

A CHAPTER IN THE HISTORY OF INHALATION ANESTHESIA

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A Chapter in the History of Inhalation Anesthesia.

This article makes no attempt to establish itself as an authoritative account of the true story of the first chapter in inhalation anesthesia. It is an attempt to give an organized account of the beginnings of inhalation anesthesia in and about Boston Massachusetts based entirely upon nearly one hundred early articles appearing in the medical journal of that time; namely, the Boston Medical and Surgical Journal issues of the dates November 18, 1846 to July 26, 1848 inclusive. At this time appeared the first announcements of the new procedure to the northeastern part of the United States in its most authoritative journal.

The advent of this new procedure by which man could safely be rendered inactive and devoid of pain can readily be appreciated as of historic interest. Without it the extreme advances of modern surgery and consequently modern medicine could not have been entirely possible. From this time medical men changed from their earlier limited ability to perform no more than the minor surgical procedures of incising abscesses, removing foreign bodies, or occasionally setting fractures and dislocations - cum dolore - into the modern surgeons of today able to skillfully perform the most radical surgery of removing lobes of the lung, reconstructing the gastro-intestinal tract, exploring the cranium in tedious brain operations, and doing a multitude of other equally difficult procedures.

Hand in hand with this tremendous development in medicine and surgery since the advent of adequate anesthesia in the middle of the nineteenth century has come the results of men who have specialized in the new field and have accumulated a mass of knowledge about analgesia, narcosis, and anesthesia, men who have collected knowledge of the actions of these various agents now used in their physiological effect on the human organism.

Physiology has gained by the accumulation of knowledge as to the exchange of gasses between the lungs, blood vessels, and tissues, - and their elimination. Pharmacology has gained by an accumulation of knowledge as to the fates of various narcotics, depressants, and stimulants when introduced into the body. Anesthesia has accumulated a body of knowledge and physical signs by which it can approximate and predict what is happening and probably going to happen during the progress of an anesthesia, and what might happen in patients with specifically studied abnormal or altered physiological make-up.

As far as the medicos and laymen in and about Boston Massachusetts are concerned the first public announcement of inhalation anesthesia came late in 1846 when the November 18th issue of the Boston Medical and Surgical Journal contained an article titled, "Insensibility during surgical Operations" written by Henry J. Bigelow M.D., a surgeon of the Massachusetts general Hospital.

Although it is true that a patent was taken out for the "New Ethereal Vapor" in October 1846 by Dr. W.T.J. Morton, dentist and Dr. Charles T. Jackson, chemist, the natural delay caused by the necessity of obtaining someone to experiment with the new agent, and the time necessary to pass before the results of the experiments were ready to be published, made the delay in public announcement until November 18, 1846.

Because this splendid article did originally announce to the Boston Medical and Surgical Journal world (if not truly the entire world) the advent of this new procedure, and because it will take the reader back to the beginning and allow him to obtain an accurate conception of it, I include it in its entirety in this paper.

It has long been an important problem in medical science to devise some method of mitigating the pain of surgical operations. An efficient agent for this purpose has at length been discovered. A patient has been rendered completely insensible during the amputation of the thigh, regaining consciousness after a short interval. Other severe operations have been performed without the knowledge of the patients. So remarkable an occurrence, it is believed, renders the following details relating to the history and character of the process not uninteresting.

On October 16 of October 1846, an operation was performed at the hospital upon a patient who had inhaled a preparation administered by Dr. Morton, a dentist of this city, with the alleged intention of producing insensibility to pain. Dr. Morton was understood to have extracted teeth under similar circumstances without the knowledge of the patient. The present operation was performed by Dr. Warren, and though comparatively slight, involved an incision near the lower jaw of some inches in extent. During the operation the patient muttered as in a semi-conscious state, and afterwards stated that the pain was considerable though mitigated; in his own words, as though the skin had been scratched with a hoe. There was probably in this instance some defect in the process of inhalation, for on the following day the vapor was administered to another patient with complete success. A fatty tumor of considerable size was removed by Dr. Hayward, from the arm of a woman, near the deltoid muscle. The operation lasted 4 or 5 minutes, during which time the patient betrayed occasional marks of uneasiness; but upon subsequently regaining her consciousness, professed not only to have felt no pain, but to have been insensible to surrounding objects, to have known nothing of the operation, being only uneasy about a child left at home. No doubt, I think, existed in the minds of those who saw this operation, that the unconsciousness was real; nor could the imagination be accused of any share in the production of these remarkable phenomena.

