Vegetable Coloring Matter," Amer. Chem. J., 3: 22-26, 1881-2. The coloring matter from African "Bethe-barra" wood was extracted and crystallized. Microscopic appearance was one of "a series of flat prisms, joined laterally." The physical properties of the crystals were determined. Ultimate analysis of lots dried at 100° and 125° C. indicate an empirical formula of $C_{28}H_{29}O_5$, with $3H_2O$ at the lower drying temperature. A table is also presented comparing the action of a series of reagents on several common coloring principles and on the new principle. There appears to be a relationship to chrysarobin and chrysophanic acid. (CP/UP)

Power, Frederick B., "Preliminary Notice of an Alkaloid in the Bark of Fraxinus americana (White Ash)," Amer. J. Pharm., 54: 99-100, 1882. An alkaloid was detected in the bark, in experiments by the student H. M. Edwards under the author's direction. Since the student is graduating and cannot continue the investigation, an announcement is made with a request that further investigation be reserved as the province of the author. (CP-I/JP)

Trimble, Henry, "On the Volatile Oils of Peppermint and Spearmint," Proc. Amer. Pharm. Assoc., 33: 501-3, 1885. Fractionation and ultimate analysis was undertaken to learn the possible chemical relation between the oils. They appear to contain identical hydrocarbons, which exist in smaller amounts than supposed and are hard to isolate. The oxygenated portion of spearmint oil is carvol; the oxygenated portion of peppermint oil is pipmenthol. Both contain resins, formed in part during distillation. (CP-I/JP)

Trimble, Henry and Macfarlane, F. D., "An Examination of Burdock Fruit," Amer. J. Pharm., 57: 127-8, 1885. A qualitative analysis of seeds, whose therapeutic value had been suggested in Squibb's Ephemeris. A bitter principle that the authors call "Lappine" was identified but could not be crystallized. Other constituents were not reported. A further investigation is promised. (CP-I/JP)

Trimble, Henry, "A Short Method for Testing Extract of Logwood," J. Soc. Dyers and Colourists, 1: 92, 1885. A relatively simple colorimetric test has been devised for testing extract of logwood. Besides the detection of tannin material, it is useful for giving a numerical value to dye tests. "Some hundreds of determinations" by the author, and experience with his test by other chemists, indicate its value. (CP-I/UP)

Trimble, Henry, and Schuchard, Herman J., "A Chemical Examination of Polygonum hydropiper," Amer. J. Pharm., 57: 21-23, 1885; 58: 356, 1886. A quantitative proximate analysis as a "Contribution from the Chemical Laboratory of the Philadelphia College of Pharmacy." In attempting to determine the nature of the "pungent principle" the authors conclude that it is "decomposed on the slightest heating, and that the only proper preparation of the drug would be one made without the application of heat." The "active principle" (polygonic acid) reported by Rademaker is believed to have been only a mixture of impure tannic and gallic acids. (CP/JP)

Trimble, Henry and Jones, Samuel S., "Analysis of Aristolochia foetida (Yerba del Indio)," Amer. J. Pharm., 58: 113-14, 1886. Extraction with various solvents and quantitative proximate analysis leads to the belief that a volatile alkaloid is present. Too little material and "the approach of College examinations" prevented further work on this drug from the Mexican Pharmacopoeia. (CP-I/JP)

Trimble, Henry, "An Analysis of the Underground Portion of Phlox carolina," Proc. Amer. Pharm. Assoc., 34: 115-119, 1886, (also in Amer. J. Pharm., 58: 479-82, 1886; as sometimes happened, the paper here is not clearly identified as a re-publication). A continuation of work started by a student. A quantitative proximate analysis is reported, and an ultimate analysis is promised in connection with a proposed comparative study. "The method of Dragendorff has been found to be the most satisfactory of a number that have been offered, and the results will always show originality if that faculty has been exercised." (CP-I/JP)

Trimble, Henry, "Composition of Precipitated Ferrous Sulphate," Proc. Amer. Pharm. Assoc., 36: 140-2, 1888. The compound is found to be of constant composition and the same as "the large crystals." Oxidation in air is found to be so slow that the author questions the need for customary storage precautions (glass-stoppered bottle and a lump of camphor in the bottle). Four samples were prepared, varying the process in different ways; a sample several years old was also checked. There had been conflicting reports in the previous literature. (CI/JP)

Trimble, Henry, "The Bitter Principle of Burdock Fruit," Amer. J. Pharm., 60: 79-80, 1888. Continuation of a previous study (see above, 1885). Analytical results are duplicated, except for the nature of the bitter principle. It is found to be a glucoside, rather than an alkaloid, "which on boiling with dilute acid decomposes into the resin, which is soluble in alcohol and sugar." The compound is now obtained in crystalline form, and a further investigation is promised. (CP-I/JP)

Trimble, Henry, "Catechu and Gambier," Proc. Amer. Pharm. Assoc., 36: 99-104, 1888 (also in Amer. J. Pharm., 60: 497-502, 1888). Comparative study on which is to be preferred therapeutically for astringent effect. Quantitative content of tannin and catechin based on three samples of each. It is concluded that astringent values cannot be determined from the quantitative value of the ether- and alcohol-soluble portions, as the textbooks indicate. Textbook statements that the drugs are chemically the same are also questioned. (CP/JP)

Trimble, Henry, and Schroeter, Hermann, J. M., "The Oils of Wintergreen and Birch," Amer. J. Pharm., 61: 398-405, 1889. A quantitative study to "investigate anew the chemical composition of the oils and in that way compare them." Unlike previous investigators, who obtained varying results, the authors found the oils "physically and chemically identical." (CP-I/JP)

Trimble, Henry, and Schroeter, Hermann, J. M., "On a Crystalline Compound in Fabiana imbricata," Amer. J. Pharm., 61: 407-8, 1889. Ultimate analysis of six samples is reported. The crystalline compound is judged "worthy of further investigation; a resin of the formula $(C_{18}H_{31}O_2)_x$ is reported but considered to be without medical value. (CP/JP)

Trimble, Henry, and Schroeter, Hermann, J.M., "Oil of Camphor," Amer. J. Pharm., 61: 273-83, 1889. No two investigators had obtained the same or even similar results on this oil. The present authors tested eight samples in a Wild polaristrobometer and selected for analytical investigation an oil judged to be the authentic crude product and available in quantity. Quantitative results are given for different fractions from "over 90 combustions"; also vapor densities. (CP/JP)

1890-1900:

Trimble, Henry, "Eupatorium purpureum," Amer. J. Pharm., 62: 73-80, 1890. Results of ultimate analysis of three different samples, 16 combustions of each, are given for the crystalline principle. A microscopical examination is also reported. The author concludes that the principle is not quercetin or quercitrin as stated in the U. S. Dispensatory, and suggests the name euparin. In 1887 the author had a student assay the leaves and in 1888 another student assayed the rhizomes, for thesis work, but neither had been able to isolate the yellow, neutral crystallized principle found by John Uri Lloyd. (CP-I/JP)

Trimble, Henry, "Chestnut-Wood Tannin," J. Franklin Institute, 132: 303-307, 1891. Quantitative proximate analysis of a verified sample of Castanea vesca shows 7.86% tannin. Much of the literature on "chestnut tannin" had actually referred to chestnut oak or horse chestnut. Reagent reactions and ultimate analyses of the purified tannin show a close similarity to gallotannic acid, although the hydrogen content is high. Results of the reagent reactions do not entirely agree with those reported by Procter, who may have had a mixed sample. (CP/)

Trimble, Henry, and Peacock, Josiah C., "Geranium maculatum," Amer. J. Pharm., 63: 265-7, 1891. Proximate analysis based on 14 collections of rhizomes. The study was stimulated by conflicting results in the literature and by the thought that the time of collecting the rhizomes might affect the tannin strength. The authors did not find the gallic acid that two other investigators had reported. They conclude that the tannin is "a glucoside decomposable into gallic acid, glucose and geranium red." (CP-I/JP)

Trimble, Henry, and Lloyd, John Uri, "The Yellow Coloring Principle of Frasera Walteri," Proc. Amer. Pharm. Assoc., 39: 143, 1891. Two classes of crystals were found, differing in shape and color but similar in solubility. The results of ultimate analyses are reported. The crystals appear to be identical except for physical appearance and melting point. This yellow principle had long been known, but there was much doubt as to its actual constitution and whether or not it was a mixture. (CP-I/JP)

Trimble, Henry, "Canaigre Tannin," Amer. J. Pharm., 65: 161-9, 1893. Extensive experiments were performed on the roots of this Southwestern plant. It is concluded that the tannin belongs to a group of tannins of which mangrove and rhatany are representative. Preparation, purification, reagent reactions, reactions of the acetyl derivative, and ultimate analyses of the tannin were systematically studied. (CP-I/JP)

Trimble, Henry, "Chestnut-bark Tannin," J. Franklin Institute, 133: 407-8, 1892. This comparative study of bark supplements the previous investigation of chestnut wood (see above, 1891). Quantitative proximate analysis shows 7.31% tannin (compared with 7.85% from wood). Ultimate analysis indicates an identity with wood tannin; both are considered identical with allo-tannic acid despite somewhat high hydrogen content. The bark tannin is the darker, although a light middle fraction can be obtained by precipitation with lead acetate, it was found. The author suggests that the darker colored tannin is tannin mixed with its anhydride. (CP-I/)

Trimble, Henry, "Four Oak Barks from India," Amer. J. Pharm., 66: 299-301, 1894. Extracted tannin solutions are tested comparatively. An ultimate analysis of one species is reported. Indian oak tannins are found to be identical with one another and with oaks indigenous to the United States, which the author has examined previously. (CP/JP)

Bastin, Edson Sewell, "Starches in Different Commercial Varieties of Cacao," Amer. J. Pharm., 66: 369-77, 1894. A microscopical investigation, presenting twelve figures. No differences are found among the starches sufficiently constant for reliable identification. "The most important result of the investigation is rather the proof it affords of the essential likeness of the starches of the different varieties," which is sufficiently distinctive to differentiate them from starches of other drugs. (CP/JP)

Bastin, Edson Sewell, "Structure of Podophyllum," Amer. J. Pharm., 66: 417-24, 1894. Habitat and microscopic and macroscopic characteristics are discussed (six figures). A stain technique was employed. (B-I/JP)

Bastin, Edson Sewell, "Structure of Heuchera Americana," Amer. J. Pharm., 66: 464-73, 1894. Discussion of pharmacognosy, with six figures. The location and relative amounts of tannin in different types of cells are described. The "alcannin test" was used for resin. (B-I/JP)

Bastin, Edson Sewell, "Geranium maculatum," Amer. J. Pharm., 66: 516-22, 1894. Pharmacognostic discussion, with five figures. (B-I/JP)

Bastin, Edson Sewell, "Structure of Asarum canadense, L.," Amer. J. Pharm., 66: 574-80, 1894. Pharmacognostic discussion, with five figures. (B-I/JP)

Sadtler, Samuel P., "On the Technical Analysis of Asphalts," J. Franklin Institute, 140: 383-6, 1895. The Lincoln process is considered good but tedious, besides requiring three solvents, of which one is unsatisfactory (sticky). An apparatus has been devised for continuous extraction, better solvents have been found, and the procedure improved--with very good reproducibility of results. Most of the experimental work was carried out by the author's assistant, Blount Hunter. (CO/UP)

Bastin, Edson Sewell, "Structure of Iris," Amer. J. Pharm., 67: 78-83, 1895. Discussion of microscopical pharmacognosy, with five figures. (B-I/JP)

Bastin, Edson S., "Structure of Cimicifuga," Amer. J. Pharm., 67: 121-8, 1895. Discussion of microscopical pharmacognosy, with seven figures. (B-I/JP)

Bastin, Edson S., "Structure of Veratrum Viride," Amer. J. Pharm., 67: 196-203, 1895. Discussion of microscopical pharmacognosy, with five figures. (B-I/JP)

Bastin, Edson S., "Structure of Epigaea repens," Amer. J. Pharm., 67: 231-6, 1895. Discussion of microscopical pharmacognosy, with three figures. The author's series of microscopical studies are reported in a set pattern, by which identifying characteristics are indicated and the structural detail carefully described and figured. None of this series of papers refers to any previous pharmacognostic study of these indigenous plants. (B-I/JP)

Bastin, Edson S., "Structure of Sassafras," Amer. J. Pharm., 67: 312-18, 1895. Pharmacognostic discussion, with four figures. (B-I/JP)

Bastin, Edson S., "Structure of Our Hemlock Barks," Amer. J. Pharm., 67: 356-62, 1895. Pharmacognostic discussion, with five figures. (B-I/JP)

Bastin, Edson S., "The Structure of Our Cherry Barks," Proc. Amer. Pharm. Assoc., 43: 211-226, 1895 (also in Amer. J. Pharm., 67: 435-452 and 595-99, 1895). A study stimulated by substitutions of non-official species. Descriptive and procedural discussion, with many histologic drawings, concerning the comparative study of five species. The author presents it as a preliminary study that "may be of service to our profession, and aid in emphasizing the importance of the histological structure of drugs." (B-I/JP)

Trimble, Henry, "The Tannin of Some Acorns," Amer. J. Pharm., 68: 601-4, 1896. Quantitative results on tannins from several species and from various parts of the acorn. (CP-I/JP)

Trimble, Henry, "The Tannins of the Palmettos," Garden and Forest, 9: 182-3, 1896. Ultimate analysis of the tannin confirms the close relation with oak-bark tannin. An analysis of the stem and root for moisture, ash and tannin is also given. (CP-I/)

Sadtler, Samuel P., "Some Results Obtained in the Destructive Distillation of Linseed Oil, with Remarks on Its Bearing on Engler's Theory of the Origin of Petroleum," Proc. Amer. Pharm. Assoc., 44: 186-7, 1896. While examining boiled oil driers 40% neutral petroleum-like oils were found in boiled linseed oil. The author finds that destructive distillation had occurred, being attributable to boiling under pressure. Preliminary experiments indicate the presence of hydrocarbon oils analogous to natural petroleum oils. These will be studied further and the work extended to other seed oils. Engler's theory on slow destructive distillation of fatty animal tissues underground, as a source of petroleum, is extended to also include "vegetable oil seeds as probable additional sources of the petroleum oil formation. (CO/UP-JP)

Bastin, Edson S., and Trimble, Henry, "A Contribution to the Knowledge of Some North American Coniferae," Amer. J. Pharm., 68: 21-39, 65-79, 136-40, 199-210, 242-54, 321-37, 383-86, 409-22, 554-66, 642-48, 1896; and 69: 90-97, 354-59, 1897. The authors report proximate analyses, tannin studies, physiology of resins, ultimate analyses and histologic studies. "While a portion of the work will necessarily be compiled," for this extensive series, "it is proposed that the most of it shall be the results of original research." (B-CP-I/JP)

Trimble, Henry, "Mangrove Tannin," Univ. Penna. Pubs., Contributions from the Botanical Laboratories, 1: 50-55, 1897. Elementary analysis indicates an empirical formula $C_{25}H_{25}O_{11}$. Reagent reactions and tests on action of heat and hydrolysis are also reported. The tannin appears identical with that from

horsechestnut, rhatany and tormentil. (CP-I/)

Trimble, Henry, "On the Occurrence of Strontium in Plants," Amer. J. Pharm., 69: 296-7, 1897. Traces of strontium have been found in the bark of various species of Castanopsis from Singapore and also of two oak species. The author concludes that strontium may be utilized by the plants to replace calcium. (B-P/UP-JP)

Trimble, Henry, "The Tannin of Castanopsis," Amer. J. Pharm., 69: 406-8, 1897. Percentages and some general characteristics of the tannins are given from several species from Singapore and two oak species. The indications are that oak tannin appears in all Indian species of castanopsis. Lack of material prevented more extensive study. (CP/JP)

Trimble, Henry, "Pomegranate Rind," Amer. J. Pharm., 69: 634-6, 1897. Skeptical of the high percentages of tannin reported in the literature, the author undertakes to verify or refute them. The high results are confirmed and identity of the tannin with gallotannic acid is established. Ultimate analysis is included in the evidence. (CP-I/JP)

Kraemer, Henry, "Examination of Powdered Vegetable Drugs," Proc. Amer. Pharm. Assoc., 45: 211-20, 1897. Development of a method proposed in a preliminary paper (1894) on quantitative results, using the microscope. "Approximate quantitative results may be obtained in the examination of unknown powders by the methods given." Standardization of conditions and having a truly representative sample are stressed. "...Every treatment that is

possible in a sample to be analyzed must be given to a standard with which the comparison is made." For example, if it is suspected that the active principle has been extracted, then the standard powder must have been extracted also. (B/JP)

Kraemer, Henry, "Qualitative Examination of Powdered Vegetable Drugs," Proc. Amer. Pharm. Assoc., 46: 295-336, 1898. An extensive systematic study, embracing 300 drugs that have been classified according to color. Charts are presented to aid in the identification of unknowns, based on distinguishing microscopic characteristics. For example, one section is headed "Containing starch; but few or no crystals of calcium oxalate and rather numerous fragments of tissues"; with subsections devoted to the more specific identifying characteristics of individual drugs of this type. (B/JP)

Kraemer, Henry, "Color Standards of Powdered Vegetable Drugs," Proc. Amer. Pharm. Assoc., 47: 194-221, 1899. The origin and nature of color, color perception, nomenclature and classification are discussed, with consideration of their application to color standards for vegetable drugs. It remains an open question whether an adequate set of color standards can be achieved, but the goal is "development of a scientific standard which might be desired or found necessary for the purpose of the United States Pharmacopoeia." The immediate goal is not a standard that will be legally valid but that will enable pharmacognosists to understand, for example, what "yellowish-brown" means. (B/JP)

Moerck, Frank Xavier, "The Assay of Belladonna Leaves and Some of Its Preparations," Amer. J. Pharm., 71: 105-20, 1899. Leaves and extracts have been assayed by different methods. The results are critically discussed, and a new method is tentatively suggested, although it is not without disadvantages. (CP-I/JP)

Moerck, Frank Xavier, "The Assay of Belladonna Leaves," Amer. J. Pharm., 71: 320-26, 1899. The previous paper showed the fallacy of Keller's assay method and suggested a more accurate method. The author now reports, with detailed tables, on studies that "improve this assay process in several directions." (CP-I/JP)

Moerck, Frank Xavier, "The Estimation of Nitrates and Ammonia in Water," Amer. J. Pharm., 71: 157-61, 1899. The author presents a critical discussion of methods of water analysis, including modifications based on his own work. (CI/UP-JP)

Kraemer, Henry, "The Morphology of the Genus Viola," Torrey Botanical Club Bulletin, 26: 172-83, 1899. Extensive observations are given on 30 species of a genus that has been chaotic. It is concluded that one group may be distinguished by a nearly globular stigma with lip-like appendage, a style with a knee-like bend in the lower part, long hairs on the stamen, and corkscrew hairs on the spurred petal. Differentiating characteristics are then suggested for the remaining species. (B-I/UP)