I subsequently undertook a number of experiments, with the view of ascertaining the nature of this new agent, and shall briefly state them, and also give some notice of the previous knowledge which existed of the use of substances I employed.

The first experiment was with sulphuric ether, the odor of which was readily recognized in the preparation employed by Dr. Morton. Ether inhaled in vapor is well known to produce symptoms similar to those produced by the nitrous oxide. In my former experience, the exhilaration has been quite as great, though perhaps less pleasurable, than that of this gas or the Egyptian haschish (extract of Indian hemp). It seemed probable that the ether might be so long inhaled as to produce excessive inebriation and insensibility; but in several experiments the exhilaration was so considerable that the subject became uncontrollable, and refused to inspire through the apparatus. Experiments were next made with the oil of wine (etheral oil), this is well known to be an ingredient in the preparation known as Hoffman's Anodyne, which also contained alcohol, and this was accordingly employed. Its effects upon the three or four subjects who tried it, were singularly opposite to

those of the ether alone. The patient was tranquillized and generally lost any inclination to speak or move. Sensation was partially paralyzed, though it was remarkable that consciousness was always clear, the patient desiring to be pinched or pricked, with a view to ascertain how far sensibility was lost. A much larger proportion of oil of wine, and also chloric ether, with and without alcohol, were tried with no better effect.

It may be interesting to know how far medical inhalation has been previously employed. Medicated inhalation has been often directed to the amelioration of various pulmonary affections with indifferent success. Instruments called inhalers were employed long ago by Mudge, Gairdner, and Darwin, and the apparatus fitted up by Dr. Beddoes and Mr. James Watt for respiring various gases has given birth to some octavo volumes. More recently, Sir Charles Scudamore has advocated the inhalation of iodine and conium in phthisis and the vapor of tar has been often inhaled in the same disease. The effects of stramonium, thus administered, have been noticed by Sigamond.

The inhalation of the ethers has been recommended in various maladies, among which may be mentioned phthisis and asthma. "On sait que la respiration de l'ether sulfurique calme souvent les accidents nerveux de certain croups", is from the Dict. des Sc. Med.; but I find that mention of the inhalation of this agent is usually coupled with a caution against its abuse, grounded apparently upon two or three cases, quoted and requoted. Of these, the first is from Brande's Journal of Science, where it is thus reported: "By imprudent respiration of sulphuric ether, a gentleman was thrown into a very lethargic state, which continued from one to three hours, with occasional intermissions and great depression of spirits - the pulse being for many days so low that considerable fears were entertained for his life." Christison quotes the following from the Midland Med. and Surg. Journal, to prove that nitric ether in vapor is a dangerous poison when too freely and too long inhaled: "A druggist's maid servant was found one morning dead in bed, and death had evidently arisen from the air of her apartment having been accidentally loaded with vapor of nitric ether, from the breaking of a three gallon jar of the Spiritus Aeth. Nitric. She was found lying on her side, with her arms folded across her chest, the countenance and posture composed, and the whole appearance like a person in a deep sleep. The stomach was red internally, and the lungs were gorged." The editor of the journal where this case is related, says he is acquainted with a similar substance, where a young man was found completely insensible from breathing air loaded with sulphuric ether, remained apoplectic for some hours, and would undoubtedly have perished had he not been discovered and removed in time. Ether is now very commonly administered internally as a diffusible stimulant and antispasmodic, in a dose of one or two drachms. But here also we have the evidence of a few experiments that ether is capable of producing grave results under certain circumstances. Orfila killed a dog by confining a small quantity in the stomach by means of a ligature around the oesophagus. Jager found that one half ounce acted as a fatal poison to a crane. It was for a long time supposed to be injurious to the animal economy. The old Edinburgh Dispensatory, republished here in

1816, explicitly states that it is to be inhaled by holding in the mouth a piece of sugar, containing a few drops, and also that regular practitioners give only a few drops for a dose; "though", it adds, "empirics have sometimes ventured upon much larger quantities, and with incredible benefit." p. 566. Nevertheless, it was known to have been taken in correspondingly large doses with impunity. The chemist Bucquet, who died of scirrhus of the colon, with inflammation of the stomach and intestines, took before his death a pint of ether daily, to alleviate his excruciating pains (he also took 100 gr. opium daily); - and Christison mentions an old gentleman who consumed for many years sixteen ounces every eight or ten days. Such facts probably led Merat and De Lens, in their *Matiere Medicale*, to question its grave effects when swallowed. Mentioning the case of Bucquet, they say, even of its inhalation, that it produces only "un sentiment de fraicheur que suit bientot une legere excitation."

This variety of evidence tends to show that the knowledge of its effects, especially those of its inhalation, was of uncertain character. Anthony Todd Thomson well sums up what I conceive to have been the state of knowledge at the time upon this subject, in his *London Dispensatory* of 1818. "As an antispasmodic, it relieves the paroxysm of spasmodic asthma, whether it be taken into the stomach, or its vapor only be inhaled into the lungs. Much caution, however, is required in inhaling the vapor of ether, as the imprudent inspiration of it has produced lethargic and apoplectic symptoms." In his *Materia Medica and Therapeutics*, of 1832, however, omitting all mention of inhalation, he uses the following words: "Like other diffusible excipients, its effects are rapidly propagated over the system, and soon dissipated. From its volative nature its exciting influence is probably augmented; as it produces distension of the stomach and bowels, and is thus applied to every portion of their sensitive surface. It is also probable that it is absorbed in its state of vapor, and is therefore directly applied to the nervous centers. It is the diffusible nature of the stimulus of ether which renders it so well adapted for causing sudden excitement, and producing immediate results. Its effects, however, so soon disappear, that the dose requires to be frequently repeated."

Nothing is here said of inhalation, and we may fairly infer that the process had so fallen into disrepute, or was deemed to be attended with such danger, as to render a notice of it superfluous in a work treating, in 1832, of therapeutics.

It remains briefly to describe the process of inhalation by the new method, and to state some of its effects. A small two-necked glass globe contains the prepared vapor, together with sponges to enlarge the evaporating surface. One aperture admits the air to the interior of the globe, whence, charged with vapor, it is drawn through the second into the lungs. The inspired air thus passes through the bottle, but the expiration is diverted by a valve in the mouth piece, and escaping into the apartment is thus prevented from vitiating the medicated vapor. A few of the operations in dentistry, in which the preparation has as yet been chiefly applied, have come under my observation. The remarks of the patients will convey an idea of their sensations.

A boy of 16, of medium stature and strength, was seated in the chair. The first few inhalations occasioned a quick cough, which afterwards subsided; at the end of eight minutes the head fell back, and the arms dropped, but owing to some resistance in opening the mouth, the tooth could not be reached before he awoke. He again inhaled for two minutes, and slept three minutes, during which time the tooth, an inferior molar, was extracted. At the moment of extraction the features assumed an expression of pain, and the hand was raised. Upon coming to himself, he said he had had a "first rate dream - very quiet," he said, "and had dreamed of Napoleon - nor had the slightest consciousness of pain - the time had seemed long," and he left the chair, feeling no uneasiness of any kind, and evidently in a high state of admiration. The pupils were dilated during the state of unconsciousness, and the pulse rose from 130 to 142.

A girl of 16 immediately occupied the chair. After coughing a little, she inhaled during three minutes, and fell asleep, when a molar tooth was extracted, after which she continued to slumber tranquilly during three minutes more. At the moment when force was applied she flinched and frowned, raising her hand to her mouth, but said she had been dreaming a pleasant dream, and knew nothing of the operation.