Kraemer, Henry, "The Crystals in Datura Stramonium, L.," Proc. Amer. Assoc. Advance. Science, 48: 305-6, 1899. Since von Wittstein has shown the value of studying calcium oxalate histologically in plants, from a systematic standpoint (based on a study of the Umbelliferae), the author has undertaken a study of some genera of Solanaceae. The present report deals mainly with Datura stramonium, which exhibits all forms of the crystals found in Solanaceae. The shape, size and location are carefully delineated. (D-I/)

Kraemer, Henry, "The Structure of Starch Grains," Science, 11: 304-5, 1900. In this invitation paper, the author shows that textbooks are wrong in two traditional figures of starch characteristics. These appearances were entirely relative to the view of an observer. The author's discussion assumes that observers should, and will, focus at the same point, the top of the lamellae. Characteristics of starch grains brought out by different reagents and stains are described. (B/)

Kraemer, Henry, "Note on the Origin of Tannin in Galls," Proc. Amer. Assoc. Advance. Science, 49: 282-3, 1900. A crystalline compound found in galls is determined to be gallic acid. This appears to be formed at the expense of the starch during the chrysalis stage of the insect. When the winged insect matures, the gallic acid is changed to tannic acid, apparently a condensation of two molecules of gallic acid with loss of one molecule of water. (CP-I/)

Kraemer, Henry, "Assay of Drugs by the Use of Living Plants," Proc. Amer. Pharm. Assoc., 48: 171-82, 1900. Extensive tables show the growth in millimeters, of two species, under standardized conditions of temperature, time and concentration of drug solution. The results permit the generalization that the "rate of growth of the radicles in the solutions containing toxic principles is inversely proportional to the toxicity of the solution." However, the procedure used was not new, similar experiments having been made by Kobert and others in Europe. The present work was done by Willard Ohliger in the Botanical Laboratory of the Philadelphia College under the author's direction. In the discussion of the paper when presented, a rather dim view was taken of physiological assays in general. The discussion summary states that "the requirements for uniform condition, food, environment, etc. in the case of animals to be experimented upon could scarcely be obtained in human beings, and hence the absence of positive data for guidance in the treatment of the sick." (B-P/JP)

Kraemer, Henry, and Watson, Herbert J., "Color Standards of the Vegetable Drugs on the United States Pharmacopoeia," Proc. Amer. Pharm. Assoc., 48: 146-63, 1900. A continuation of previous work to establish color standards (see 1899). Pharmacopoeial plant drugs are presented in tables, divided into 17 color groups with a scale of colors within each group. Number values are assigned to indicate "the proportions of the respective colors." The aim is to make color one criterion in U. S. P. standards, on a systematic basis, for both crude and powdered drugs. A need for more study is noted concerning the relation between fineness of drug powder to color and between change of color and therapeutic activity. (B/JP)

The College of Pharmacy of the City of New York

1870-1879:

Squibb, Edward R., "On Fluid Extracts and Their Menstrua," Proc. Amer. Pharm. Assoc., 18: 161-80, 1870. A detailed and highly competent paper on the preparation of fluid extracts. The author has devised "a more plain and simple application of the principle of specific gravity...to measure the rate and extent of exhaustion by percolation..." This method indicates that official processes do not sufficiently exhaust the drugs, that the prescribed menstrua are not always the best available, and that the presumed advantage of coarse powders is a delusion. The re-percolation method described had been used previously, but apparently not systematically studied and presented with extensive procedural tables as in the present paper. To achieve the goal of a standardized product it is necessary that "a stock of weak percolate of different densities be carried from one making to the next for each fluidextract." (PA/JP)

Walz, Isidor, "Determination of Moisture in Bone Black," Amer. Chemist, 2: 168, 1872. Authorities have differed as to the proper temperature for determination of moisture in bone black. A series of experiments shows that at temperatures above 250° F. "an increase of weight (probably caused by oxidation) takes place," resulting in a moisture estimate that is too low. The author recommends heating samples for one hour at 250° F. or drying over sulfuric acid for 24 hours. (CI/UP)

1880-1889:

Schrenk, Joseph, "On the Development of the Root-stock of Dicentra cucullaria," Torrey Bot. Club Bull., 9: 47-49, 1882. Bulblet buds in various stages of development are described. It is a difficult morphologic problem whether the buds belong to the bulblets or to the axis on which the bulblets are inserted, but the latter structure is probably the correct view. (B-I/)

Schrenk, Joseph, "Notes on Tuckahoe," Torrey Bot. Club. Bull., 11: 1-3, 1884. Structural points of "Indian Bread" that have not received proper attention are described. The exact nature of the growth remains unsolved, but the author believes it to be analogous with resinosis or gummosis. A histologic description of the mass of Tuckahoe is included. (B-I/UP)

Schrenk, Joseph, "Notes on the Haustoria of Some North American Parasitic Phanerogams," Torrey Bot. Club Bull., 11: 109-14, 1884. The outgrowth from roots is described macroscopically and microscopically. The author found that vascular cells of haustoria are connected with the foster root in a way that opens communication between the parasite and the stem of the host plant. The author questions whether botanists can still assume that only air passes through these channels. (B-I/UP)

Day, David F., "A Catalogue of the Native and Naturalized Plants of the City of Buffalo and Its Vicinity," Buffalo, 1883, 215 pp.; reviewed in Amer. J. Science, 27 (2nd series): 415, 1884. The catalog names all plants detected within a 30-mile radius of Buffalo. The reviewer felt "It has set a good

example by including upon the basis of real investigations, all the cryptogramous plants of the region which have been fairly determined." (B-I/UP)

Schrenk, Joseph, "Notes on Limnanthemum lacunosum, Griseb.," Torrey Bot. Club Bull., 12: 13-16, 1885. The author's specimens of the species exhibiting submersed leaves are different from those previously described in the Bulletin. The literature is reviewed and findings presented "as a contribution to the better understanding of its morphology and histology." It is particularly shown that the inflorescence is not inserted in the petiole as previously described. (B-I/UP)

Schrenk, Joseph, "Ueber die Entstehung von Stärke in Gefässen," Botanische Zeitung, 45: 152-3, and 263, 1887. Careful observation of a prepared specimen of Aristolochia serpentaria, as well as a fresh slice of rhizome, shows that starch is distributed in the vessels in the manner reported by A. Fischer. The starch granules are not found through the whole length of a duct but only at one point of cross section. It may be seen especially from longitudinal section that the starch mass probably forms a tylosis of the duct. (B-I/)

Schrenk, Joseph, "On the Histology of the Vegetative Organs of Brasenia peltata, Pursh," Proc. Amer. Assoc. Advance. Science, 1887, p. 272; also in Torrey Bot. Club Bull., 15: 29-47, 1888. Unrecorded peculiarities are described, including hairs projecting into the wide intra-cellular air-passages of the petiole. What had been previously identified as creeping rootstock is found to be actually a system of runners from the

rhizome proper. Observations are made on the origin and nature of the mucilage that coats parts of the plant in contact with water, upon which there had been no published investigations. The mucilage was found to contain nitrogenous matter and tannin. (B-I/UP)

Day, David F., "Catalogue of the Flowering and Fern-like Plants growing without Cultivation in the Vicinity of the Falls of Niagara," Troy, 1888, 67 pp.; reviewed in Amer. J. Science, 36 (3rd series): 395, 1888. The reviewer's main criticism is that some plants that "may be expected to occur at the Falls" are included in the regular list of the catalog, along with the species actually observed. (B-I/UP)

Schrenk, Joseph, "Notes on the Inflorescence of Callitriche," Botan. Gazette, 13: 296-99, 1888; also in Proc. Amer. Assoc. Advance. Science, 1888, p. 285. New peculiarities of the bracts of the inflorescence are reported. Histologic evidence is presented to support the view that the pistil and stamen must be considered parts of a single flower, rather than separate flowers. (B-I/UP)

Rusby, Henry Hurd, "General Floral Features of the San Francisco and Mogollon Mountains of Arizona and New Mexico and Their Adjacent Regions," Transac. New York Acad. Sciences, 8: 76-81, 1888-89. The author describes the soil, temperature and topographical features of the various areas where the plants he lists were collected. (B-I/UP)

Schrenk, Joseph, "On the Floating Tissue of Nesaea verticillata," Torrey Bot. Club Bull., 16: 315-23, 1889. The author presents figures on histologic structure and a discussion of his own and other observations. Formation of a spongy tissue is described, about which there remains some question as to function. It may aid in aeration of submerged parts, but the author suggests that the most important function is probably that of keeping the stems afloat. (B-I/UP)

Rusby, Henry Hurd, "An Enumeration of the Plants Collected in South America, 1885-86," Torrey Bot. Club Bull., 15: 177-84, 247-53, 1888; 16: 13-20, 61-64, 153-60, 189-92, 259-62, 324-27, 1889; 17: 9-12, 53-60, 91-94, 211-14, 281-84, 1890; 18: 35-38, 107-110, 261-64, 331-34, iv, 1891; 19: 1-4, 148-51, 263-66, 371-74, 1892; 20: 137-40, 1893; 25: 495-500, 542-45, 1898; 26: 145-52, 189-200, 1899; 27: 22-31, 69-84, 124-37, 1900. See also, "An Enumeration of Plants Collected in Bolivia, 1885-86," Torrey Bot. Club Bull., 23: 471-99, 1896. This series is based on a two-year journey along the South American Pacific Coast and across the continent for botanical investigations of medical interest. The author's field trips were prior to his teaching at the New York College of Pharmacy, but reports on his observations continued to be issued periodically during his teaching years. The collection included about 3000 numbers, about ten specimens of each being collected, on the average. The publications cited are listings of plants collected, with some descriptive comments, identifying numbers and botanical classification. (B/)

1890-1900:

Rusby, Henry Hurd, Ibidem (part of the South American series appeared in the last decade)

Rusby, Henry Hurd, "Cascara Sagrada and Its Allies," Proc. Amer. Pharm. Assoc., 38: 203-12, 1890. A critical discussion of variations in the crude drug, centering about the "principal task" of discriminating between R. Purshiana and R. Californica. Extensive macroscopic and especially microscopic observations are given, since pharmacy must rely on the microscope for positive identification. (B-I/JP)

Coblentz, Virgil, "Ueber einige Selen- und Schwefelderivate des Aethyl- und Propylamins," Berichte der Deutschen Chemischen Gesellschaft, 24: 2131-2136, 1891. A selenium-containing derivative of both bases and a sulfur derivative of ethyl amine have been produced for the first time. The experiments were conducted at the University of Berlin, employing a process used by Professor S. Gabriel to prepare sulfurized derivatives of propylamine. The reactions are discussed, and the results of numerous ultimate analyses are presented. (CO/UP)

Coblentz, Virgil, and Gabriel, S., "Zur Kentniss des Dithioäthylamins (Diamidoäthyldisulfids)," Berichte der Deutschen Chemischen Gesellschaft, 24: 1122-1125, 1891. In an earlier notice the supposition was spoken of that potassium hydrosulfide and brom-ethyl phtalimid reacted to form an addition product, mercaptophtalimid, whose behavior corresponds to the disulfide.

It was stated, however, that the addition product exists as the monosulfide $(C_8H_4O_2mN.C_2H_4.)_2S$. The present experiments, conducted at the University of Berlin, show that the disulfide is prepared with great ease out of the mercapto compound. The results of partial and ultimate analyses are presented and the reactions discussed. (CO/UP)

Jellif(f)e, Smith E., "Notes Upon Strophanthus Hispidus and Strophanthus Kombe," Proc. Amer. Pharm. Assoc., 44: 220, 1896. Different kinds of Strophanthus seeds found on the American market are separated into three fairly well marked artificial classes. Both macroscopic and microscopic characteristics are used as the basis. Completely specific differences in the seeds cannot be offered, but the characteristics are considered of some importance in their identification. (B/JP)

Rusby, Henry Hurd, "A New Achimenes from Bolivia," Torrey Bot. Club Bull., 23: 151-2, 1896. Botanical description of a unique specimen. (B/UP)

Rusby, Henry Hurd, "The Affinities of Dendrobangia, Rusby," Torrey Bot. Club Bull., 24: 79-81, 1897. It is concluded that the affinities of the plant are clearly with the Icacinaceae, but it seems to be strikingly distinct from any other genus. This plant was first described by the author, and he here corrects some points that were "misinterpreted or overlooked" in the original description. (B/UP)

Coblentz, Virgil, "Gelsemic Acid," Amer. J. Pharm., 69: 228-31, 1897. Some twenty combustions of gelsemic acid have been made, using various methods. All methods left carbon deposits in the combustion tube. Analytical work in acetyl and brom gelsemic acid was also carried out. This preliminary investigation was "carried on at intervals for some years," but the author "desires to complete some molecular weight determinations before assigning a definite formula." Evidence is expected that will support the author's assumption that gelsemic acid is a principle distinct from aesculin. (CP-I/JP)

Coblentz, Virgil, "Gelsemic Acid," Proc. Amer. Pharm. Assoc., 45: 225-31, 1897 (also in Amer. J. Pharm., 69: 439-46, 1897). Criticism and comparisons of ultimate analyses show that Gelsemic acid is not identical with aesculin, as Robbins and others had assumed (although this was disputed by Wormley). The author believes there may be a relationship in certain groupings, which has not yet been fully determined. The present report is based on determination of the empirical formula, melting point, derivatives, hydrolysis, etc. (CP-I/JP)

University of Michigan, School of Pharmacy (f. 1868)

1870-1879:

Prescott, Albert B., "On Sulphophenic Acid," Proc. Amer. Pharm. Assoc., 19: 550-8, 1871 (reprinted in Chem. News, 26: 269-71, 1872). The preparation, characteristics and composition are discussed. Experiments especially focussed on conditions of the reaction between sulfuric and phenic acids that will give the highest yield and on the method of removing residue. Tests were also conducted on coagulating power and, in a rather crude way, on antiseptic effect by following the progress of putrefaction when fresh meat is immersed in a solution. (CO-T/JP)

Prescott, Albert B., "Comparative Determinations of the Solubilities of Alkaloids in Crystalline, Amorphous and Nascent Conditions: Water-washed Solvents Being Used," Proc. Amer. Assoc. Advance. Science, 24: 114-17, 1875 (also in Amer. Chemist, 6: 84-5, 1876). Further data is presented on the power of solvents when used to extract alkaloids from aqueous solutions or moist residues. (CP/)

Prescott, Albert B., "Note on Froehde's Reagent as a Test for Morphia," Amer. J. Pharm., 48: 59-64, 1876. A critical review of the literature and a report of experience with the use of molybdates in assay and the effect of concentrated sulfuric acid on morphine. (CP/JP)

Prescott, Albert B., and Thum, Hugo, "Trial of Various Schemes for the Separation and Quantitative Estimation of Quinia, Quinidia, Cinchonia, and Cinchonidia," Proc. Amer. Pharm. Assoc., 26: 828-38, 1878. Chemically-pure salts were prepared and used to determine the solubilities in different menstrua and the effect on solubility of mixing the salts. A method is suggested for adapting the results to assay methods for cinchonidia and quinidia and for quinine sulfate in the presence of total alkaloids. The latter is essentially Kerner's test. (CP/JP)

Prescott, Albert B., "The Valuation of Tincture of Opium," Proc. Amer. Pharm. Assoc., 26: 823-6, 1878. A comparative study of the Hager and Staples processes, with the laboratory assistance of students. Quantitative results are given for 12 samples. Staples' process yields the best crystals of morphia, and the author has preferred it. But "Mr. Heim's results somewhat strengthen the comparative usefulness of Hager's process..." and "I must hold it as nearly or quite as good as the other." (CP/JP)

Prescott, Albert B., "Morphiometric Processes for Opium," Proc. Amer. Pharm. Assoc., 26: 807-23, 1878. A comparative study for the U.S.P. Committee of Revision of five different processes, using five different opium samples. The author presents quantitative results and an extensive critical discussion. (CP/JP)

Prescott, Albert B., "Chemical and Microscopical Analysis of the Bark of Rhamnus Purshiana (Cascara Sagrada)," Amer. J. Pharm., 51: 165-8, 1879. The author presents histologic drawings of the bark structure and the results of qualitative proximate analysis. A light yellow resin and a crystallizable body were obtained, which he hopes to investigate further. (CP-B-I/JP)

1880-1889:

Prescott, Albert B., "Estimation of Alkaloids by Potassium Mercuric Iodide," Amer. Chem. J., 2: 294-304, 1880-81. A critical discussion is presented of experience with Mayer's Reagent for the volumetric determination of the chief alkaloids. Various deficiencies and uncertainties have become apparent. The iodine and mercury in alkaloidal iodomercurates have been determined, and the iodomercurate of strychnine appears complex and variable. None of the iodide belonging to potassium mercuric iodide apparently becomes liberated in the precipitation of strychnine salt or of several other alkaloids tested. In contrast to Mayer's findings, none of the mercury of the reaction appears to be left in solution. Uncertainties in the ratio of Mayer's Reagent to the amount of alkaloid precipitated are also found. Most of the laboratory data presented were obtained by students. (CP/)

Langley, John Williams, "On the Concentration of Certain Acid Radicals by the Differential Action of Chemism," Proc. Amer. Assoc. Advance. Science, 34: 130-31, 1885. Based on experimental data, a provisional hypothesis is presented that chemism acts by linear attraction on distances greater than the radius of molecular attraction. (CO/UP)

Prescott, Albert B., "Control Analyses and Limits of Recovery in Chemical Separations," Proc. Amer. Assoc. Advance. Science, 34: 109-17, 1885. The control analyses reported were used to test methods needed for various investigations, hence have no uniform pattern. There is an excellent critical discussion, however, presenting data and an evaluation of the methods. (CO/)

Cheever, Byron W., "The Estimation of Phosphorus in Iron and Steel," Transac. Amer. Institute of Mining and Engineers, 13: 163-5, and 656-7, 1885. A modified assay method is presented, using potassium chlorate to oxidize the carbon and "thus avoid the tedious and vexatious evaporations necessary for successfully carrying out the usual methods." (CI/UP)

Cheever, Byron W., "Estimation of Manganese, Carbon, and Phosphorus in Iron and Steel," Transac. Amer. Institute of Mining and Engineers," 14: 372-81, 1886. Working on standard assays the author finds certain reactions under certain conditions give erroneous results, if overlooked. A widely used colorimetric estimation of manganese is severely criticized. The nature of the difficulties are explained and modified procedures suggested. (CI/UP)

Vaughan, Victor C., "Tyrotoxicon, Its Presence in Poisonous Ice Cream; Its Development in Milk and Its Probable Relation to Cholera Infantum and Kindred Diseases," Amer. J. Pharm., 58: 452-64, 1886 (reprinted from Report of the Michigan State Board of Health July 12, 1886). Work leading to the discovery of an especially poisonous ptomaine is summarized. The author describes recent tests on himself and others with ice cream known to have been poisonous. He discusses the possible mode of production of the toxic agent and the possible connection with cholera infantum and its treatment. (P-T/UP-JP)

Vaughan, Victor C., "The Chemistry of Tyrotoxicon, and Its Action Upon the Lower Animals," J. Analyt. Chem., 1: 281-7, 1887. Diazobenzol butyrate has been prepared and shown to be the same as tyrotoxicon, a ptomaine discovered by the author. This is the first time that a diazobenzol has been found as a product of putrefaction. Comparative tests on diazobenzol butyrate and tyrotoxicon show that both are decomposed in moist air with the same rapidity; that a precipitate of tyrotoxicon estimated as potassium sulfate and calculated in terms of diazobenzol indicates identity; and that nine experiments on dogs and cats give apparently identical toxic reactions. The various comparative tests are described in detail. (CO-T/UP)

Cheever, Byron W., "Colorimetric Estimation of Manganese in Steel," Transac. Amer. Institute of Mining and Engineers, 15: 102-4, 1887. A method previously criticized by the author (see 1886) is tested in various modifications. He reaffirms that it is unreliable for "exact results," but suggests a modification that gives the least variable results. (CI/UP)

Cheever, Byron W., "Conversion of Manganese to Permanganic Acid," J. Analyt. Chem., 1: 176-8, 1887. Varied answers have been given to the question as to whether all the manganese in a nitric acid solution can be oxidized to permanganic acid by boiling with lead dioxide. The author attempts to answer the question more thoroughly than can be done by colorimetry. Twenty consecutive tests on manganese in a solution of steel showed from 70% to 100% of the Mn oxidized to $HMnO_4$. Various modifications of method did not diminish the percentage of error. (CI/UP)

Cheever, Byron W., "Two Conditions of Phosphorus in Iron," Transac. Amer. Institute of Mining and Engineers, 15: 448-55, 1887, and 16: 269-78, 1888. The condition of phosphorus is different in different samples of iron containing the same amount of phosphorus. The author concludes that phosphorus exists as both phosphide and phosphate, the former being injurious and the second existing as slag. An attempt is made to learn what percentage causes cold shortness in steel and how this is modified by the presence of other elements. An analytical method is devised to show the presence of phosphate in nearly all metal. The experiments help explain why different percentages of phosphorus have been given by different authors as consistent with good quality iron. (CI/UP)

Prescott, Albert B., "Positive and Negative Units of Valence," Proc. Amer. Assoc. Advance. Science, 36: 130-31, 1887. A discussion of some features of a working theory consistent with the use of negative and positive bonds in the notation devised by Otis C. Johnson, a colleague on the Michigan faculty

(see Chemical News, 42: 51, 1880), for oxidation equations. The sum of positive and negative valence units is used in notation, but the entire number of different units of valence is used in constitutional formulas. (CO/UP)

Freer, Paul C., and Perkin, William Henry, Jr., "The Synthetical Formation of Closed Carbon Chains," J. Chem. Soc. (London), 51: 820-49, 1887, and 53: 202-22, 1888. A treatise written on a high level that discusses the author's own experiments as well as others. Various research problems are pointed out. The possible formulas for closed carbon chains are presented in relation to experimental methods of distinguishing between possible alternatives. (CO/UP)

Freer, Paul C., and Perkin, William Henry, Jr., "Synthese von Hexamethylenederivaten," Berichte der Deutschen Chemischen Gesellschaft, 21: 735-37, 1888. Preliminary results suggesting synthetic equations, upon which an exhaustive communication is promised for a later time. (CO/UP)

Langley, John Williams, "Ueber eine wahrscheinliche Aeusserung chemischer Anziehung als mechanischer Zug," Zeitschrift für Physikalische Chemie, Stöchiometrie und Verwandtschaftslehre, 2: 83-91, 1888. From experimental work the author assumes that during electrolysis a concentration of the acid radical on a metal always happens where a salt is formed by the acid. The hypothesis is offered that the chemical affinity produces a direct and straight attraction that is effective over a greater distance than a molecular radius and is of a selective character. An attempt is made to quantify

the relationship between electrical energy and linear distance of attraction. (CI/UP)

Freer, Paul C., and Perkin, William H., Jr., "Zur Kentnisse des Heptamethyleneringes," Berichte der Deutschen Chemischen Gesellschaft, 21: 738-39, 1888. Experiments with ischeptanetetracarbon-acid ether show the existence of a seven-membered carbon ring to be improbable. Further experiments have been undertaken that may soon settle this point decisively. (CO/UP)

Prescott, Albert B., and Dunn, W. L., "Estimation of Bromine in the Presence of Chlorine," J. Analyt. Chem., 3: 373-78, 1889 (also Proc. Amer. Assoc. Advance. Science, 1889, pp. 173-76). In recent years chemists had sought complete separation and use of a direct method. The present authors seek to determine the best of the known methods of indirect estimation and the best of the proposed methods of direct estimation. The results are given, with a set of control analyses for each method tested. (CI/UP)

Vaughan, Victor C., "Ptomaines from Mixed Typhoid Cultures," J. Analyt. Chem., 4: 111-14, 1890 (reprinted from J. Amer. Med. Assoc., December 14, 1889). Ptomaine was isolated from mixed cultures grown from stools of known typhoid patients. Given to dogs it causes elevation of temperature and severe gastro-intestinal disturbance. The author expects to determine which bacterium produces the toxic agent. (P-T/UP)

1890-1900:

Spalding, Volney Morgan, "Development of the Sporocarp of Griffithsia Bornetiana," Proc. Amer. Assoc. Advance. Science, 39: 327, 1890. An intensive study of the growth of this species. The author observed great variability in the number and position of peripheral cells; early formation of spore-producing cells; and notable differences between this and related species. (B/UP)

Freer, Paul C., "The Constitution of Aliphatic Ketones, and the Action of Sodium on Acetone," Amer. Chem. J., 13: 308-22, 1891. A critical and competent discussion of the controversy over the constitution of ketones and whether they must contain a hydroxyl group. It is concluded that the old formula containing a carbonyl group should be assigned to free ketones, in view of the difference in behavior from unsaturated compounds. However, an instability of atomic grouping seems apparent. (CO/UP)

Freer, Paul C., "The Influence of Negative Atoms and Groups of Atoms on Organic Compounds," Proc. Amer. Assoc. Advance. Science, 40: 181-82, 1891. Experiments with a large number of acids confirm the assumption that the more negative the grouping of elements is made the more pronouncedly acid the compound becomes. However, the second chlorine atom exercises much less influence than the first. The chlorinated acids saponify with great rapidity and this phenomenon is being studied further. Important modifications of Menschutkin's methods were made and some new methods evolved in the study. (CO/UP)

Freer, Paul C., and Higley, George O., "The Action of Chlorcarbonic Ether on Acetone Sodium," Amer. Chem. J., 13: 322-6, 1891. The author attempts to ascertain the nature of the sodium derivative and the position of the sodium atom in the acetone radicle. A neutral oil produced in the reaction was separated into two fractions. The analysis and vapor density of one fraction indicate that is an isomer of aceto-acetic ether. Arguments are given for and against this supposition. (CO/UP)

Freer, Paul C., and Dunlap, Frederick L., "On the Saponification of the Substituted Acetic Esters," Amer. Chem. J., 14: 366-76, 1892. Ostwald showed that organic acids increase in avidity with the replacement of hydrogen by chlorine or bromine. The hypothesis of the present author was that the relationships of the acids as to acidity would be of the same order as the rapidity of saponification. This relationship is here found not to be true, although the same rank order is maintained among the compounds. The mono-chlor, di-chlor and tri-chlor-acetic esters and their corresponding bromine compounds were studied. (CO/UP)

Prescott, Albert B., "The Iodomercurates of Organic Bases," Amer. Chem. J., 14: 606-11, 1892. The author previously presented determinations of the iodomercurates of several vegetable alkaloids (see above, 1880), which did not entirely agree with the data of Groves (England). To resolve the doubt full elementary analyses of the iodomercurates have been made in the author's laboratory by Lyman F. Kebler. The precipitates

of quinine, pyridine and quinoline were used. The elementary composition was determined at several different degrees of concentration, because of the variability in the volumetric value of Mayer's Reagent. The method of ultimate analysis was also a matter of experiment because the presence of both iodine and mercury results in some unusual analytical features. Extensive analytical data are given, but the discussion of differences between the iodomercurates is reserved for a later time when confirming data are available. (CP/)

Freer, Paul C., "Some Reactions with Acetoacetic Ether and with Salicylic Ether," Amer. Chem. J., 14: 407-22, 1892. A comparative experimental study of reactions of the two compounds. To advocates of formula for aceto-acetic ether, the author points out that there is no satisfactory explanation why the hydroxyl group will not yield an acetyl derivative, while salicylic ether does so readily. (CO/UP)

Freer, Paul C., "On the Action of Sodium on Acetone," Amer. Chem. J., 15: 582-606, 1893. In a third paper on this reaction, the author now describes improved apparatus, which yields large amounts of reaction products at one operation. Hence the real changes taking place could be more adequately determined. The sodium acetone formerly described as a uniform body was found to consist of sodium acetone mixed with a number of other substances. It is shown that sodium in sodium acetone is attached to oxygen, not carbon. (CO/UP)

Freer, Paul C., and Higley, George O., "The Action of Metals on Nitric Acid. The Reduction of Nitric Acid by Copper," Amer. Chem. J., 15: 71-81, and 378, 1893. Although extensively studied, no one has determined quantitatively all the products of reduction. The author used improved methods to throw new light on the complicated reactions involved. Apparently the sole products of reduction of excess nitric acid by copper are nitrogen trioxide (about 10%) and nitrogen dioxide (about 90%). This proportion is affected only slightly by varying temperature. (CI/UP)

Campbell, Edward De Mille, and Trowbridge, P. F., "Notes on the Higher Oxids of Nickel," J. Analyt. Chem., 7: 301-7, 1893. An attempt failed to obtain Krauss's higher oxid of nickel in a form constant enough for quantitative work. Oxidation was then pushed as high as possible to investigate the stability of the precipitated oxid, which was found to vary even when produced under identical conditions. (CI/UP)

Spalding, Volney M., "The Traumatropic Curvature of Roots," Annals of Botany, 8: 423-51, 1894. A comparison of experimental data with that of others shows fairly general agreement, but diverse views are taken of interpretation. The author believes that the action is not mechanical, but an irritation response. It is believed that the results support Prof. Pfeffer, who aided the investigation by his personal attention and facilities at the Botanical Institute of the University of Leipzig. (B-P/UP)

Johnson, Otis C., "Action of Nitric Acid Upon the Chlorids of Zinc, Bismuth and Cadmium," Proc. Amer. Assoc. Advance. Science, 43: 163, 1894. The chlorids were completely changed to nitrates upon heating. This disagrees with the results of H. Wurtz (1858), who found that much chlorid remains even after adding acid and evaporating six times. The present author found this to be true except for zinc, bismuth and cadmium chlorids. (CI/UP)

Schlotterbeck, J. O., and Boyce, S. R., "Notes on the Behavior of Albuminate of Iron and Ferratin with Artificial Gastric Juice," Proc. Amer. Pharm. Assoc., 42: 206-10, 1894. Schmiedeberg considered Ferratin, a new synthetic iron compound, to be the same as that extracted from swine livers. The present authors determined the percentage of iron in each and attempted to determine the exact extent of change in the two compounds produced by digestive action. The two are probably equally altered in the stomach. More work will be done, but the therapeutic advantages of Ferratin over the albuminates are not apparent. (CO/JP)

Campbell, Edward De Mille, "Determination of Nickel in Nickel-Steel," J. Amer. Chem. Soc., 16: 96-102, 1894. The author gives electrolytic and volumetric methods and describes special apparatus and reagents to meet industrial needs of rapidity and accuracy. The laboratory work was done by students under the author's direction, using steel containing various but known amounts of nickel, manganese and copper. (CI/UP)

Campbell, Edward De Mille, "On the Oxidation of Some Gases with Palladinized Copper Oxide," Amer. Chem. J., 17: 681-92, 1895. The ignition point was determined with pure copper oxide to learn to what extent the presence of 1% finely divided palladium affected the temperature at which combustion commenced. The rate of dissociation was found to increase with the rise in temperature, but oxidation of the gases did not reach a higher limit than that at 400°. The laboratory work was done by students A. F. Flinterman, C. R. Rose and E. B. Hart. (CI/UP)

Freer, Paul C., "The Constitution of Tetrinic Acid," Proc. Amer. Assoc. Advance. Science, 44: 94, 1895. The author demonstrates that the constitution of tetrinic acid may be represented by the formula: $CH_2-COH=CH_3-COO$. (CO/UP)

Freer, Paul C., "On the Action of Chlorcarbonic Ester on Sodium Acetone, Amer. Chem. J., 17: 1-18, 1895. One fraction of the oil produced in the reaction was assumed, in previous research, to be an isomer of aceto-acetic ether, although analytically the hydrogen was too high. Present research attempts to explain the discrepancy. It is found that the fraction is a mixture of bodies, all distilling at about the same temperature. Further proof is offered also that the sodium in sodium acetone is attached only to oxygen. (CO/UP)

Stevens, Alviso Burdett, and Judy, J. N., "Assay of Wild Cherry Bark," Amer. J. Pharm., 67: 534-7, 1895. Comparative assays show that thin, green wild cherry bark should not be more valuable therapeutically than older, thicker bark. Almost

twice as much HCN was found than that reported previously, due to repeated distillations. Two methods were tested for HCN assay, and it was found that passing the distillate into KOH gives more accurate and satisfactory results. (CP-I/JP)

Freer, Paul C., "Tetrinic Acid," Amer. Chem. J., 17: 779-96, 1895. The author offers a detailed critical discussion of the literature and reports on his experiments to answer some of the contradictions. With this paper he leaves the subject to Wolff (Germany), who is working the same field. (CO/UP)

Freer, Paul C., "On the Action of Sodium on the Esters of Aconitic and Citric Acids. Preliminary Notice," Amer. Chem. J., 17: 31-33, 1895. A series of experiments is reported on the ethereal salts of tribasic acids, paralleling those of Dieckmann on dibasic acids. The sodium acts on triethyl aconitate first to replace part of the hydrogen, then sodium ethylate separates, resulting in a ketone compound. The reaction with tri-ethyl citrate is similar. (CO/UP)

Prescott, Albert B., "Notes Upon Some Philippine Island Drugs Under Analysis for Alkaloids, Etc.," Proc. Amer. Pharm. Assoc., 43: 241-44, 1895. The samples were drugs used medicinally by natives and collected by an exploring party in natural history from the University of Michigan. All drugs were checked for alkaloids and gave negative results except one (containing berberine). Other distinctive principles were sought, but more work on these is being planned for future students. The laboratory work of the present study was conducted by two students. (CP/JP)

Prescott, Albert B., and Trowbridge, P. F., "Periodides of Pyridine," J. Amer. Chem. Soc., 17: 859-69, 1895. Various periodides have been synthesized and the methods used are discussed. The results and problems of analysis are also examined. (CO/UP)

Campbell, Edward De Mille, and Andrews, W. H., "Separation of Nickel and Iron," Amer. Chem. J., 17: 164-7, 1895. An improved assay of high accuracy is based on precipitation of nickel by potassium xanthate (as nickelous xanthate). Most previous methods precipitated iron first, which carried some nickel with it, although some workers tried to avoid this by precipitating the nickel first. Further research is being undertaken on potassium xanthate as a precipitant. (CI/UP)

Campbell, Edward De Mille, and Babcock, S. C., "On the Influence of Heat Treatment and Carbon Upon the Solubility of Phosphorus in Steels," Amer. Chem. J., 18: 719-23, 1896. With low carbon the effect of heat treatment on the solubility of phosphorus is found to be slight. With increase of carbon, the effect of hardening is to diminish the solubility of phosphorus. In the presence of high carbon the solubility is increased by slow cooling. Probably a difficultly soluble compound of iron is formed with carbon and phosphorus at high temperatures. (CI/UP)

Campbell, Edward De Mille, and Babcock, S. C., "Further Study on the Influence of Heat Treatment...," Ibid., 19: 786-90, 1896. An extension of the work reported above. (CI/UP)

Newcombe, Frederick C., "Rheotropism and the Relation of Response to Stimulus," Botanical Gazette, 22: 242-3, 1896. Of 17 species of dicotyledons, eight are positively rheotropic, nine are neutral, none negative. The author believes the rheotropic mechanism develops in response to environment but that it may be started--almost certainly--by stimuli other than those to which it originally corresponded. (B-P/UP)

Freer, Paul C., and Sherman, P. L., "On the Constitution of Some Derivatives of Formic Acid, First Paper," Amer. Chem. J., 18: 562-84, 1896. The authors show that sodium is attached to nitrogen in sodium formylphenylhydrazine and that no hydroxyl group is present. Formanilide salts appear to contain a hydroxyl group, but the free body seems differently constituted than its salts. Different groups attached to formyl are found to have different influences on the possibility of producing the natroxyl group. (CO/UP)

Campbell, Edward De Mille, and Hart, E. B., "On the Quantitative Determination of Hydrogen by Means of Palladous Chloride," Amer. Chem. J., 18: 294-98, 1896. Using the qualitative reagent of Phillips, a quantitative test is devised and its accuracy demonstrated. The hydrogen is completely absorbed by a 1% solution of palladous chloride. A 2% solution offers no advantage. (CO/UP)

Prescott, Albert B., and Baer, Samuel H., "Pyridine Alkyl Hydroxides," J. Amer. Chem. Soc., 18: 247-51, 1896. Pyridine isopropyl hydroxide remains in aqueous solution for a time without decomposition or loss in any way. The residue by evaporation contains considerable unchanged hydroxide, along with undetermined decomposition products. The normal carbonate, sulphate, and platinum chloride of this base are easily prepared and preserved. (CO/UP)

Prescott, Albert B., "Notes on a Few Pyridine Alkyl Iodides," J. Amer. Chem. Soc., 18: 91-6, 1896. A gradation is shown among homologous normal members of the series---and also among isomeric members---in melting points and solubilities. As the boiling points of free alkyl iodides rise, the melting points of addition products fall. Other properties and methods of preparation are described. (CO/UP)

Campbell, Edward De Mille, "On the Diffusion of Sulfides through Steel," Amer. Chem. J., 18: 707-19, 1896. Further experiments to determine the best conditions for the diffusion of sulfides previously reported. After two years of negative results it was found that the property of diffusing is peculiar to an oxy-sulphide of phosphorus, instead of to the normal sulphide. Supporting data are given from forty diffusion tests. A possible explanation is that the oxysulfide is extremely mobile at the temperature of red-hot steel and would be readily absorbed by any porous body. The observed effect of gravity (i.e., more sulfide in bottom of bar) shows that diffusion occurs in liquid rather than gaseous form. The laboratory work is credited to "private assistants." (CI/UP)

Campbell, Edward De Mille, "A Pure Carbide of Iron," Amer. Chem. J., 18: 836-47, 1896. Experimental data indicates that iron is probably capable of forming a series of ferrocarbons analogous to the olefin series of hydrocarbons, having a general formula C_nFe_{3n}. The primary products of a solution would be olefins and hydrogen, but these combine in a secondary reaction to yield paraffins. (CO/UP)