A stout boy of 12, at the first inspiration coughed considerably, and required a good deal of encouragement to induce him to go on. At the end of three minutes from the first inhalation, the muscles were relaxed and the pupil dilated. During the attempt to force open the mouth he recovered his consciousness, and again inhaled during the two minutes, and in the ensuing one minute two teeth were extracted, the patient seeming somewhat conscious, but upon actually awaking he declared "it was the best fun he ever saw", avowed his intention to come there again, and insisted upon having another tooth extracted upon the spot. A splinter which had been left, afforded an opportunity of complying with his wish, but the pain proved to be considerable. Pulse at first 110, during sleep 96, afterwards 144; pupils dilated.

The next patient was a healthy-looking, middle-aged woman, who inhaled the vapor for four minutes; in the course of the next two minutes a back tooth was extracted, and the patient continued smiling in her sleep for three minutes more. Pulse 120, not affected at the moment of the operation, but smaller during sleep. Upon coming to herself, she exclaimed that "it was beautiful - she dreamed of being at home - it seemed as if she had been gone a month." These cases which occurred successively in about an hour, at the room of Dr. Morton, are fair examples of the average results produced by the inhalation of the vapor, and will convey an idea of the feelings and expressions of many of the patients subjected to the process. Dr. Morton states that in upwards of two hundred patients, similar effects have been produced. The inhalation, after the first irritation has subsided, is easy, and produces a complete unconsciousness, at the expiration of a period varying from two to five minutes; during which the patient is completely insensible to the ordinary tests of pain. The pupils, in the cases I have observed, have been generally dilated; but with allowance for excitement and other disturbing influences, the pulse is not affected, at least in frequency; the patient remains in a calm and tranquil slumber, and wakes with a pleasurable feeling.

The manifestation of consciousness or resistance I at first attributed to the reflex function, but I have since had cause to modify this view.

It is natural to inquire whether no accidents have attended the employment of a method so wide in its application, and so striking in its results. I have been unable to learn that any serious consequences have ensued. One or two robust patients have failed to be affected. I may mention as an early and unsuccessful case, its administration in an operation performed by Dr. Hayward, where an elderly woman was made to inhale the vapor for at least half an hour without effect. Though I was unable at the time to detect any imperfection in the process, I am inclined to believe that such existed. One woman became much excited, and required to be confined to the chair. As this occurred to the same patient twice, and in no other case as far as I have been able to learn, it was evidently owing to a peculiar susceptibility. Very young subjects are affected with nausea and vomiting, and for this reason Dr. M. has refused to administer it to children. Finally, in a few cases, the patient has continued to sleep tranquilly for eight or ten minutes, and once, after a protracted inhalation, for the period of an hour.

The following case, which occurred a few days since, will illustrate the probable character of future accidents. A young man was made to inhale the vapor, while an operation of limited extent, but somewhat protracted duration, was performed by Dr. Dix upon the tissues near the eye. After a good deal of coughing, the patient succeeded in inhaling the vapor, and fell asleep at the end of about ten minutes. During the succeeding two minutes the first incision was made, and the patient awoke, but unconscious of pain. Desiring to be again inebriated, the tube was placed in his mouth and retained there about twenty-five minutes, the patient being apparently half affected, but, as he subsequently stated, unconscious. Respiration was performed partly through the tube and partly with the mouth open. Thirty-five minutes had now elapsed, when I found the pulse suddenly diminishing in force, so much so, that I suggested the propriety of desisting. The pulse continued decreasing in force, and from 120 had fallen to 96. The respiration was very slow, the hands cold, and the patient insensible. Attention was now of course directed to find the return of respiration and circulation. Cold affusions, as directed for poisoning with alcohol, were applied to the head, the ears were syringed, and ammonia presented to the nostrils and administered internally. For fifteen minutes the symptoms remained stationary, when it was proposed to use active exercise, as in case of narcotism from opium. Being lifted to his feet, the patient soon made an effort to move his limbs, and the pulse became more full, but again decreased in the sitting posture, and it was only after being compelled to walk during half an hour that the patient was able to lift his head. Complete consciousness returned only at the expiration of an hour. In this case the blood was flowing from the head, and rendered additional loss of blood unnecessary. Indeed, the probable hemorrhage was previously relied on as salutary in its tendency.