Schlotterbeck, J. O., and Van Zwaluwenburg, A., "Comparative Structure of the Leaves of Datura Stramonium, Atropa Belladonna and Hyoscyamus Niger," Proc. Amer. Pharm. Assoc., 45: 202-8, 1897. A detailed histologic study "to determine once and for all the most characteristic features of these three leaves, in their finer structure, with a view to their identification when in the form of a fine powder." (B-I/JP)

Prescott, Albert B., "Alkyl Iodides and Bismuth Iodides of Vegetable Bases," Proc. Amer. Pharm. Assoc., 45: 208-11, 1897; also in J. Amer. Chem. Soc., 20: 96-100, 1898. Ultimate analyses and empirical formulas are given for bismuth iodides of nitrogen bases. Theoretical vs. empirical evidence for linkage in the compounds is examined. "Constitutional" formulas are also presented. The alkaloidal bismuth iodides are not considered uniform enough, quantitatively, for entirely satisfactory assay. After discussing advantages and disadvantages, the author concludes that Dragendorff's reagent (a potassium bismuth iodide) gives no general advantage over Mayer's reagent, despite "how unsatisfactory the latter has been found in the hands of analysts." (CP/JP)

Schlotterbeck, J. O., "The Development of the Seed of Melampyrum Pratense and of Croton Tiglium," Proc. Amer. Assoc. Advance. Science, 46: 275-78, 1897. A minute study of different stages of plant development, identifying the distinguishing features of seeds that seem similar. (B/JP)

Campbell, Edward De Mille, and Thompson, Firman, "A Preliminary Thermochemical Study of Iron and Steel," J. Amer. Chem. Soc., 19: 754-66, 1897. Diminution of tensile strength is found almost exactly proportion to diminution of heat of solution. An attempt is made to determine whether carbon alone is responsible for variations in the heat of solution of steels subjected to different heat treatments. Results are inconclusive and the work is to continue. Little previous work had been done on the thermochemistry of steels. (CI/UP)

Newcombe, Frederick C., "Cellulose Ferment," Proc. Amer. Assoc. Advance. Science, 46: 280, 1897. A cellulose-dissolving enzyme previously had been extracted only from the malt of Hordeum vulgare. The author now obtains such a ferment from cotyledons of seedlings of Lupinus albus. The effect of the extracted enzyme on sections of cellulose tissue is described. (B-P/UP)

Freer, Paul C., and Lachman, Arthur, "The Action of Sodium Upon Methylpropylketone and Acetophenone," Amer. Chem. J., 19: 878-90, 1897. The study elucidates the reactions involved. Large amounts of oils containing halogen are formed by the action of benzoyl chloride on the sodium derivatives of

ketones--a previously unrecorded observation. Also noteworthy is the large amount of benzoic acid always recovered from reactions of benzoyl chloride with sodium ketones. (CO/UP)

Campbell, Edward De Mille, and Champion, E. C., "Electrolytic Determination of Tin in Iron Ores," J. Amer. Chem. Soc., 20: 687-90, 1898. The assay method is modified, principally by converting the tin from sulphostannate to double oxalate for electrolytic deposition. This avoids any necessity of precipitating and filtering out the tin after it has once been obtained in solution as sodium sulphostannate. (CI/UP)

Campbell, Edward De Mille, and Hartman, W. E., "On the Influence of Silicon on the Heat of Solution of Coked Cast Iron," J. Amer. Chem. Soc., 20: 690-95, 1898. Thermochemical evidence is sought to indicate a change in the condition in which silicon exists in cast iron, due to a change in the temperature at which the iron is made. Under conditions of high temperature or a moderate amount of silicon, the heat evolved by the oxid of silicon is proportional to the amount of silicon present. The heat of solution is much less under conditions of low silicon or low furnace temperature. A compound of silicon with iron has a rather high heat of formation. Extensive analytical results are presented. (CI/UP)

Prescott, Albert B., and Gordin, H. M., "Certain Alkaloidal Periodides, and the Volumetric Estimation of Alkaloids as Higher Periodides," J. Amer. Pharm. Assoc., 46: 355-73, 1898; also in J. Amer. Chem. Soc., 20: 706-28, 1898. A method

is described for analysis of various periodides, with a comparison of calculated and found results. The preferred procedure of purification for analysis is explained. The authors succeeded in obtaining enneaiodide of atropine, a heptaiodide of strychnine and a heptaiodide of brucine, and apparently a triiodide and heptaiodide of aconitine. The iodine factors were verified by volumetric control. The literature on iodopotassium iodide as a reagent for alkaloids is also critically reviewed. (CP/JP)

Freer, Paul C., and Sherman, P. L., "Formamide and Its Sodium and Silver Salts," Amer. Chem. J., 20: 223-8, 1898. The authors have found, to date, only one series of sodium and silver salts of the acid amides. The silver compounds are all white and easily decomposable. The constitution is uncertain. (CO/UP)

Johnson, Otis C., "A New and Delicate Test for Nickel," Proc. Amer. Assoc. Advance. Science, 47: 203, 1898. A delicate and characteristic test for nickel is described, with which only lead will interfere. A solution of cobalt and nickel is treated with sodium carbonate and bromine; after washing, the cobaltic and nickelic hydroxides are treated with hot KI. A liberation of iodine indicates the presence of nickel. (CI/UP)

Newcombe, Frederick C., "Cellulose Enzymes," Annals of Botany, 13: 49-81, 1899. None of the five enzyme extracts tested appeared to be more suited than others for dissolving any one kind of reserve cellulose. With all of the ferments, the walls at first become hyaline, gradually become more

transparent, finally "melt" wholly away in solution. Enzymes from Lupinus albus and Phoenix dactylifera act on starch so feebly and on reserve cellulose so energetically that the author regards them as cystase (as distinguished from diastase). (B-P/UP)

Freer, Paul C., "On the Constitution of the Phenylhydrazones," Amer. Chem. J., 21: 14-64, 1899. A general structural formula is postulated on the basis of the reactions and properties determined and discussed. It was found that some phenylhydrazones are stable; others are readily oxidized. Isolated oxidation products were very unstable. The oxidation reaction was explored for further proof of an azo grouping. Extensive, competent research. (CO/UP)

Freer, Paul C., "The Action of Benzoyl Chloride on the Phenylhydrazones of Benzoin," Amer. Chem. J., 22: 396-402, 1899. Even at 0° benzoyl chloride severs the two sodium atoms in the phenylhydrazone molecule, yielding benzanilide. This remarkable effect had not been previously observed in phenylhydrazones. A detailed, critical discussion of the reactions and results is presented. (CO/UP)

Newcombe, Frederick C., "The Rheotropism of Roots," Proc. Amer. Assoc. Advance. Science, 49: 276, 1900 (see also, Science, 13: 250, 1901). In an extension of previous work, all of the 15 rheotropic plants found have been positive reactors (i.e., root-tip curves against the stream). There is considerable evidence to confirm the author's postulate

that the stimulus is due to one-sided pressure of the water upon the root. (B-P/UP)

Schlotterbeck, J. O., "Adlumia cirrhosa, a New Protopine-bearing Plant," Amer. Chem. J., 24: 249-53, 1900; also in Berichte der Deutschen Chemischen Gesellschaft, 33: 2799-2801, 1900, and Proc. Amer. Pharm. Assoc., 48: 267-70, 1900. "Mountain Fringe" is so closely allied to the Papaveraceae that one expects it to contain one or more alkaloids, hence a chemical study was made. The roots yielded about 1% alkaloid. Not enough was obtained for combustions, but "enough of its properties have been determined to make its positive identification possible." The crystalline form, solubility, melting point, color reactions, and the crystalline forms of its salts, all agree with protopine--which the author also had obtained from Bocconia cordata. There is a remarkable similarity of physical properties to fumarine (alkaloid of the Fumariaceae), and the two are probably identical. (CP-I/JP)

Stevens, Alviso B., "Wild Cherry Bark and Its Preparations," Proc. Amer. Pharm. Assoc., 48: 207-11, 1900. "Over 250 estimations" were made on wild cherry bark. Different sides of the tree varied considerably in glucoside content. Many tests were made on preparations to determine their relative keeping qualities. The amount of menstruum specified in the U. S. Pharmacopoeia was found to be too small for complete extraction. Experiments were also conducted to determine the optimum concentration of alcohol in menstrua to avoid interference with the action of the ferment on the glucoside. (CP-I/JP)

Schlotterbeck, J. O., "The Nature of Commercial Sanguinarine Nitrate," Proc. Amer. Pharm. Assoc., 48: 256-59, 1900. A commercial alkaloidal product was used, since less than 1% alkaloid could be obtained from a commercial extract claimed to contain 8 to 17%. Analysis showed that the product was not sanguinarine but nearly pure chelerythrine, or a mixture of all the alkaloids of Sanguinaria with some decomposition products. The author discusses the literature and the confusion of nomenclature, etc., in the light of his finding. (CP-I/JP)

University of Wisconsin, Course in Pharmacy (f. 1883)
1883-1889:

Trelease, William, "Observations on Several Zoogloeae and Related Forms," Johns Hopkins University, Studies from the Biological Laboratories, 3: 193-216, 1884-87. A series of systematic inoculations with specimens obtained from Johns Hopkins. Various species were observed that reproduce themselves truly, perpetuating certain macroscopic characteristics manifested in color and form of their zoogloea masses, although they are scarcely distinguishable under the microscope. Perhaps due to insufficient descriptions in the literature and a dearth of specimens, some species could not be identified with the chromogene forms recognized by writers on bacteria. The author therefore hesitates to apply new names, but hopes that the study contributes to subsequent recognition of the species, whatever names they may finally bear. The appearance, size and growth habits of each species are given in detail from microscopic and macroscopic observations. (P/UP)

Van Hise, Charles R., "On Secondary Enlargements of Feldspar Fragments in Certain Keweenawan Sandstones," Amer. J. Science, 27: 399-403, 1884. Additions to the mineral grains were found to have occurred in certain feldspathic sandstones. Both deposits of such a secondary structure (previously described for quartz) are found to be crystallographically continuous. The author believes this phenomenon throws light on the origin of some crystalline schists. It is concluded that fragmentary particles frequently enlarge by renewed growth. (O/UP)

Van Hise, Charles R., "Enlargements of Hornblende Fragments," Amer. J. Science, 30: 231-5, 1885. Enlargements similar to those observed in feldspar (see above) are given a similar descriptive analysis. The new finding was made during a study of certain conglomerates under the direction of Professor R. D. Irving. (O/UP)

Trelease, William, "The Genus Cintractia," Torrey Bot. Club Bull., 12: 69-70, 1885. A comparative discussion of the smuts of the genus Ustilago and genus Cintractia. The author holds that Ustilago junci must be re-considered as Cintractia junci. (B-I/UP)

Trelease, William, "The Smut of Timothy (Tilletia striaeformis, Westd.)," Report of the Commissioner of Agriculture, 1885, pp. 87-88. A study of macroscopic and microscopic characteristics, prepared at government request. Other species upon which the smut has been observed are noted. (B-I/UP)

Trelease, William, "Thalictrum," Botan. Gazette, 11: 92-3, 1886. More attention to the polygamo-dioecious species of this genus has been needed. A new differentiating description of T. polygamum Muhl. and T. purpurascens Linn. is given on the basis of carefully examined material from four herbaria. (B-I/UP)

Trelease, William, "The Nectary of Yucca," Torrey Bot. Club Bull., 14: 135-41, 1886. The author refutes Professor Riley's statement that the stigmatic cavity is nectariferous; the observations of Brongniart are also revised. The author's drawings show that, like in other Liliaceae, the nectar glands occur within the partitions that separate the three cells of the pistil. (B-I/UP)

Trelease, William, "A Spot Disease of Orchard Grass. Scolecotrichum graminis, Fekl.," Report of the (U.S.) Commissioner of Agriculture, 1886, pp. 129-31. The causative agent is identified as Scolecotrichum graminis. The organism, propagation of the disease and nature of the spores are discussed in detail, on the basis of macroscopic and microscopic observations. (B-I/UP)

Van Hise, Charles R., "Upon the Origin of the Mica-schists and Black Mica-slates of the Penokee-Gogebic Iron-Bearing Series," Amer. J. Science, 31: 453-59, 1886. It is concluded that observed forms of fragmental rock arise by metasomatic changes only. The rock presents every appearance of complete original crystallization and ordinarily would be classed as a genuine crystalline schist. Grades of micaceous

rocks are described that have step-wise degrees of becoming crystalline. (O/UP)

Power, Frederick B., "On the Fluorescent Principle of Hydrastis Canadensis, Lin.," Pharm. Rundschau, 4: 102-4, 1886. The literature is reviewed and observations by different authors compared. From the report of Lyons and his own recent experiments the author concludes that the fluorescent substance is an oxidation product of hydrastine and does not represent an "inherent proximate principle." While still alkaloidal in nature, perhaps oxy-hydrastine, the substance will be hard to isolate. (CP-I/JP)

Power, Frederick B., and Weimar, Henry, "On the Constituents of Wild Cherry Bark (Prunus serotina, Ehrhart)," Proc. Amer. Assoc. Advance. Science, 36: 121-6, 1887 (also Pharm. Rundschau, 5: 203-5, 1887). It was found that crystallizable amygdalin does not occur in the bark, but an analogous amorphous substance was isolated. A supposed "bitter principle" appears to be a fluorescent substance with characteristics of a glucoside. The ferment principle is not the same as emulsin or synaptase of almonds. (CP-I/JP)

Power, Frederick B., and Werbke, Norbert C., "On the Constituents of Wintergreen Leaves, (Gaultheria procumbens, Linn.)," Proc. Amer. Assoc. Advance. Science, 37: 124-5, 1888 (and Pharm. Rundschau, 6: 208-11, 1888). The terpene was isolated from the volatile oil, which Cahours had stated was there. It is present in much smaller amounts than had been

supposed. Some of its physical properties are examined. The distinguishing characteristics between oil of wintergreen and the closely related oil of sweet birchbark are also demonstrated. There was no andromedotoxin, which had been found in some other ericaceous plants. (CP-I/)

1890-1900:

Power, Frederick B., and Cambier, J., "Robinia Pseudacacia," Transactions of the British Pharmaceutical Conference, 1890, pp. 162-3 (also in Pharm. Rundschau, 1890). Qualitative proximate analysis was conducted to determine the toxic principle in the bark of the locust tree. A small amount of alkaloid found is believed identical with choline. From albuminoid substances, globulin and albumose were isolated, the latter producing vomiting and purging. Not enough of the basic substances was obtained to determine their character. (CP-I/JP)

Power, Frederick B., "On the Composition of the Oils of Wintergreen and Birch, and the Characters of the Synthetic Oil of Wintergreen," Chemical News, 62: 67-8, 75-7, 91-2, 1890. From past research and the present investigation the author presents evidence that most of the conclusions of Henry Trimble and H. J. M. Schroeter are incorrect (Amer. J. Pharm., 61: 398, 1889; see above). These authors are also accused of ignoring research reported by Power and Werbke in the Pharmaceutische Rundschau (Sept., 1888, p. 208) and in the Pharmaceutical Journal (Nov. 3, 1888, p. 349). "...It would be charitable to

presume that they were unaware of its publication, but from some of the statements in their article it would not appear probable..." While Trimble considered the two oils identical, Power finds that oil of wintergreen consists of methyl salicylate with small amounts of terpene, and oil of birch is pure methyl salicylate only. Unlike Trimble, he holds that no trace of benzoic acid and probably no ethyl alcohol is found in either oil. Trimble held that a representative sample of synthetic oil of wintergreen does not have the composition of natural oil. Power holds that a high quality synthetic oil is comparable to the natural product and—unlike Trimble—advocates its inclusion in the U.S.P. (CP-I/)

Barnes, Charles R., "Notes on North American Mosses," Botanical Gazette, 16: 205-7, 1891. New localities for some species are established on the basis of specimens sent to the author by collectors. Various species are described, with discussion of characteristic features. (B-I/UP)

Hodge, Clifton F., "A Microscopical Study of Changes Due to Functional Activity in Nerve Cells," J. Morphology, 7: 95-168, 1892. Experiments on a series of animals, including frog, cat, dog, birds, and the honey bee, with some observations on chased foxes and pathologic human material. The results are intended to show the effects of a day's normal activity in cells of different parts of the nervous system. Stimuli were both controlled and uncontrolled, in different series of tests. The author describes morphologic change in nucleus, in cell protoplasm, and in the cell capsule under conditions of fatigue. Curves representing the process of cell fatigue and recovery are not straight lines. (P/UP)

(Hobbs, William Herbert, "Secondary Banding in Gneiss," Bull. Amer. Geological Soc., 3: 460-64, 1892.)* (O/UP)

(Hobbs, W. H., "Notes on Some Pseudomorphs from the Tacomic Region," Amer. Geologist, 10: 44-48, 1892.) (O/UP)

(Hobbs, W. H., "On Intergrowths of Hornblende with Augite in Crystalline Rocks," Science, 20: 354, 1892.) (O/UP)

(Hobbs, W. H., "On Some Metamorphosed Eruptives in the Crystalline Rocks of Maryland," Transac. Wis. Acad. Science, Arts and Letters, 8: 156-60, 1892.) (O/UP)

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* Papers that appear to be within the general scope of this appendix but issuing from chairs of geology and of mineralogy and metallurgy of the Wisconsin pharmacy faculty are here listed in parentheses. This includes the work of R. D. Salisbury, J. M. Clements, W. H. Hobbs, and of Charles R. Van Hise except when he held the chair of analytical chemistry (1883-86). The only teacher at another school falling within this group is W. H. Pettee of the University of Michigan. Although listed, such papers were not actually examined because their obliquity as a group to the pharmaceutical interests of the present study did not promise further illumination of the topic.

(Hobbs, W. H., "Note on Cerussite from Illinois and Wisconsin," Transac. Wis. Acad. Science, Arts and Letters, 8: 399-400, 1892.) (O/UP)

Kremers, Edward, "On Citronellone, an Unsaturated Fatty Aldehyde," Amer. Chem. J., 14: 203-12, 1892. The author reports on ultimate analyses, optical rotation and reactions with bromine, sodium acid sulphite, hydroxylamine, ammoniacal silver oxide and permanganate, of fractions of the oil from Eucalyptus maculata, variety citriodora. The empirical formula $C_{10}H_{18}O$ is proposed for the oil. Analyses of certain salts are also given. The work is to be continued. (CP/)

Kremers, Edward, "The Menthol Group," Proc. Amer. Pharm. Assoc., 40: 273-87, 1892. Following an extensive historical part, the author gives reports on the preparation and tests (especially optical rotation of fractions) of menthone, menthoxine, menthene, menthene notroscochloride, menthene nitrol benzylamine and nitrosomenthene. The possibility of at least one crystallizable nitrolamine is established and others shown to be very probable. Future research tasks are indicated. The laboratory work and part of the literature search were conducted by students. (CP-I/JP)

Kremers, Edward, and Urban, Leo C., "The Menthol Group," Proc. Amer. Pharm. Assoc., 41: 185-97, 1893. Further studies of crystalline derivatives mentioned in the previous paper are reported. Several new and interesting derivatives were prepared. Ultimate analyses are included in the extensive experimental report. (CP-I/JP)

Russell, Harry Luman, "The Bacterial Flora of the Atlantic Ocean in the Vicinity of Woods Holl, Massachusetts. A Contribution to the Morphology and Physiology of Marine Bacteria," Botanical Gazette, 18: 383-95, 1893. About 50 samples of water are analyzed in research paralleling that previously conducted by the author on waters from the vicinity of Naples, Italy. The author reports biological features of the different organisms, number per cubic centimeter, and distribution of species. Bacterial populations at 30 to 65 feet down are compared with those at sea bottom. It is concluded, contrary to popular belief, that a large proportion of the bacteria in the mud are inhabitants solely of this habitat. (P/UP)

Davies, John Eugene, "On Some Analogies Between the Equations of Elasticity and Electro-Magnetism," Transac. Wis. Acad. Science, Arts and Letters, 9: 1-20, 1893. A non-experimental but learned paper. Striking analogies are shown between the analytical formulas, especially in the differential equations. Other equations are shown to be peculiar to electro-magnetism. Some of the analogies had previously been noted by others. (O/UP)

Austin, Louis W., "Experimentalunterschungen über die elastische Längs- und Torsionsnachwirkung in Metallen," Annelen der Physik und Chemie (Leipzig), 50: 659-77, 1893. Observations on longitudinal fatigue of metals had been made previously, but not on the whole range of phenomena. At Strasburg, the author made an extended series of observations on different kinds of

wires. The limitations, sources of error and effects of temperature are discussed in the part on method. Graphs and extensive tables support the conclusion that longitudinal fatigue and torsional fatigue seem to follow the same laws, and that the fatigue is nearly proportional to the deforming strain. For a short strain, the curves of disappearance of strain look similar to those for producing strain; and these results are independent of the diameter of the wire. (O/UP)

(Hobbs, W. H., "Phases in the Metamorphism of the Schists of Southern Berkshire," Bull. Amer. Geological Soc., 4: 167-8, 1893.) (O/UP)

(Hobbs, W. H., "New Occurrences of Parallel Intergrowths of the Minerals Allanite and Epidote," Amer. Geologist, 12: 218-19, 1893) (O/UP)

(Hobbs, W. H., "On a Rose-Coloured Lime- and Alumina-Bearing Variety of Talc," Amer. J. Science, 45: 404-7, 1893.) (O/UP)

(Hobbs, W. H., "Ueber den Volcanit, ein Anorthoklas-Augit-Gestein von der chemischen Zusammensetszung der Dacite," Zeitschrift der Deutschen Geologischen Gesellschaft," 45: 578-93, 1893 (also in Bull. Amer. Geological Soc., 5: 598-602, 1894).) (O/UP)

(Hobbs, W. H., "On the Geological Structure of the Mount Washington Mass of the Tacomic Range," J. Geology, 1: 717-36, 1893.) (O/UP)

(Hobbs, W. H., "The Geologic Structure of the Housatonic Valley Lying East of Mount Washington," J. Geology, 1: 780-802, 1893.) (O/UP)

(Van Hise, Charles R., and Bayley, William S., "Preliminary Report on the Marquette Iron-Bearing District of Michigan," Report U. S. Geological Survey, 1893-94, pp. 477-650.) (O/UP)

Cheney, Lellen Sterling, and True, Rodney H., "On the Flora of Madison and Vicinity, a Preliminary Paper on the Flora of Dane County, Wis.," Transac. Wis. Acad. Science, Arts and Letters, 9: 45-135, 1893. An extensive work of collection, identification and classification, fairly complete through the Bryophyta for Madison and environs but incomplete and preliminary for Dane County as a whole. (B-I/UP)

Austin, Louis W., "The Effect of Extreme Cold on Magnetism," Physical Review, 1: 381-2, 1894. Trowbridge had said that steel bars magnetized at ordinary temperatures lose most of their magnetism when subjected to extreme cold. The author's experiments challenge this idea for the first time, showing that magnetism remains the same or is slightly increased under apparently the same conditions that led Trowbridge to report 66% loss. The present author replaced the silk suspension of the magnetometer needle by quartz fiber because of the fatigue factor. (O/UP)

(Hobbs, W. H., "On a Recent Diamond Find in Wisconsin and on the Probable Source of This and Other Wisconsin Diamonds," Amer. Geologist, 14: 31-35, 1894.) (O/UP)

(Hobbs, W. H., "Differential Faults," Amer. Geologist, 14: 35-7, 1894.) (O/UP)

Kremers, Edward and Urban, Leo C., "Hydrocymenes and Derivatives," Proc. Amer. Pharm. Assoc., 42: 251-73, 1894. The introduction discusses possible isomers of derivatives of paramethylisopropylbenzene. Experiments reveal the structure of the nitrosylchloride addition product of menthene. Possible linkages, substitutions, etc. of some derivatives are discussed on theoretical grounds. (CO/JP)

Snow, Benjamin Warner, "Note on the Infra-Red Spectra of the Alkalies," The Physical Review, 1: 221-23, 1894. An explanation is offered of experimental errors in a previous paper that had been criticized by Kayser and Runge. Errors arose mainly through the calibration of prisms (which are much harder to use accurately than a diffraction grating) and impurities in the salts used, which were the purest available (but used without further purification). When allowance is made for corrections, the data on wave-length of infra-red lines correspond closely to those predicted by the Kayser-Runge formula. (O/UP)

Snow, Benjamin W., "On the Continuous Spectrum of Sodium," The Physical Review, 1: 296-98, 1894. Bunsen and Kirchhoff had detected a faint continuous background spectrum

for certain alkalies, upon which the characteristic metallic lines were superimposed. Data are presented that possibly explain this phenomenon. The author suggests that the background spectrum may be due to the presence in the flame of particles of incandescent sodium oxide at a temperature too low for dissociation. A strong continuous spectrum in the infra-red area was observed when 1 Gm. lumps of sodium were burned in a Bunsen burner; in an oxyhydrogen flame the continuous spectrum almost disappeared, and the energy of the D-line was doubled by the more intense heat. (O/UP)

Snow, Benjamin W., "On the Directed Velocity of the Particles in the Electric Arc," Proc. Amer. Assoc. Advance. Science, 43: 110, 1894. Two carbons were bored out and connected to terminals of an AC circuit. The image of the arc, as seen through the hollow core, was projected upon the slit of a spectroscope, and a bit of iron was burned. Had the velocity of approach or recession of the arc discharges been as great as one mile per second, the lines of the specimen would have been broadened, or doubled--but there was no displacement. (O/UP)

Snow, Benjamin W., "On the Radiation of Obscure Heat by a Metallic Mass," Proc. Amer. Assoc. Advance. Science, 43: 110, 1894. A known mass of cast iron was heated to 100° or cooled to 0° and placed near one of the bars of an interferential comparater. Expansion or contraction of the bar was noted, reaching a maximum in two hours and returning to normal not less than twenty-four hours after effects from the mass were first detected. (O/UP)

Kremers, Edward, "On the Chemical Composition of the Volatile Oil from Monarda Fistulosa," Proc. Amer. Pharm. Assoc., 43: 256-63, 1895. Previous experimenters could not guarantee the source of their oils, but the present author has collected his own plants near Madison and extracted the oil himself. The oil was fractionated; the fractions were then subjected to ultimate analyses, saponification and oxidation. A crystalline coloring matter with phenol characteristics was also isolated. A previous paper from the Philadelphia College of Pharmacy is criticized, and because of doubt as to the exact species used by others no definite conclusion can be offered as to whether there are two species that produce two isomeric yet chemically distinct phenols: thymol and carvacrol. (CP-I/JP)

Birge, Edward Asahel, "On the Vertical Distribution of the Pelagic Crustacea of Lake Mendota, Wis., During July, 1894," Biologisches Centralblatt, 15: 353-55, 1895. Samples were taken from six depths of water. Four species were considered numerous enough to be useful in determining vertical distribution. Distributive changes occur in the fall as lake temperatures become more uniform throughout its depth. The results do not confirm findings previously reported by France. (P/UP)

Cheney, Lellen S., "Sphagna of the Upper Wisconsin Valley," "Parasitic Fungi of the Wisconsin Valley," and Hepaticae of the Wisconsin Valley," Transac. Wis. Acad. Science, Arts and Letters, 10: 66-8, 69 and 70-72, 1895. Identification of specimens in three collections made by others and submitted to the author. (B-I/UP)

Russell, Harry L., "A Leaf Rot of Cabbage," Proc. Amer. Assoc. Advance. Science, 44: 193, 1895. The disease, which is described in detail, appears different from that reported by Garman. It appears to be associated with bacteria, although the author has not been able to reproduce the disease from pure cultures of isolated bacteria. (P/UP)

Kremers, Edward, "Notes on Limonene and Its Derivatives," Amer. Chem. J., 17: 692-97, 1895. A considerable quantity of limonene was obtained by the fractionation of carvene. Tables are presented to show what influence some of the more common solvents have upon the rotatory power (in relation to per cent of oil and specific gravity). Similar data are presented for fractions just above and below limonene. The laboratory work was done by Edward A. Mayer. (CP/)

True, Rodney H., "The Effect of Sudden Changes of Turgor and of Temperature on Growth," Annals of Botany, 9: 365-402, 1895 (also Proc. Amer. Assoc. Advance. Science, 44: 194-5, 1895). The author has attempted to learn whether change in the concentration of the substratum or change of the surrounding temperature (of 1 to 19°C.), as such, influences plant growth. It was found that both act as a shock to the irritable organism (Vicia faba), producing a pronounced retardation of rate of growth. (B/UP)

(Clements, Julius Morgan, "The Volcanics of the Michigamme District of Michigan," J. Geology, 3: 801-822, 1895.) (O/UP)

Kahlenberg, Louis, and Schreiner, Oswald, "Ueber Borsäure und Ihre Salze," Zeitschrift für Physikalische Chemie, Stöchiometrie und Verwandtschaftslehre, 20: 547-68, 1896. The authors seek to determine whether, in aqueous solutions, the differences among the borates can be shown through the application of physical methods. This problem is approached indirectly by studying solutions of salts of complex acids from borates and polyvalent alcohols. There are also sections on sodium salts and on boric acid itself. Much experimental data has been gathered--especially molecular weight determinations and freezing points--and reported in graphs and tables. (O/UP)

Kahlenberg, Louis, and True, Rodney H., "On the Toxic Action of Dissolved Salts and Their Electrolytic Dissociation," Botanical Gazette, 22: 81-124, 1896. This may have been the first attempt to use Arrhenius' theory of the dissociation of electrolytes to explain the action of solutions of acids, bases, and salts on living things. The authors aim at determining by extensive experiments to what extent the Arrhenius theory might be applied. It was found that the condition in which substances exist in solution usually determines, in large measure, their action on plants. Only when solutions were made up on the basis of chemical equivalents, rather than percentage strengths, did consistent relationships appear. It is concluded that the toxic action of solutions of electrolytes (when dissociation is practically complete) is probably due to the ions present. The authors hope that a "thread of reasonableness" has thus been found running through hitherto unorganized phenomena in the study of such medicinal remedies as fungicides and antiseptics. (CI-P/)

(Van Hise, Charles R., "A Central Wisconsin Base Level," Science, 4: 57-59, 1896.) (O/UP)

(Van Hise, Charles R., "Northern Michigan Base Level," Science, 4: 217-220, 1896.) (O/UP)

Russell, Harry L., and Weinzirl, John, "The Bacterial Flora of Cheddar Cheese," Science, 4: 430, 1896. A qualitative and quantitative study of various phases of the ripening process. First there is an over-all diminution, then enormous development, of the lactic acid group. Then comes a prolonged decline. It is concluded that these facts cannot be reconciled with the theory that the digesting bacteria are the active agents in curing cheese. (P/UP)

Birge, Edward A., "The Vertical Distribution of the Limnetic Crustacea of Lake Mendota," Biologisches Centralblatt, 17: 371-74, 1897. A continuation of previous work (see above, 1895) to determine the annual and vertical distribution, through a series of 400 observations. Distribution data are analogous to the previous study. It is concluded that the limitation of downward extension is not due to change of temperature but that the crustacea are excluded from deep water by an accumulation there of the products of decomposition of plankton. Forces affecting distribution are complex and appear to act differently on different species and different ages. (P/UP)

Cheney, Lellen S., "North American Species of Amblystegium," Botanical Gazette, 24: 236-91, 1897. A comprehensive study showing that descriptions previously available were often unsatisfactory. An attempt has been made to discover some clearer diagnostic characters for the several species. Emphasis is placed on quantitative measurement (rejecting phrases such as "a little shorter"), employing averages of a large number of measurements of cells and organs. Sixteen species have been separated and classified into three groups. (B-I/UP)

True, Rodney H., and Hunkel, Carl G., "The Toxic Action of Phenols on Living Plants," Proc. Amer. Pharm. Assoc., 45: 252-60, 1897; also Proc. Amer. Assoc. Advance. Science, 46: 281-82, 1897. A large number of experiments were made to extend knowledge of the poisonous action of phenols on plants, using widely separated representatives of the plant kingdom. Toxic values are assigned to various substances and tabulated. The possibility of relating results to the degree of dissociation and the modifying effects of certain chemical radicles is discussed on theoretical grounds. It is believed that the reaction of protoplasm is governed by chemical laws. It appears that electrolytic dissociation plays a subordinate role, as to physiological effect, and that undissociated molecules are largely determining. The sensitiveness of plants to chemical substances as a delicate test for certain compounds had been studied by Engelmann, Pfeffer, Nägeli, and others. (P/JP)

Russell, Harry L., "Pure Lactic Cultures of Bacteria in Cheese-Making," J. Royal Agric. Soc. (of England), 8: 141-52, 1897; also in 13th Annual Report of the University of Wisconsin Agricultural Experiment Station. A bacillus of the lactic-acid type that does not form gas was isolated from ripening cheese. It was found to represent 99% of the bacteria found in Wisconsin cheese. Several thousand pounds of cheese were made with the bacillus under varying climatic conditions. Advantages found were a saving of time, somewhat better flavor and texture than without any "starter," and more uniform quality than the controls. (P/UP)

(Van Hise, Charles R., "The Marquette Iron-Bearing District of Michigan," Monograph, U. S. Geological Survey, vol. 28, 1897, 608 pp.) (O/UP)

True, Rodney H., "The Toxic Action of a Certain Group of Substances," Proc. Amer. Assoc. Advance. Science, 47: 410, 1898. It had been assumed that salts act on living organisms through osmotic activity rather than toxic effect. The author determined the "boundary concentration" as a measure of osmotic action, i.e., the concentration that a majority of Spirogyra can endure for 24 hours. It was found that the boundary concentration of potassium nitrate and sodium chloride lies much below the point representing the same osmotic value as cell sap (assuming purely osmotic action). Hence it appears that these salts exert a pronounced toxic action. (P-B/UP)

True, Rodney H., "Notes on the Physiology of the Sporophyte of Funaria and of Mnium," Proc. Amer. Assoc. Advance. Science, 47: 435, 1898. Structure, function and curves of growth rate are reported, together with response to gravitation and light intensities during the life cycle. (B-P/UP)

True, Rodney H., "The Physiological Action of Certain Plasmolyzing Agents," Botanical Gazette, 26: 407-16, 1898. An attempt to analyze the injurious physiological action of some common and less harmful salts into osmotic (physical) and toxic (chemical) components. For a standard solution (i.e., osmotic effect only), cane sugar was used. Spirogyra (algae) were used as the test organism. The author determined for each substance (a) the concentration at which plasmolysis begins, (b) the calculated boundary concentration, (c) the boundary concentration found by experiment. It is concluded that sodium and potassium salts probably act chiefly through chemical action, rather than osmotic properties as previously assumed. (P-B/UP)

Kahlenberg, Louis, and Lincoln, A. T., "Solutions of Silicates of the Alkalies," J. Physical Chem., 2: 77-90, 1898. A competent paper confirming that the sodium silicates are hydrolytically decomposed into sodium hydroxide and silicic acid, based on freezing point data. Similar results were obtained for other silicates. The degree of decomposition could be calculated from the lowering of the freezing point. (CI/UP)

Kahlenberg, Louis, and Schreiner, Oswald, "Die wässerigen Lösungen der Seifen," Zeitschrift für Physikalische Chemie, Stöchiometrie und Verwandtschaftslehre, 27: 552-66, 1898. Aqueous soap solutions are non-colloidal and good electrical conductors. The boiling point method was not suited to testing such solutions, because of the formation of soap bubbles. Freezing point determinations are practicable only with the oleic acid salts, because palmitates and stearates precipitate at low temperature. These show that double molecules are present in the aqueous solutions. Electrical conductivity determinations are based on the fact that the soap, through hydrolysis, splits into acid salt and free alkali. The Krafft theory of colloidal solutions, which is based on the special conditions of concentrated soap solutions, does not hold under present conditions. (CO/UP)

(Clements, Julius M., "A Study of Some Examples of Rock Variation," J. Geology, 6: 372-92, 1898.) (O/UP)

Kremers, Edward, "On True and Bis-nitroso Compounds," Proc. Amer. Assoc. Advance. Science, 47: 208, 1898. Von Baeyer maintained that the differences of the menthene nitroso-chloride prepared by Sieker and Kremers and of that prepared in his own laboratory were due mainly to the fact that the former consisted of a simple molecule and the latter of a double molecule. The author's experiments do not support this view. All white nitroso-addition products of unsaturated hydrocarbons examined exhibit, in solution, a double molecule, which has a tendency to dissociate. (CO/UP)

Kremers, Edward, and Koske, E. C. W., "Decomposition of Iodoform by Light," Proc. Amer. Pharm. Assoc., 46: 380-85, 1898. The author argues against the conclusions of Fleury (France) on the basis of extensive analytical data. A ratio of time to per cent decomposition is established. The author suggests an improved technique of placing the tube of iodoform solution in a glass container filled with Lugol's solution. (CO/JP)

(Clements, Julius M., and Smith, H. L., "The Crystal Falls Iron-Bearing District of Michigan," Monograph, U. S. Geological Survey, vol. 36, 1899, 512 pp.) (O/UP)

Kahlenberg, Louis, Davis, D. J., and Fowler, R. E., "The Inversion of Sugar by Salts," J. Amer. Chem. Soc., 21: 1-23, 1899. The paper extends knowledge concerning inversion of sugar by salts. A freezing point method is established to determine the speed of inversion. It is found that when metals are arranged in a series according to the speed with which their salts (of the same acid radical) invert sugar, then the order is similar to that of the electrochemical series (with the exception of aluminum). Chlorides invert sugar more rapidly than sulphates because the ionizing tendency of chlorine is greater than that of the sulphuric radical. (CO/UP)

Kahlenberg, Louis, "Differences of Potential Between Metals and Non-aqueous Solutions of Their Salts," J. Physical Chem., 3: 379-403, 1899, and 4: 709-14, 1900 (also Proc. Amer. Assoc. Advance. Science, 49: 128, 1900). Various solvents, metals

and salts were used. The experimental results do not agree with calculated electromotive forces calculated according to the Nernst formula. (C/UP)