Two recent cases serve to confirm and one I think to decide, the great utility of this process. On Saturday, the 7th Nov., at the Mass. General Hospital, the right leg of a young girl was amputated above the knee, by Dr. Hayward, for disease of this joint. Being made to inhale the preparation,

after professing her inability to do so from the pungency of the vapor, she became insensible in about five minutes. The last circumstance she was able to recall, was the adjustment of the mouth piece of the apparatus, after which she was unconscious until she heard some remark at the time of securing the vessels - one of the last steps of the operation. Of the incision she knew nothing, and was unable to say, upon my asking her, whether or not the limb had been removed. She refused to answer several questions during the operation, and was evidently completely insensible to pain or other external influences. This operation was followed by another, consisting of the removal of a part of the lower jaw by Dr. Warren. The patient was insensible to the pain of the first incision, though she recovered her consciousness in the course of a few minutes.

The character of the lethargic state, which follows this inhalation, is peculiar. The patient loses his individuality and awakes after a certain period, either entirely unconscious of what has taken place, or retaining only a faint recollection of it. Severe pain is sometimes remembered as being of a dull character; sometimes the operation is supposed by the patient to be performed upon somebody else. Certain patients, whose teeth have been extracted, remember the application of the extracting instruments; yet none have been conscious of any real pain.

As before remarked, the phenomena of the lethargic state are not such as to lead the observer to infer this insensibility. Almost all patients under the dentist's hands scowl or frown; some raise the hand. The patient whose leg was amputated, uttered a cry when the sciatic nerve was divided. Many patients open the mouth, or raise themselves in the chair, upon being directed to do so. Others manifest the activity of certain intellectual faculties. An Irishman objected to the pain, that he had been promised an exemption from it. A young man taking his seat in the chair and inhaling a short time, rejected the globe, and taking from his pockets a pencil and card wrote and added figures. Dr. M. supposing him to be affected, asked if he would now submit to the operation, to which the young man willingly assented. A tooth was accordingly extracted, and the patient soon after recovered his senses. In none of these cases had the patients any knowledge of what had been done during their sleep.

I am, as yet, unable to generalize certain other symptoms to which I have directed attention - (Since the above was written, I find this irregularity of symptoms mentioned in the case of poisoning by alcohol. Dr. Ogs-ton, according to Christison, has in vain attempted to group together and to classify the states of respiration, pulse, and pupil.) The pulse has been, as far as my observation extends, unaltered in frequency, though somewhat diminished in volume, but the excitement preceding an operation, has, in almost every instance, so accelerated the pulse that it has continued rapid for a length of time. The pupils are in a majority of cases dilated; yet they are in certain cases unaltered, as in the above case of amputation.

The duration of the insensibility is another important element in the process. When the apparatus is withdrawn at the moment of unconsciousness, it continues, upon the average, two or three minutes, and the patient

then recovers completely or incompletely, without subsequent ill effects. In this sudden cessation of the symptoms, this vapor in the air tubes differs in its effects from the narcotics or stimulants in the stomach, and, as far as the evidence of a few experiments of Dr. Morton goes, from the ethereal solution of opium when breathed. Lassitude, headache and other symptoms lasted for several hours, when this agent was employed.

But if the respiration of the vapor be prolonged much beyond the first period, the symptoms are more permanent in their character. In one of the first cases, that of a young boy, the inhalation was continued during the greater part of ten minutes, and the subsequent narcotism and drowsiness lasted more than an hour. In a case alluded to before, the narcotism was complete during more than twenty minutes, the insensibility approached to coma.

Such cases resemble those before quoted from Christison and other authors, and show that the cessation of the inhalation, after it has been prolonged for a length of time, does not produce a corresponding cessation of the symptoms; while, if the inhalation is brief, the insensibility ceases in a short time. Recovery, in the latter case, is not improbably due to the complete and rapid elimination of the vapor from the lungs; the more gradual return to consciousness, in the former case, to the presence of a larger quantity of unexhaled particles. A fact mentioned by Christison bears upon this point. This author states that insensibility from the presence of a large quantity of alcohol in the stomach, often gives place to a complete and sudden return of consciousness, when the alcohol is removed by the stomach pump. It is probable that the vapor of the new preparation ceases early to act upon the system, from the facility with which it is inhaled.