Kahlenberg, Louis, "The Dissociation Power of Solvents," J. Physical Chem., 3: 12-35, 1899. Investigation of a large number of non-aqueous solvents as electrolytes shows that different solvents act differently on one and the same salt. To harmonize molecular weight determinations with relatively high electrical conductivity, it appears that for many non-aqueous solvents one may have to assume a combination between the solvent and solute. (CO/UP)

(Hobbs, W. H., "A Spiral Fulgurite from Wisconsin," Amer. J. Science, 8: 17-20, 1899.) (O/UP)

(Hobbs, W. H., "The Diamond Field of the Great Lakes," J. Geology, 7: 375-88, 1899.) (O/UP)

(Hobbs, W. H., "Newark Formation of the Pomperang Valley, Connecticut," Science, 11: 141-2, 1900.) (O/UP)

Kahlenberg, Louis, and Austin, R. M., "The Toxic Action of Solutions of Acid Sodium Salts on Lupinus albus," J. Physical Chem., 4: 553-69, 1900 (also Proc. Amer. Assoc. Advance. Science, 49: 127, 1900). Seedlings have been grown in solutions of acid sodium salts of oxalic, tartaric, malic, succinic and citric acids. The concentration at which plants just survive is lower than it would be if toxicity were related to hydrogen ions only. It is concluded that here the theory of electrolytic dissociation is not a satisfactory explanation. (P-CO/UP)

Kahlenberg, Louis, and Emerson, John B., "The Toxic Action of Solutions on the Leech and the Vinegar Eel," Proc. Amer. Assoc. Advance. Science, 1900, p. 127. Solutions of 55 acids, salts and bases and of 15 alkaloids were tested for toxic action. Animals were placed in solutions of different strength, and the lapse of time to death was noted. The results are discussed in the light of the theory of electrolytic dissociation. (P-CO/UP)

Kahlenberg, Louis, "The Relation of the Taste of Acid Salts to Their Degree of Dissociation," J. Physical Chem., 4: 33-37 and 533-37, 1900. Taste tests are conducted on acid sodium salts of various di-basic organic acids and the acid salts of citric acid. The sour taste is more intense than it ought to be on the assumption that sourness is entirely due to hydrogen ions. It is concluded that no entirely satisfactory explanation can be given on the basis of dissociation theory. (P-CO/UP)

Kahlenberg, Louis, "On the Electrolytic Deposition of Metals from Non-aqueous Solutions," J. Physical Chem., 4: 349-54, 1900. Little had been done previously at ordinary temperatures, probably on the assumption that such solutions do not conduct enough current for determinations. Silver was completely deposited from silver nitrate solution in pyridine, from pyridine and water, from nine volumes of water to one of acetone, and from water saturated with aniline. (O/UP)

Kahlenberg, Louis, and Mehl, Hugo F., "The Toxic Action of Electrolytes on Fishes," Proc. Amer. Assoc. Advance. Science, 49: 128, 1900. The survival time of weighed and measured fish, in different percentage solutions, is discussed in relation to dissociation theory. (P-CO/UP)

(Van Hise, Charles R., "Some Principles Controlling the Deposition of Ores," J. Geology, 8: 730-70, 1900.) (O/UP)

True, Rodney H., "The Toxic Action of a Series of Acids and of Their Sodium Salts on Lupinus albus," Amer. J. Science, 9 (4th series): 183-92, 1900; cf. invitation paper on same work in Science, XI (n.s.): 305, 1900. Part of a larger investigation dealing with the toxic action of dissolved salts and their electrolytic dissociation. The authors here compare the toxic action of sodium salts of a series of acids with the acids themselves. Extensive tables of toxic values indicate the number of liters of water in which a molecular weight (in Gms.) of a given substance must be dissolved to give the physiological response. It is concluded that: "Given the degree of ionization of the molecules of an acid and of its sodium salt at the limit-concentrations, it is possible approximately to analyze the resultant toxic effect into those components which are due (1) to the hydrogen ions, (2) to the anions and, in case ionization is incomplete, (3) to the residual undissociated molecules." The author (True) is responsible for the botanical part and formulation of results; Louis Kahlenberg is responsible for the chemical part. (P-CO/UP)

APPENDIX D

The syllabus on following pages may be the most informative outline of a late 19th-century curriculum that was published by an independent school. It appears in the Prospectus of the College of Pharmacy of the City of New York (New York, 1889),78 pp.

(Students are advised to preserve this Syllabus, as they will find it convenient for reference, taking notes, and private study.)

SYLLABUS

of the

LECTURES AND LABORATORY INSTRUCTION

in the

COLLEGE OF PHARMACY OF THE CITY OF NEW YORK

For the

SESSION OF

1889-90

SYLLABUS OF LECTURES ON GENERAL CHEMISTRY.

PROFESSOR ARTHUR H. ELLIOTT.

Junior Course.

NON-METALLIC ELEMENTS.

First Lecture. Introduction. Matter: definition; compound and simple; distinction between compounds and mixtures; kinds of matter; the elements, their number, how they occur in nature, comparative abundance. General properties of matter: impenetrability, extension or volume, units of volume, figure or form, indestructibility.

Second Lecture. Divisibility of matter: atoms, molecules, differences in molecules, masses. Atomic attraction or chemical affinity. Molecular attraction or cohesion. The three states of matter—solid, liquid, gaseous. Repulsion. Polarity. Crystals. Mass attraction or adhesion. Gravitation, weight, units of weight. Density or specific gravity, units of density.

Third Lecture. Oxygen. History. Occurrence in nature. Preparing, collecting, transferring, and preserving gases. Physical properties, liquefaction. Chemical properties, relation to ordinary combustion. Physiological properties. Functions in nature, relation to animal life, liberation by plants. Use in arts, in medicine. Its compounds.

Fourth Lecture. Ozone. History. Probable occurrence in the atmosphere. Preparation, physical and chemical properties, constitution. Function in nature. Uses.

Hydrogen. History: occurrence, preparation, physical properties, liquefaction. Chemical properties, action of spongy platinum. The oxyhydrogen blow-pipe. Drummond light. Effect on animals. Compounds with oxygen.

Fifth Lecture. Water. Occurrence in nature. Discovery of its composition. Its exact composition, synthesis, and analysis. Physical properties, as water, as ice, as steam. Chemical properties, as a solvent, water of hydration. Hydroxides or hydrates. Water of crystallization. Deliquescence and efflorescence.

Sixth Lecture. Natural waters; atmospheric waters, rain, etc. Sweet or fresh waters; ground water, spring, well (shallow and arte-

sian), river and pond water. Normal constituents of sweet waters, mineral, organic.

Seventh Lecture. Sweet waters continued. Living organisms; plants, animals, microbes. Contaminated waters. Sanitary considerations; diseases conveyed by water. Selection of water for manufacturing and domestic purposes. Purification of water. Chemical and biological analysis of water. Sea-water; the ocean; inland seas.

Eighth Lecture. Mineral waters; definition. Classification: saline, acidulous, alkaline, chalybeate, sulphur, acid, alum, borax, siliceous; examples. Artificial mineral waters, their preparation, etc.

Ninth Lecture. Hydrogen dioxide. History. Occurrence in nature; preparation, properties, uses.

Nitrogen. History. Occurrence, preparation; properties, physical, chemical, physiological. Functions in nature. Compounds.

The atmosphere. Discovery of its composition.

Tenth Lecture. The atmosphere—a mixture, not a compound. Chemical composition. Minor constituents invariably present. Relation to natural phenomena, to combustion, to vegetable and animal life; microbes and their germs; relation to mould, fermentation, putrefaction, disease. The air of cities, of houses, ground air. Sewer gas.

Eleventh Lecture. Compounds of Nitrogen and Oxygen. Nitrogen pentoxide. Nitric acid; occurrence, formation in nature, preparation, composition, impurities, properties, tests. Uses in arts, in medicine.

Nitrogen monoxide. History. Preparation, purification, properties; use as an anæsthetic.

Twelfth Lecture. Nitrogen Dioxide; Nitrogen Trioxide; Nitrous acid; Nitrogen Tetroxide.

Compounds of Nitrogen and Hydrogen. Ammonia; occurrence, preparation, properties, tests. Uses in arts; in medicine.

Compounds of Nitrogen with Chlorine and Iodine.

Thirteenth Lecture. Carbon. Occurrence in Nature. Different forms.

The Diamond: its occurrence, crystalline form, properties, uses, origin, artificial formation.

Graphite: Occurrence, crystalline form, properties, uses, origin.

Amorphous Carbon: anthracite, charcoal, lampblack, gas carbon; their nature, properties, and uses.

Fourteenth Lecture. Compounds of Carbon and Oxygen. Carbon dioxide: its occurrence, formation by animals, yeast, etc.; preparation, composition, physical properties, liquefaction, solidification, solubility in water. Carbonic acid, carbonates, tests, relation to plants, effect upon animals; its presence in polluted air; uses in the arts.

Carbon monoxide; preparation: water gas; physical, chemical, and physiological properties. Production by coal stoves.

Fifteenth Lecture. Compounds of Carbon and Hydrogen. Hydrocarbons. Methane or marsh gas—occurrence; sewer gas; gas wells; formation by microbes during putrefaction; properties, uses. Ethene or olefiant gas. Acetylene. Petroleum, Ozokerite, and Paraffin. Essential oils. Illuminating gas. Combustion and flame.

Sixteenth Lecture. The Halogens. Chlorine; its discovery, occurrence, preparation, properties, tests, uses, compounds. Hydrochloric acid, aqua regia, chlorides. Oxides of chlorine. Hypochlorous acid, bleaching powder. Javelle water. Labarraque's solution. Bleaching. Chloric acid. Chlorates.

Seventeenth Lecture. Bromine; discovery, occurrence, preparation, properties, compounds. Hydrobromic acid. Bromides; uses in arts and medicine.

Iodine; discovery, occurrence, preparation, properties, tests, compounds. Hydriodic acid. Iodides; uses in arts and medicine.

Fluorine; history, occurrence, compounds. Hydrofluoric acid; preparation, properties, tests, uses in arts.

Eighteenth Lecture. Sulphur; history, occurrence, preparation, purification, properties, tests, compounds, uses in arts and medicine. Compounds. Oxides. Sulphur dioxide; preparation, properties, uses as bleaching, antiseptic, disinfectant, and cooling agent. Sulphurous acids and sulphites.

Nineteenth Lecture. Fuming sulphuric acid. Common sulphuric acid; preparation, properties, impurities, tests, uses. Thiosulphuric acid and its salts, commonly known as hyposulphites; uses.

Sulphuretted hydrogen; preparation, properties, tests, uses.

Carbon disulphide. Chlorides of Sulphur. Selenium, Tellurium.

Twentieth and Twenty-first Lectures. Boron; occurrence, preparation, properties. Boric acid. Borates. Silicon; occurrence, preparation, properties. Silicic acid. Silicates. Phosphorus; history, occurrence. Common phosphorus; preparation, properties. Amorphous phosphorus; preparation, properties. Uses of phosphorus; matches.

Twenty-second and Twenty-third Lectures. Oxides of phosphorus. Hypophosphorous acid; preparation, composition, properties, use in medicine. Phosphoric acids and phosphates; their uses in the arts and in medicine. Phosphorus and Hydrogen.

Twenty-fourth Lecture. Chemical Philosophy. Nomenclature. Combination by weight. Constancy of composition; equivalents; multiple proportions; atomic weights; combination by volume. Laws of Gay-Lussac and Avogadro. Atomicity.

Twenty-fifth Lecture. Notation. Empirical, molecular, and graphic formulæ. Acids, bases, salts, compound radicals. Chemical reactions. Classification of the elements.

Senior Course.

METALS.*

First and Second Lectures. The metals. Definition. Occurrence in nature. Comparative abundance. Physical properties; lustre, opacity, color, specific gravity, malleability, ductility, fusibility, welding property, volatility.

Compounds. Alloys. Compounds with non-metallic elements. Oxides, hydroxides or hydrates, sulphides, haloid salts, oxy-salts.

Crystallization. Classification.

Third and Fourth Lectures. Potassium.

Fifth, Sixth, and Seventh Lectures. Sodium.

Eighth Lecture. Lithium, Rubidium, Cæsium, Ammonium.

Ninth and Tenth Lectures. Calcium, Barium, Strontium.

Eleventh Lecture. Magnesium, Zinc, Cadmium, Beryllium.

Twelfth and Thirteenth Lectures. Lead, Copper, Thallium.

Fourteenth and Fifteenth Lectures. Mercury, Silver.

Sixteenth and Seventeenth Lectures. Aluminium, Gallium, Indium, Cerium, Didymium, Lanthanum, Yttrium, Erbium, Terbium, Ytterbium, Scandium, Samarium, Decipium.

Eighteenth Lecture. Tin, Titanium, Zirconium, Thorium.

Nineteenth, Twentieth, and Twenty-first Lectures. Antimony,

* In discussing the metals individually, the following order will be followed with each metal and each of its important compounds: History; occurrence in nature; preparation; impurities; purification; physical, chemical, and physiological properties; tests; compounds; functions in nature; uses in the arts, pharmacy, and medicine.

Special attention will be paid to those metals used in the U. S. Pharmacopœia, in reference to the preparation of compounds there formulated.

Arsenic, with special reference to the separation of the metals in cases of poisoning.

Twenty-second and Twenty-third Lectures. Bismuth, Vanadium, Tantalum, Niobium, Iron.

Twenty-fourth Lecture. Nickel, Cobalt, Manganese, Chromium.

Twenty-fifth Lecture. Uranium, Tungsten, Molybdenum, Gold, Platinum, Palladium, Rhodium, Iridium, Ruthenium, Osmium.

PROFESSOR CHARLES F. CHANDLER.

Senior Course.

ORGANIC CHEMISTRY.

First and Second Lectures. Organic Chemistry. Nature and sources of organic bodies. Synthesis. Decompositions and transformations.

Proximate and elementary analysis. Empirical, molecular, typical, and graphic formulæ.

Third and Fourth Lectures. Classification of Organic Bodies. Homologous series, isomerism. Physical properties: Density, melting and boiling points, optical properties.

Fatty Compounds.

Fifth Lecture. Hydrocarbons. Series of hydrocarbons, names, general formulæ, examples.

Sixth Lecture. Petroleum. Manufacture of petroleum products, uses, tests, methods employed, tests for illuminating oils. Essential oils. Azo-paraffins (Cyanogen, Hydrocyanic Acid, Cyanides, Ferrocyanides, Ferricyanides, etc.).

Seventh Lecture. Haloid Ethers. Alcohols, oxygen ethers, compound ethers or esters. Methyl alcohol, ethyl or common alcohol.

Eighth Lecture. Ethyl alcohol continued. Ethyl ethers. Preparations, uses, tests, for methyl and ethyl alcohols. Fermentation changes. Fusel oil products. Wines. Products of distillation of fermented liquors, names, preparations. Ageing of liquors. Malt liquors, preparation, characteristics.

Ninth Lecture. Higher monatomic alcohols and ethers. Diatomic alcohols or glycols. Triatomic alcohols and ethers. Chloroform, bromoform, iodoform. Glycerin, nitro-glycerin, the fats and soaps. Butter and Oleomargarine. Oils, Oleates.

Tenth Lecture. Tetratomic and pentatomic alcohols and ethers. Hexatomic alcohols and ethers. Carbohydrates. Glucoses, sugars, starch, cellulose, nitro-cellulose. Gums, Glycogen, etc.

Eleventh Lecture. Aldehydes, chloral hydrate, croton chloral hydrate, ketones.

Twelfth Lecture. Organic acids. Formic, Acetic, Oxalic, Lactic, Tartaric, Citric.

Thirteenth Lecture. Amines, amides, amic acids.

Aromatic Compounds.

Fourteenth Lecture. General Properties of Aromatic Bodies. Hydrocarbons, Benzol, Toluol, Xylol, and Naphthalene, Anthracene, etc.

Fifteenth Lecture. Aromatic Haloid Ethers, Cyanogen Derivatives, Nitro-derivatives, Nitro-benzol.

Sixteenth Lecture. Amido-derivatives, Aniline, Toluidine, Xylidine, Naphthylamine, etc.

Seventeenth Lecture. Azo, Diazo, and Hydrazine Compounds. Sulpho-derivatives. Sulphonic Acids.

Eighteenth Lecture. Aromatic Alcohols and Phenols. Benzilic Alcohol, Carbolic Acid, Cresol, Naphthol, Resorcin, Hydroquinone, Alizarine, Quinone, Orcin, Pyrogallol, etc.

Nineteenth Lecture. Aromatic Aldehydes, Benzoic, Cinnamic, and Salicylic Aldehydes. Aromatic Ketones.

Twentieth Lecture. Aromatic Acids. Benzoic, Toluic, Cinnamic, Salicylic, Gallic, Tannic, Phthalic, etc. Terpenes, Camphors, Menthol, Volatile and Essential Oils.

Twenty-first Lecture. Resins, Balsams, Glucosides, and Bitter Principles.

Twenty-second Lecture. Alkaloids. Pyridine Bases. Pyridine and Picoline. Chinoline Bases. Conine, Nicotine.

Twenty-third Lecture. Alkaloids. Creatine, etc. Theobromine, etc. Opium Bases, etc. Cinchona Bases. Strychnine Bases. Atropine, etc.

Twenty-fourth Lecture. Coloring Matters and Dye Stuffs. Braziline, Chlorophyl, Curcamin, Hematoxyline.

Twenty-fifth Lecture. Albuminoids and Gelatinous Bodies, Gelatin, Chondrin, Albumens, Myosin, Globulin, Fibrin, Peptones, Hemaglobin.

BOTANY AND MATERIA MEDICA.

PROF. HENRY H. RUSBY.

I. BOTANY.

Junior Year.

First Lecture. Nature. The Organic and Inorganic kingdoms. The Animal and Vegetable sub-kingdoms. Botany, Structural and Physiological; Systematic, Geographical, Fossil, Medical, etc. The Cell and its Relations to Plant Structure. General characters of Stem and Branches. The Phytomer. General characters of the Leaf.

Second Lecture. The Flower. The Essential Organs, their origin, functions, and parts. The Perfect Flower. Classification of flowers with reference to their possession of essential organs. (*Dissection of the flowers of Salix, Hippuris, Hydrangea, and Viburnum.*)

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Third Lecture. The Flower, continued. The Perianth. The Torus. The Complete Flower. The Epicalyx. The Numerical Plan. Floral Symmetry, and the Relative Positions of Parts. Suppression, Multiplication, and Metamorphosis of Parts. Teratology. Floral Regularity. The Typical Flower. (*Dissection of the flowers of Anemone, Pyrus, Saponaria, Malva, Hepatica, Corydalis, Erythronium, Œnothera, Geranium, Castalia, Rosa, Viola, Lathyrus, and Nepeta.*)

Fourth Lecture. Appendages to the different organs. The Disc. Modifications of the Torus. Adhesion and Cohesion of Parts. (*Dissection of the flowers of Ranunculus, Aquilegia, Delphinium, Gaultheria, Asclepias, Sarracenia, Eschscholtzia, Vaccinium, Echium, Primula, Prunus, Portulaca, and Philadelphus.*)

Fifth Lecture. The Flower, continued. The Perianth in detail. Præfloration. The Androecium in detail. (*Dissection of the flowers of Steironema, Lycopersicum, Hibiscus, Crotalaria, Robinia, Solanum, Lobelia, Hypericum, Asclepias, Scutellaria, Brassica, Tilia, Linaria, Cucurbita, and the buds of Reseda, Œnothera, Clematis, Robinia, Hibiscus, Datura, and Convolvulus.*)

Sixth Lecture. The Flower, continued. The Gynœcium in detail. Structure and Forms of Simple and Compound Pistils. (*Dissection of the flowers of Rubus, Liriodendron, Phaseolus, Illicium, Actæa, Astragalus, Hypericum, Papaver, Brassica, Primula, Castalia, and Pinus.*)

Seventh Lecture. The Flower, continued. Structure and forms of Ovules. Structure and forms of Pollen. Pollination and Fertilization.