The process is obviously adapted to operations which are brief in their duration, whatever be their severity. Of these, the two most striking are, perhaps, amputations and the extraction of teeth. In protracted dissections, the pain of the first incision alone is of sufficient importance to induce its use; and it may hereafter prove safe to administer it for a length of time, and to produce a narcotism of an hour's duration. It is not unlikely to be applicable in cases requiring a suspension of muscular action; such as the reduction of dislocations or of strangulated hernia; and finally it may be employed in the alleviation of functional pain, of muscular spasm, as in cramp and colic, and as a sedative or narcotic.

The application of the process to the performance of surgical operations, is, it will be conceded, new. If it can be shown to have been occasionally resorted to before, it was only an ignorance of its universal application and immense practical utility that prevented such isolated facts from being generalized.

It is natural to inquire with whom this invention originated. Without entering into details, I learn that the patent bears the name of Dr. Charles T. Jackson, a distinguished chemist, and of Dr. Morton, a skillful dentist, of this city, as inventors - and has been issued to the latter gentleman as proprietor.

It has been considered desirable by the interested parties that the character of the agent employed by them, should not be at this time announced; but it may be stated that it has been made known to those gentlemen who have had occasion to avail themselves of it. I will add, in conclusion, a few remarks upon the actual position of this invention as regards the public.

No one will deny that he who benefits the world should receive from it an equivalent. The only question is, of what nature shall the equivalent be, Shall it be voluntarily ceded by the world, or levied upon it? For various reasons, discoveries in high science have been usually rewarded indirectly by fame, honor, position, and occasionally, in other countries, by funds appropriated for that purpose. Discoveries in medical science, whose domain approaches so nearly that of philanthropy, have been generally ranked with them; and many will assent with reluctance to the propriety of restricting by letters patent the use of an agent capable of mitigating human suffering. There are various reasons, however, which apologize for the arrangement which I understand has been made with regard to the application of the new agent.

1st. It is capable of abuse, and can readily be applied to nefarious ends.

2nd. Its action is not yet thoroughly understood, and its use should be restricted to responsible persons.

3rd. One of its greatest fields is the mechanical art of dentistry, many of whose processes are, by convention, secret or protected by patent rights. It is especially with reference to this art, that the patent has been secured. We understand, already, that the proprietor has ceded its use to the Mass. General Hospital, and that his intentions are extremely liberal with regard to the medical profession generally, and that so soon as necessary arrangements can be made for publicity of the process, great facilities will be offered to those who are disposed to avail themselves of what now promises to be one of the important discoveries of the age. (9)

Evidently the staff of the periodical anticipated a justifiable strain on the credulity of their readers, for in the editorial section a short paragraph vouched for the integrity of the author of the article. It further explained the humanitarian motives of the two patent holders and observed as to the honorable motives behind the method of introduction with its secrecy and protection. It was further explained that the controllers had no

9 Bigelow, Henry J., "Insensibility during surgical operations produced by inhalation." The Boston Medical and Surgical Journal 35:309-317 Nov. 18, 1846.

intention of withholding their "new substance" from the accredited medical profession nor of gaining undue reward, but told of their determination to prevent premature use and abuse. (40)

If the intention of the editorial was to quell any criticism or denouncement, it was wholly unsuccessful, for the storm of the antagonists was to be so great that even the editorial policy of the magazine was to sway. However, as would happen today, within the next issue the subject had become of vital interest, and the Boston Medical and Surgical Journal became filled with criticism launched against the method of introduction, the honor of the men involved, the morality of the procedure; there was even an outright denouncement of the discovery as pure hoax.

The first of these articles of criticism was sent in by a Dr. J. F. Flagg. (25) He commented strongly on the medical ethics which were soundly against any such things as secret and patent medicines. It pained him that colleagues of his should be a party to a procedure which, in his opinion, was nothing other than the act of foisting another patent medicine on the world. It seemed to him that the substance for which the patent had been obtained was nothing more or less than the well known sulphuric ether, and he doubted very much the legality of the patent. The "three reasons" for protection were nothing other than clever subterfuges for hiding the real purpose, material gain. He saw no reason for protecting professional secrets of dentists that did not exist. In conclusion Dr. Flagg flatly stated that he would not recognize the patent and would use sulphuric ether, which he believed the

40 "Operations without Pain." The Boston Medical and Surgical Journal 35:324
Nov. 18, 1846.

25 Flagg, J.F., "The inhalation of an ethereal vapor to prevent sensibility to pain during surgical operations." The Boston Medical and Surgical Journal 35:356-359 Dec 2, 1846.

substance to be, wherever and whenever he chose. He stated that "to patent it would be what it would have been for the immortal philanthropist Jenner to have patented vaccination." (25)

In a later article Dr. Flagg states that the new procedure was nothing other than the application of an old substance to a new method, that if anything was patentable, therefore, it was the method and not the substance which has been a part of the materia medica for years. We further learn from Dr. Flagg that Dr. Morton had distributed advertising material of his "new discovery" before the appearance of the initial article in November, 1846. (24)

Dr. Flagg was not alone in his criticisms, for within a short time a J. D. Mansfield sent in an article to show that all the profession had not accepted the method of introduction used. He also decried the patent, and again applying medical history asked, "Why did not Dr. Stearns, when he discovered the medicinal properties of ergot, get the right of using it patented and allow no one to use it but those who bought the privilege of him?" (36) An instance in which a mixture of an "ethereal compound" was inhaled as a part of the amusement at a social gathering was cited to show the substance was not a new and unknown one. As to the use of the new substance Dr. Mansfield ends with the offer that "on this point - every physician can satisfy himself by a few simple experiments - without being obliged to sacrifice his professional dignity by patronizing quackery." (36)

(25) op. cit.

(24) Flagg, J.F., "Inhalation of sulphuric ether." The Boston Medical and Surgical Journal 35:407-409 Dec. 16, 1846.

(36) Mansfield, J.D., "The inhalation of ethereal vapor etc." The Boston Medical and Surgical Journal 35:424-425 Dec. 23, 1846.

(36) id.

The attacks came from all parts of the eastern seaboard, and on December 16th the Boston Magazine contained an editorial reprint from the Philadelphia Medical Examiner. Here we are told that Dr. Morton was advertising in the newspapers of that city "his improvement whereby pain may be prevented." (29) The "responsible persons" who had taken up the discovery and were backing the patent holders were severely criticized. The "three reasons" of Dr. Bigelow's original article were held up to ridicule. History again was resorted to, for "did not Swain give his panacea to the poor gratis, and a lot of ground to build a church on to boot. We are persuaded that the surgeons of Philadelphia will not be seduced from the high professional path of duty into the quagmire of quackery of this will -O- the-wisp." (29) The article advised medical practitioners to consider what must be the nefarious influence of such an agent upon the nervous system if it rendered a patient unconscious and insensible to pain. These men were asked to consider the effect upon their conscience and their reputation in the profession if they undertook to use this substance. "If such things are to be sanctioned by the profession, there is little need of reform conventions or any other efforts to elevate the professional character. Physicians and quacks will soon constitute one fraternity." (29)

From the city of Baltimore came an article by T.E.B., Baltimore College of Dental Surgery. (47) It ridiculed Dr. Bigelow's original article and declared the patent to be utterly ridiculous. In addition the author

(29) "Insensibility during surgical operations produced by inhalation." The Boston Medical and Surgical Journal 35:413-414 Dec. 16, 1846.

(29) id.

(29) id.

(47) T.E.B., "Insensibility produced by ethereal inhalation." The Boston Medical and Surgical Journal 35:445-448 Dec. 30, 1846.

stated that the discovery was useless. The cases cited by Dr. Bigelow were taken up and were thoroughly torn apart. Special attention was paid to the grimaces exhibited by the patients, for the author could not conceive of facial expression of discomfort without consciousness of it. Then he drew a very apt simile unconsciously by disparagingly comparing the process to none other than rendering the patient "dead drunk." Lastly the three reasons of Dr. Bigelow are again reviewed after the critics manner:

"Dr. Bigelow's reasons for 'patenting' in this case are curious.