Eighth Lecture. Cross-Fertilization. Anemophilous and Entomophilous Flowers. Adaptations in Color, Form, and Odor. Mechanical Contrivances.

Ninth Lecture. Structure and classification of Fruits.

Tenth Lecture. The Seed, its structure and forms. Germination and early growth. Mono-, di-, poly-, cotyledons. The Roots.

Eleventh Lecture. Structure and classification of Roots.

Twelfth Lecture. The Stem, its structure. Classification, contents of Cells.

Thirteenth Lecture. The Stem, contin'd. Modified stems. Buds. Phyllotaxis.

Fourteenth Lecture. The Leaf, its structure and office. Modified leaves and leaf-like organs. Parasitical plants.

Fifteenth Lecture. Classification of leaves with reference to Outline, Apex, Base, Division, and Venation.

Sixteenth Lecture. The Leaf, continued. Classification with reference to Margin, Texture, and Surface. Trichomes.

Seventeenth Lecture. Anthotaxy, classification of. Special forms of Bracts. Flower-stems.

Eighteenth Lecture. Cryptogamous Plants.

Nineteenth Lecture. Cryptogamous Plants, continued.

Twentieth Lecture. Chemical and Medicinal constituents of plants.

Twenty-first Lecture. Botanical Classification and Nomenclature.

Twenty-second to Twenty-fifth Lecture. Practical Analysis.

II. MATERIA MEDICA.

Senior Year.

First Lecture. Definition of Materia Medica and Therapeutics. General principles of Posology. Circumstances modifying the effects of remedies.

Second Lecture. Classification of medicines.

VEGETABLE DRUGS.

Third Lecture. *Order* 1: **Ranunculaceæ**, Pulsatilla, Adonis, Hydrastis, Staphisagria, Aconitum, Cimicifuga. *Order* 4: **Magnoliaceæ**, Illicium, Magnolia, Drimys. *Order* 6: **Menispermaceæ**, Calumba, Picrotoxinum, Menispermum, Pareira.

Fourth Lecture. *Order* 7: **Berberideæ**, Berberis, Caulophyllum, Podophyllum. *Order* 10: **Papaveraceæ**, Opium, Sanguinaria, Chelidonium, Eschscholtzia.

Fifth Lecture. *Order* 11: **Cruciferæ**, Sinapis alba and nigra. *Order* 15: **Violariæ**, Viola Tricolor. *Order* 20: **Polygaleæ**, Senega, Krameria. *Order* 27: **Guttiferæ**, Cambogia. *Order* 31: **Malvaceæ**, Althæa, Gossypium. *Order* 32: **Sterculiaceæ**, Oleum Theobromæ, Sterculia.

Sixth Lecture. *Order* 34: **Lineæ**, Erythroxylon, Linum. *Order* 37: **Zygophylleæ**, Guaiacum. *Order* 38: **Geraniaceæ**, Geranium. *Order* 39: **Rutaceæ**, Buchu, Xanthoxylum, Pilocarpus, Citrus, etc. *Order* 40: **Simarubeæ**, Quassia, Simaba. *Order* 42: **Burseraceæ**, Myrrha.

Seventh Lecture. *Order* 43: **Meliaceæ**, Azedarach. *Order* 47: **Celastrineæ**, Euonymus. *Order* 49: **Rhamneæ**, Cascara Sagrada, Frangula. *Order* 51: **Sapindaceæ**, Guarana. *Order* 53: **Anacardiaceæ**, Rhus Glabra, Mastiche.

Eighth Lecture. *Order* 57: **Leguminoseæ**, Scoparius, Tragacantha, Glycyrrhiza, Physostigma, Chrysarobinum, Kino, Santalum, Piscidia, Balsamum Tolutanum, Balsamum Peruvianum, Hæmatoxylon, Cassia Fistula, Senna, Tamarindus, Copaiba, Acacia, Catechu.

Ninth Lecture. *Order* 58: **Rosaceæ**, Rosa Centifolia and Gallica, Prunum, Prunus Virginiana, Amygdalus, Guillaja, Rubus, Brayera, Cydonium. *Order* 62: **Hamamelaceæ**, Hamamelis, Styrax.

Tenth Lecture. *Order* 67: **Myrtaceæ**, Oleum Cajuputi, Eucalyptus, Oleum Myrciæ, Caryophyllus, Pimenta, Chequen. *Order* 75: **Cucurbitaceæ**, Colocynthus, Pepo, Bryonia, Elaterium. *Order* 78: **Cacteæ**.

Eleventh Lecture. *Order* 80: **Umbelliferæ**, Conium, Carum, Ajowan, Anisum, Fœniculum, Sumbul, Asafœtida, Galbanum, Ammoniacum, Coriandrum. *Order* 82: **Cornaceæ**, Cornus. *Order* 83. **Caprifoliaceæ**, Sambucus, Viburnum.

Twelfth Lecture. *Order* 84: **Rubiaceæ**, Cinchona, Ipecacuanha.

Thirteenth Lecture. *Order* 85: **Valerianeæ**, Valeriana. *Order* 88: **Compositæ**, Eupatorium, Grindelia, Erigeron, Inula, Anthemis, Pyrethrum, Matricaria, Tanacetum, Absinthium, Santonica, Arnica, Calendula, Lappa, Taraxacum, Lactucarium.

Fourteenth Lecture. *Order* 91: **Campanulaceæ**, Lobelia. *Order* 93: **Ericaceæ**, Uva Ursi, Gaultheria, Chimaphila. *Order* 101: **Sapotaceæ**, Gutta-percha. *Order* 103: **Styraceæ**, Benzoinum. *Order* 104: **Oleaceæ**, Manna, Oleum Olivæ.

Fifteenth Lecture. *Order* 106: **Apocynaceæ**, Apocynum, Strophanthus, Quebracho. *Order* 107: **Asclepiadeæ**, Asclepias, Condurango. *Order* 108: **Loganiaceæ**, Gelsemium, Spigelia, Ignatia, Nux Vomica.

Sixteenth Lecture. *Order* 109: **Gentianeæ**, Chirata, Gentiana. *Order* 111: **Hydrophyllaceæ**, Eriodictyon. *Order* 113: **Convolvulaceæ**, Jalapa, Scammonium. *Order* 114: **Solanaceæ**, Dulcamara, Capsicum, Belladonna, Stramonium, Hyoscyamus, Fabiana, Tabacum, Brunfelsia.

Seventeenth Lecture. *Order* 115: **Scrophularineæ**, Digitalis, Leptandra. *Order* 125: **Verbenaceæ**, Lippia. *Order* 126: **Labiatæ**, Lavandula, Mentha, Origanum, Thymus, Hedeoma, Melissa, Salvia, Rosmarinus, Scutellaria, Marrubium. *Order* 131: **Chenopodiaceæ**, Chenopodium.

Eighteenth Lecture. *Order* 132: **Phytolaccaceæ**, Phytolaccæ, bacca and radix. *Order* 134: **Polygonaceæ**, Rheum, Rumex. *Order* 138: **Aristolochiaceæ**, Serpentaria. *Order* 139: **Piperaceæ**, Cubeba, Matico, Piper. *Order* 141: **Myristicaceæ**, Myristica.

Nineteenth Lecture. *Order* 142: **Monimiaceæ**, Boldo. *Order* 143: **Laurineæ**, Cortex Cinnamomi, Camphora, Cassia, Nectandra, Coto and Paracoto, Sassafras. *Order* 145: **Thymeliaceæ**, Mezereum. *Order* 148: **Loranthaceæ**, Phoradendron. *Order* 149: **Santalaceæ**, Oleum Santali.

Twentieth Lecture. *Order* 151: **Euphorbiaceæ**, Cascarilla, Oleum Tiglii, Alveloz, Kamala, Oleum Ricini, Stillingia. *Order* 153: **Urticaceæ**, Ulmus, Humulus, Cannabis, Ficus. *Order* 156: **Juglandaceæ**, Juglans.

Twenty-first Lecture. *Order* 159: **Cupuliferæ**, Quercus, Galla, Castanea. *Order* 160: **Salicineæ**, Salicinum, Salix. *Order* 165: **Coniferæ**, Thuja, Juniperus, Sabina, Turpentines, Pinches, Resina, Creasotum, Oleum Succini.

Twenty-second Lecture. *Order* 169: **Orchideæ**, Vanilla, Cypripedium. *Order* 170: **Scitamineæ**, Cardamomum, Zingiber. *Order* 173: **Irideæ**, Iris, Crocus. *Order* 178: **Liliaceæ**, Sarsaparilla, Aloe, Allium, Scilla, Convallaria, Colchicum, Veratrum.

Twenty-third Lecture. *Order* 187: **Palmæ**, Areca. *Order* 191: **Aroideæ**, Calamus. *Order* 200: **Gramineæ**, Amylum, Malum, Saccharum, Triticum, Stigmata Maidis. **Filices**, Aspidium. **Algæ**, Chondrus, Fucus. **Lichenes**: Cetraria. **Fungi**, Ergota, Ustilago.

ANIMAL DRUGS.

Twenty-fourth Lecture. **Class Insecta**, Cantharis, Cera alba and flava, Mel, Coccus. **Class Pisces**, Ichthyodia, Oleum Morrhuæ, Eulachon Oil. Class Aves, Vitellus. **Class Mammalia**, Moschus, Castoreum, Fel Bovis, Serum, Saccharum lactis, Acidum lacticum, Carbo animalis.

Twenty-fifth Lecture. **Class Mammalia (con.)**, Cetaceum, Adeps, Glycerinum, Lanolinum, Pepsinum, Pancreatinum.

SYLLABUS OF THE JUNIOR COURSE OF LECTURES ON THEORETICAL AND PRACTICAL PHARMACY.

PROFESSOR P. W. BEDFORD.

Pharmacy Explained. Theoretical, practical, and their relations to each other. Methods of drug business in the past as compared with the present. Legislation bearing on pharmacy, and pharmacy laws. Colleges of Pharmacy. Boards of Pharmacy. Foreign pharmacy contrasted with our own. Pharmacopœias and Dispensatories, their scope and authority. The United States Pharmacopœia, its history, the present revision, and how it varies from its predecessors. Foreign pharmacopœias, attempts to secure a universal pharmacopœia. Books of reference and aids to study.

Metrology. *The Balance*, its construction, use, care, varieties.

Weighing, the principles involved, standards of weight and how derived, varieties of weights in use, their relation to each other.

Metric System, its derivation, adaptability, simplicity, its relation to other systems, the terms and symbols used. Caution. Parts by weight as used in the U. S. P.

Measures of Capacity, how made, how tested for accuracy, methods of measuring, domestic measures unreliable.

Specific Gravity. Relation of weight to volume. Methods employed, apparatus used, practical illustration of all methods as applied to solids and fluids.

Specific volume, how determined, and its practical application demonstrated.

Indigenous Drugs, their collection, preparation, and preservation. Selection of drugs as to quality.

Mechanical Division, preparation, implements used, pharmacopœial fineness; commercial powdered drugs, pharmacopœial products.

Heat. Sources from which it may be obtained, its use, practical demonstration, etc. Determination of temperature, thermometer, relation between various arbitrary scales of temperature, applications of heat alluded to in general.

Solution. Definition of solution, solvents employed, methods of facilitating solution, apparatus used, simple solution, chemical solution, various classes of solutions in the United States Pharmacopœia.

Dialysis, how conducted, its uses and advantages.

Maceration and other similar processes of solution as applied to drugs.

Percolation. This process will be fully explained, and practically illustrated by all methods now in use.

Expression. Hydraulic and screw presses, filter presses.

Filtration. Filtering media of all kinds, and the various kinds of apparatus for conducting the process.

Decantation and the use of siphon illustrated.

Evaporation. All varieties of apparatus employed in this operation will be illustrated, explained, and many practically demonstrated.

Distillation and Sublimation. Construction of the many forms of apparatus explained, the vaporizing and condensing apparatus practically illustrated by

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processes conducted in making some pharmaceutical products. Other operations, in which heat is employed, will also be demonstrated.

Crystallization as a theory and process, and its product will be shown by numerous examples, models, and working processes.

Precipitation. The methods, the theory, the changes which occur in the process, the precautions necessary to secure the product desired in a state of purity, will have full explanation and practical illustration.

Generation, *Collection*, and *Solution of Gases*, with necessary apparatus for pharmaceutical products, or testing, will illustrate the principles involved and methods employed.

Pharmacopœial Preparations classified, their general features described, notable articles mentioned in detail, methods of study for senior year designated.

Dispensing Pharmacy, general, and also specific instruction, as time will permit.

SENIOR COURSE.—First Portion.

Inorganic Pharmaceutical Chemicals.

In the products that follow, the lecturer will briefly allude to the sources modes of manufacture, quality, purity, recognition and application of tests, but the pharmacopœial products will be more fully detailed, the processes explained as to pharmaceutical methods and character, use and ordinary doses.

Acids. Sulphuric, Nitric, Hydrochloric, Acetic. Description of their manufacture, pharmacopœial uses, combinations, tests of purity, tests of recognition. Important salts of the acids.

Potassium and its compounds. Sources, forms of occurrence, crude salts of commerce, their purification, conversion into pharmacopœial compounds. Potassium carbonate, bicarbonate, citrate, caustic (solid and solution), nitrate, chlorate, acetate, bitartrate, tartrate, Rochelle salt.

Sodium, chloride, sulphate, carbonate, bicarbonate (cryolite, products and manufacture), nitrate, borate, chlorate.

Ammonium, gas liquor, purification, chloride, sulphate, solutions, other salts, spirit, aromatic spirit. Stoichiometrical illustrations.

Calcium, hydrate, solution, syrup, carbonate, bicarbonate, chloride, phosphate, lacto-phosphate (syrup), gummate; sulphurated and chlorinated lime. Disinfectants.

Aluminium, hydrate (from clay, from cryolite), sulphate, porous alum, ammonia alum, potash alum, burnt alum.

Magnesium, magnesite (dolomite), sulphate, carbonate, hydrate, chloride, citrate (granular and solution).

Barium, Strontium, Lithium, Cerium, their salts, and their pharmaceutical preparations.

Chlorine, Bromine, Iodine. Under these elements will come the chief discussion of all the chlorides, bromides, and iodides in chemical, pharmaceutical, and medicinal use, and the various pharmaceutical combinations, with many

illustrations and practical production of the corresponding salts and preparations of the U. S. P.

Iron. Metallic combinations with elements, with acids. Preparations made by decompositions of the sulphates, and of the solution of tersulphate; scale salts, arsenical antidote, and the many other salts and compounds of iron.

Manganese, sulphate, carbonate, iodide, and syrup.

Silver, nitrate, oxide, cyanide.

Copper, sulphate, oxide, carbonate, acetate, oleate.

Lead, acetate, carbonate, solutions, ointments, plasters, etc.

Cadmium and its salts will receive but brief mention.

Zinc, chloride (and solution), oxide, sulphate, carbonate, valerianate, oleate, etc.

Arsenic and antimony with their preparations and pharmacopœial tests will occupy an evening or more, and with the practical manufacture of some of their medicinal products, and those of

Bismuth, fully two evenings will be needed.

Mercury, its metallic subdivision in form of pill, ointment, powder, and plaster; its combination with elemental bodies, with acids, all the various chemical and pharmaceutical combinations. Practical demonstration of their manufacture and testing.

SENIOR COURSE.—Second Portion.

Organic Pharmaceutical Preparations.

Lignin, and products derived from wood fibre. Products of destructive distillation of wood.

Starch, and sources from which it is derived.

Exudations of Plants: gums, gum resins, resins, oleo-resins, balsams.

Sugar in its varieties. **Syrups,** medicated and otherwise.

Fermentation Products. Alcohol series. Ethers, chloroform, chloral, amylic alcohol, valerianic and lactic acids.

Products of the **Grape:** wine, argols, cream of tartar, tartaric acid. Citric acid and other fruit products.

Organic Acids. Under this head will be considered the more important acids that have pharmaceutical interest.

Volatile Oils, their production, use, adulteration, general and special tests.

Expressed and Fatty Oils, manufacture, use, special and general tests.

Fats (animal and vegetable), ointments, cerates, wax, soaps.

Alkaloids, their occurrence, composition, methods of extraction; practical examples, tests of the leading alkaloids. Dispensing; their use and doses.

Opium and **Cinchona,** with their alkaloids, pharmaceutically considered.

Poisons, classification, methods of treatment, antidotes.

Animal Drugs and products used in pharmacy.

Pharmaceutical Manipulations; reading of prescriptions, dispensing practically illustrated.

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OBLIGATORY JUNIOR COURSE IN PRACTICAL CHEMISTRY.

PROFESSOR ARTHUR H. ELLIOTT.

A brief synopsis of this course is here given:

First Day.

(*a*) *Class Work.* Chemical Manipulation. Working with glass tubes; bending, drawing, etc.; fitting and boring corks for apparatus.

(*b*) *Laboratory Work.* Application of Chemical Manipulation. Making of apparatus for generation of gases, etc.

Second Day.

(*a*) *Class Work.* Making and handling of gases. Oxygen, Hydrogen, etc.

(*b*) *Laboratory Work.* Making and testing of Hydrogen, Oxygen, Carbon Dioxide, and other gases.

Third and Fourth Days.

(*a*) *Class Work.* Separation of metals by Group reagents. Use of symbols. Writing equations for Reactions, etc.

(*b*) *Laboratory Work.* Special practice in the separation of metals into Groups.

Fifth Day.

(*a*) *Class Work.* Silver, Lead, and Mercury (Mercurous).

(*b*) *Laboratory Work.* Special practice on preceding group of metals.

Sixth and Seventh Days.

(*a*) *Class Work.* Mercury, Lead, Bismuth, Copper, Cadmium, Antimony, Arsenic, Tin. Work the same as in former group of metals.

(*b*) *Laboratory Work.* Special practice with above group of metals.

Eighth Day.

Laboratory Work only. Special practice with all preceding groups of metals.

Ninth and Tenth Days.

(*a*) *Class Work.* Zinc, Aluminum, Iron, Nickel, Cobalt, Manganese, Chromium. Special blowpipe and other reactions, with separation and identification of the group.

(*b*) *Laboratory Work.* Special practice in above metals; also in writing equations, and the separation of unknown mixtures of above metals.

Eleventh Day.

(*a*) *Class Work.* Chemical Equations. Graphic Formulæ.

(*b*) *Laboratory Work.* Separation of mixtures of metals.

Twelfth Day.

(*a*) *Class Work.* Group of Alkaline Earthy metals. Chemical Equations.

(*b*) *Laboratory Work.* Special practice on Alkaline Earthy metals, etc. Separation of the members of the group. Practice in writing Equations.

Thirteenth Day.

Laboratory Work only. Special practice on all groups of metals studied.

Fourteenth Day.

(*a*) *Class Work.* Group of Alkali Metals and Magnesium.

(*b*) *Laboratory Work.* Use of blowpipe and other tests as presented in the Class. Practice on blowpipe tests.

Fifteenth and Sixteenth Days.

Laboratory Work only. Practice on the Separation of all the metals.

Seventeenth Day.

(*a*) *Class Work.* Inorganic Acids. Nitric, Chloric, Carbonic, Hydrosulphuric, Sulphurous, and Hydrocyanic acids.

(*b*) *Laboratory Work.* Practice with the above acids and separation of the same.

Eighteenth Day.

(*a*) *Class Work.* Inorganic acids. Hydrochloric, Hydriodic, Hydrobromic, and Hydrocyanic acids.

(*b*) *Laboratory Work.* Separation and identification of above acids in mixtures.

Nineteenth Day.

(*a*) *Class Work.* Inorganic Acids. Sulphuric, Phosphoric, Chromic, Boracic, Silicic, Hydrofluoric acids.

(*b*) *Laboratory Work.* Separation and identification of above acids in mixtures.

Twentieth Day.

(*a*) *Class Work.* Organic Acids. Acetic, Tartaric, Citric, Oxalic, Tannic.

(*b*) *Laboratory Work.* Practice with the Organic Acids.

Twenty-first Day.

Laboratory Work only. Analysis of unknown complex substances, with a view to the testing for impurities in pharmaceutical preparations.

Twenty-second Day.

Examination. This will embrace the writing of equations and a practical examination of each student in the testing of impure pharmaceutical preparations.

Throughout the course the student will work upon unknown material, receiving full directions in the class. Special practice in the writing of equations will be given during the entire course. *Students are required to be in their places promptly at 9 o'clock A. M., and remain until their work is accomplished.* Daily marks will be kept by the instructor.

After completing the obligatory course, it is earnestly hoped that the student will pursue an additional course of optional study in more advanced work. Every care will be taken to make the various courses eminently practical, instructive, and valuable. By forming small classes, students receive the additional benefits derived from systematic instruction. The optional courses are as follows:

Advanced course in Quantitative Analysis.
Alkalimetry and Acidimetry.
Gravimetric and Volumetric Analysis.

OBLIGATORY SENIOR COURSE IN PRACTICAL PHARMACY

PROFESSOR ARTHUR H. ELLIOTT.

The following is an outline of the work to be completed in twenty-two days:

1. Specific Gravity. Practice with solids lighter and heavier than water, soluble and insoluble in water; liquids, etc. Examples, use of specific-gravity bottle, hydrometers, etc.

Thermometers: Fahrenheit, Centigrade, Réaumur. Testing and comparing. Transposing from one scale to another.

2. General pharmaco-chemical work. Inorganic pharmaceuticals.
   (*a*) Trituration, mercuric iodide, etc.
   (*b*) Solution. Methods of preparing chemicals for solution; use of various solvents; the preparation of special solutions, and also standard solutions for testing, etc.
   (*c*) Boiling, evaporation, distillation and fractional distillation, crystallization, granulation, exsiccation, manufacture of pure chemicals involving the foregoing operations.
   (*d*) Precipitation, red iodide of mercury, precipitated sulphur.
3. Miscellaneous organic pharmaceuticals.
   (*a*) Aqua amygdalæ amaræ, anisi, aurantii florum, camphoræ, cinnamomi, creasoti, fœniculi, menthæ piperitæ, rosæ, etc. Methods of securing aqueous solutions of essential oils, etc.

(*b*) Unguentum hydrargyri, hydrargyri nitratis and oxidi, iodi, iodoformi, plumbi iodidi, etc.

(*c*) Syrups of acacia, bromide and iodide of iron, hydriodic acid, hypophosphites, squill, wild cherry, and others.

(*d*) Cerates, cantharides, camphor, subacetate of lead, resin, etc.

(*e*) Decoctions, cetraria, sarsaparilla comp., etc.

(*f*) Infusions, cinchona, wild cherry, senna comp., brayera.

(*g*) Mixtures, chloroform, iron and ammonium acetate, rhubarb and soda, citrate of potassium, etc.

(*h*) Pills, making of mass, cutting, coating, etc., choice of excipient, nitrate of silver, permanganate of potassium, iodide of iron, opium, phosphorus, rhubarb, and others from prescriptions procured at drugstores.

(*i*) Emulsions, cod-liver and other fixed oils, turpentine, resins, balsams, etc.

(*j*) Suppositories, gelatin, tannic acid, etc.

(*k*) Wafers.

(*l*) Scale salts—Iron citrate, tartrate, phosphate, pyrophosphate, etc.

4. Exhaustion of Drugs, Percolation, etc.

(*a*) Fluid extracts of belladonna, cinchona, cotton root, gentian, glycyrrhiza, sarsaparilla, taraxacum, wild cherry, etc.

(*b*) Tinctures of arnica, benzoin, cantharides, cubeb, digitalis, iodine, nux vomica, opium, rhubarb, squill, ginger, etc.

(*c*) Abstracts, jalap, podophyllum, etc.

5. Volumetric Analysis. Acidimetry and Alkalimetry. Use of Standard Solutions, Indicators, etc.

6. Water Analysis. Sanitary Examination of Waters for Domestic Purposes.

7. Urine Analysis.

8. Milk and Butter. Analysis and Examinations for Purity. Oleomargarine.

9. Proximate Organic Analysis of Drugs. Detection of Adulterations.

10. Valuation of Opium, Cinchona, Nux Vomica, Jalap, etc.

The amount of work done in this department will depend upon the skill and application of the student; but it is expected that each one will cover practically all the ground embraced in the above examples, so as to give a groundwork for future study. And those students who can spare the time will be able to make more elaborate investigations during the Spring Session in the Laboratory.

SYLLABUS OF LECTURES ON PHARMACOGNOSY.

PROFESSOR JOSEPH SCHRENK.

Junior Course.

SIX LECTURES.

The construction and use of the microscope, with practical exercises. The vegetable cell; the cell-wall; the cell-contents. The various cell-tissues. The vegetable secretions. Micro-chemical reagents. Methods of preparing specimens for examination. Mounting for permanent preservation.

Senior Course.

FIRST, SECOND, AND THIRD LECTURES.

Introduction.—Synopsis of the morphology of the parts of plants used as drugs. Kinds of cells and tissues; systems of tissues; cell-contents.

Objects for illustration will be taken chiefly from drugs mentioned in this syllabus. The students will be assisted, throughout the course, in preparing their own specimens for microscopical examination.

In the subsequent lectures, as many of the more important drugs, especially of those enumerated below, will be remarked upon and examined as time will permit. The descriptions given will refer principally to name and classification, geographical distribution, physical characteristics, morphology and anatomy, constituents, substitutions, and, occasionally, historical data

FOURTH AND FIFTH LECTURES.

Roots.—Sarsaparilla, Senega, Gentiana, Taraxacum (and Chicory), Lappa Asclepias, Althæa, Belladonna, Calumba, Rheum, Glycyrrhiza (Spanish, Russian), Ipecacuanha, Gelsemium, Pareira, Krameria.

SIXTH AND SEVENTH LECTURES.

Rhizomes.—Zingiber, Calamus, Veratrum, Cypripedium, Convallaria, Sanguinaria, Podophyllum, Valeriana, Arnica, Serpentaria, Spigelia, Hydrastis, Cimicifuga.

EIGHTH AND NINTH LECTURES.

Tubers and Bulbs.—Jalapa, Aconitum, Colchicum, Scilla.

Barks.—Cinchona, Frangula, Cinnamomum, Ulmus, Prunus Virginiana, Viburnum, Sassafras, Quillaia, Gossypii rad. cort.

Herbs and Flowers.—Lobelia, Absinthium, Tanacetum, Mentha, Cannabis, Eryngium, Arnica, Santonica, Matricaria.

TENTH LECTURE.

Leaves.—Pilocarpus, Uva Ursi, Senna, Erythroxylon, Belladonna, Stramonium, Hyoscyamus, Digitalis, Buchu, Aconitum, Conium, Eucalyptus, Hamamelis.

ELEVENTH LECTURE.

Fruits.—Piper, Pimenta, Capsicum, Colocynthis, Illicium, Cardamomum, Conium, Coriandrum, Anisum, Carum, Fœniculum.

TWELFTH LECTURE.

Seeds.—Physostigma, Sinapis, Nux Vomica, Ignatia, Ricinus, Myristica, Stramonium, Colchicum.

Not Classified.—Amylum, Lycopodium, Kamala, Lupulinum, Ergota, Galla.

SYLLABUS OF LECTURES ON PHYSICS.

PROFESSOR ARTHUR H. ELLIOTT.

First Lecture. **Liquids, Gases, and Vapors.** Liquid pressure. The Hydraulic press and its applications. Equilibrium of liquids. Flotation. Capillarity. Diffusion of liquids. Exosmose and Endosmose. Applications of osmose. Elasticity of gases. Weight of gases. Pressure of gases. Atmospheric pressure. The Barometer. Variations in height of barometer. Boyle's law. Manometers. Aneroid barometer. Diffusion of gases. Absorption of gases by solids. Balloons. Air pump. Sprengel's pump. Suction and force pumps. The siphon.

Second Lecture. **Heat.** Theories. General effects. Expansion of solids, liquids, and gases. Thermometers. Different thermometric scales. Alcohol and mercury thermometers. Registering thermometers. Pyrometers. Linear and cubical expansion of solids. Compensating pendulum and watch balance. Expansion of liquids. Maximum density of water. Expansion of gases. Air thermometer.

Third Lecture. **Heat.** Change of state. Fusion. Latent heat of fusion. Freezing mixtures. Alloys, fluxes. Vaporization. Latent heat of vaporization. Freezing machines. Elastic force or tension of vapors. Causes that affect vaporization. Ebullition. Causes that affect ebullition. Papin's Digestor. The vacuum pan. Condensation of vapors and gases. Density of gases and vapors. Specific heat. Sources of heat. Heat and work. Hygrometers. Conduction and convection of heat.

Fourth Lecture. **Light.** Theories. How light is propagated. Shadows. Velocity of light. Intensity of light, how measured. Reflection. Plane mirrors.

Fifth Lecture. **Light.** Refraction. Prisms. Lenses. Spherical aberration. Dispersion of light. The spectrum. Achromatism. Color of bodies. Complementary colors.

Sixth Lecture. **Optical Instruments.** Simple and compound microscopes. The telescope. The magic lantern. The camera obscura. Photography. The eye. Double refraction. Polarized light and its applications.

Seventh Lecture. **Magnetism.** Natural and artificial magnets. The magnetic fluids. Poles of magnets. Magnetic induction. Magnets and magnetic substances. Diamagnetism. The magnetic needle. Direction of needle, and dip. The mariner s compass. Astatic needle. Armatures.

Eighth Lecture. **Static Electricity.** Nature of the force. Conductors and non-conductors. Kinds of electricity. Production by friction, pressure, cleavage, heat. Distribution on bodies. Influence of points. Electrical induction. Gold leaf electroscope. Electric machines. Electrophorus. Plate electrical machine. Effects of static electricity. Condensers. The Leyden jar. Applications of static electricity. Lightning rods.

Ninth Lecture. **Dynamic Electricity.** Galvani's experiments. Volta's pile. The simple galvanic cell. Amalgamation of zinc. Elements, poles, and electrodes. Daniell's battery. Grove's, Bunsen's, Tyndall's, Smee's, and Gravity batteries. Bichromate batteries. Leclanché battery. Medical batteries.

Tenth Lecture. Detection of currents. Galvanometers. Effects of currents. Electric lights. Arc and incandescent lights. Electrolysis. Electroplating. Electromagnets. Electromagnetic machines. The telegraph. Induced currents. The induction coil. The telephone.

APPENDIX B

The classic address of Albert B. Prescott of the University of Michigan before the convention of the American Pharmaceutical Association in 1871; transcribed in full from the Proceedings of the American Pharmaceutical Association, 19: 425-429, 1871.

PHARMACEUTICAL EDUCATION

By A. B. Prescott,
Professor of Organic Chemistry and Pharmacy in the University of Michigan

The conditions of pharmaceutical apprenticeship in this country, constitute a subject of regret to all thoughtful observers. But no class of people are less subject to idle regret than are men of science, and as such, pharmacists will not rest easy without efforts to improve those conditions which shape the character of their vocation at its source.

In a large number of instances, the apprentice is led to perform mechanical labor in blind ignorance of the nature of the material with which he deals; he becomes habituated to a feeble and automatic mode of action, and hence, too often, he never afterward breaks through to the light. Elementary text-books on chemistry and botany are not placed in his hands; he learns to refer to official and non-official authorities, and to follow after statements and methods which he does not understand; and, too often, he finally ceases to "wonder why" he does this or that. The history of processes of preparation, and the discussion of physical and chemical ways and means are in a tongue unknown to him.

In many instances, this condition of things may be remedied by the pharmacists having apprentices in charge, but in this country and at present, in a far larger number of instances, such remedy is impossible, because the pharmacist has little more science than his apprentice. He also was a blind apprentice, if he was an apprentice at all, and he is too often unconscious or regardless of his own

deficiencies. In the larger number of drug stores there are no orderly facilities for the application of chemical and physical tests. Where even a chemist could find but imperfect means for the testing of medicines, the apprentice often completes his term in ignorance of those simple but very important tests which might be made in any drug store, or he may make empirical and fallacious attempts in obedience to directions not understood. From this apprenticeship, the young man emerges into responsible dealing in a trade abounding in adulterations and substitutions, low standards and shrewd deceptions. From this beginning, year after year still leaves him at the mercy of wholesale deceptions, innocent of the wrong done under his hand, if we may term him innocent whose ignorance places human life in daily jeopardy.

In Germany, the state requires and regulates apprenticeship, enforces instructions during the same, and secures the scientific character and the efficiency of such instruction by official examinations; and the same fact is true, to a certain extent, in Great Britain. It is evident that before we can hope for such apprenticeship, we must obtain a new generation of competent masters by some other means.

There is now a general demand for school training in technical science for all young men who are to enter upon vocations requiring applications of science: engineers, miners, manufacturers, mechanics, agriculturists, and (shall they be named at the last?) pharmacists. Every year this demand is notably more imperative. This education, of inestimable advantage to the pharmacist <u>whenever</u> obtained, is certainly never more useful than when secured <u>before</u> apprenticeship. This is the logical order; first principles, then their applications. It is true that from <u>didactic</u> college instruction only, the principles of science are feebly apprehended, and

especially in physical and chemical science, but vague and evanescent ideas are likely to be obtained by lectures alone. But, as we have just seen, it is not in the shop that the conditions of practical study are to be found at present; indeed, such conditions never can be so perfectly furnished in the shop as in the school laboratory. And it is the growing conviction of thoughtful educators, that physical science must be, and is to be taught in college laboratories. The student must handle the materials and wield the forces of physical and chemical action before he obtains a clear acquaintance with the same. And it is more than knowledge of natural forces, it is the skill to guide those forces that constitutes power, and such skill is best acquired in school laboratories. Moreover, the mental and manual discipline of laboratory science-work under the teacher, the training in care and accuracy imperative thereto, is excelled by no other discipline for the perceptive, inductive, and executive faculties, and it is discipline especially useful in the vocation of pharmacy. Such laboratory work ought not to be briefly completed; the broad field of pharmacy, reaching far into the sciences of inorganic and organic nature, require years of pupilage. A preparation that is to give ability, interest and good success to the lifetime should not have its opportunities too grudgingly counted in months.

But it may be urged, will young men who have taken and graduated from college courses in technical science, be willing to enter into the drudgery of apprenticeship in the shop of the apothecary, there to learn those practical details of daily duty and sale, which every one admits can be better learned in the shop; indeed, cannot be learned elsewhere? The question has its parallels. Farmers and mechanics cry out with fear, that too much school education of any sort may lift their sons above their

vocations. It is a question asked at thousands of firesides, but the world is full of answers,—there is no danger of too much schooling. To look at the industrial and national progress of Germany, is to receive a full answer.

It belongs to right education to fit men in heart, as well as in head and in hand, for the practical pursuits of life. If college bred, aye, and college graduated men feel above the work at the foot of the ladders of industry, then their feeling needs to be corrected, and their teachers in college and their elders in industrial art in community should join in curing them of this false pride. That young man whose knowledge of science breeds contempt of handicraft, has but poorly learned science, and has missed its true enthusiasm.

The objection to college graduation before apprenticeship, is constantly being made in the polytechnic vocations, and as constantly overcome; but in no vocation is there so good ground to silence the objection as in pharmacy. It is precisely to the ignorant apprentice in pharmacy that its work is drudgery. Too many of our apprentices have not taken that step which the world has taken in little more than a generation,—the step from dreary charm-dealing to scientific pharmacy. Give them first the fundamental sciences, and the daily duties of apprenticeship become invested with constant interest. The soiling of hands and dusting of garments they will regard no more than the literary writer regards the inkstain on his fingers. If a task, it is but probation for an honorable vocation in science, the significance of which the apprentice sees everywhere before him. Many duties are but experiments and verifications of principles ascertained, and operations studied at the school laboratory. He sees the

chemical reactions going on under the hands of his elders with interest, but without the presumptuous confidence of the uninformed. Having more self-respect, certainly, than the untaught, he is not more "above his business," for his business is higher in his estimation. He knows the long line of noble men whose master minds and patient labors have been devoted to the elucidation of every substance and every operation with which he has to deal. And in the after-life of responsible business he is not in danger of being victimized by the confidence operations of the drug trade.

All the schools of pharmacy which have been recognized as such by this Association require the completion of apprenticeship before granting a college diploma. In so doing, these colleges, in addition to their function as educators, perform a useful office in the discrimination and indorsement of certificates of apprenticeship, and in regulation of pharmacy. But, the writer submits, it is greatly to be regretted that no one of the colleges of pharmacy which this Association represents has ever required laboratory training, either before apprenticeship or before college graduation. This regret is expressed with no lack of appreciation of the useful services which these colleges have performed in keeping pharmacy alive in this country. And also, it is to be regretted that our institutions of science have not, more generally, organized courses of science applied to pharmacy. A young man can obtain the fragments of pharmaceutical science at many institutions, but in so doing he must be the constructor of his own education, and he loses those inestimable advantages which arise from the illustration and application of sciences, even in their rudiments, toward that profession they are designed to benefit. He also misses the professional enthusiasm and stimulus due to the incitement of a professional college fellowship.

Concerning the qualifications of English, German, and general education, which ought to precede apprenticeship, the writer forbears to enter, but would express his sense of the importance and indeed inherent necessity of such requirements. General education may properly be included in that of the technical school.

September 14, 1871.

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