Reason I. Because the ether is capable of abuse, and therefore 'should be restricted to responsible persons.' (That is to such as can pay for it.)

Corollary 1. People who have money cannot abuse sul. ether.

Corollary 2. Poor people cannot be trusted with the knowledge.

Reason II. Its action (that of ether) is not thoroughly understood, and 'its use should be restricted to responsible persons.' (people who can purchase the right to use it.)

Corollary 1. People who have money can thoroughly understand what is not 'thoroughly understood.'

Corollary 2. Poor people have poor intelligence.

Reason III. 'One of its greatest fields is the mechanical art of dentistry many of whose processes are by convention secret, or protected by patent rights.' It is especially with reference to this art that the patent has been secured. 'Producing stupor' belongs to mechanical dentistry.

Corollary. It is lawful to keep secrets from dentists, provided they be imparted to the surgeons of the Massachusetts General Hospital. (47)

An article appearing in the Boston Journal quoted from the New York Annalist edited by Wm. C. Roberts M.D. (27) briefly criticized the method of introduction and the profiteering which was evidently coming of it. It

(47) op. cit.

(27) "Insensibility during surgical operations." The Boston Medical and Surgical Journal 35:464 Dec. 30, 1846.

expressed regret that respected physicians had been drawn to the side of the introducers; but it was not a criticism of the substance. Another from this city in the New York Journal of Medicine and Collateral Sciences deplored the dangerous and "almost fatal" consequences from the inhalation of sulphuric ether, which this new substance seems to be. "We are sorry to see many of our brethren, at home and abroad, stooping with, and become abettors of quackery in any form." (28)

To sum up in a reasonable manner the mass of vituperative criticism against the new discovery a contributor who signed himself as Claudian wrote a letter to the January 20, 1847 issue of the Boston Medical and Surgical Journal; he summarized, I think, the opinions of the majority of reasonable medical practioners of the day.

Dear Sir - I have always been opposed to quackery in any shape. I detest charlatanism in every form; ergo, I am not pleased with the method whereby the "new gas" and the patent "letheon" are offered to the public. Notwithstanding the respectable gentlemen of the profession who have undertaken to sustain Dr. Jackson and Mr. Morton in the (I do not say unprofessional) course they have taken, I believe the majority of medical men will disapprove the measure, even though this vis-a-tergo influence is still applied to the wheel. In this instance aq̄ fortis will avail nothing; for the profession, in the first place, are opposed to the use of patent remedies, and from education i.e., long training, they hate them as they abhor those who vivere lupto. We are not yet satisfied who are really the inventors. If it should be proved that the inventors, or inventor, is not Dr. J. or Mr. M., then those who could overlook the first difficulty will meet with one more objectionable; they will exclaim, ohe! jam satis.

But suppose we grant the claimants the honor etc., of the invention and purchase the right, etc. etc. I can conceive that it may be many times a dangerous application, one that will increase the danger of every formidable operation, and render dangerous those that are not perilous by its influence on the brain and its appendages, which at such times may prove very deleterious; a fact evident to all who are acquainted with the toxological properties of the drug, and its action on the animal economy when administered sufficiently to induce insensibility and narcosis.

I have seen a quotation from the Albany Argus, stating that the "new gas" had been tried there(Albany), and its effects upon the patient were

(28) "Insensibility during surgical operations by inhalation." The Boston Medical and Surgical Journal 35:518-519 Jan. 20, 1847.

similar to those of the nitrous oxid gas; an unhappy effect, which consequently disappointed the operator, and afflicted the patient. This shows another objection to its use.

If it is sulphuric ether, I expect that its administration will frequently produce the excitement and intoxication caused by the nitrous oxide; for I have witnessed like appearances many times in those persons who have respired the ether. I have a right, therefore, to apprehend the difficulties and dangers I have alluded to, and feel bound to warn the inexperienced against the too hasty adoption of it, and also to ask the attention of the more practised to the subject that all necessary precaution be taken and the evil consequences that might result from indiscretion and precipitancy be avoided.

These, then, are the reasons that I have to offer, and they have been given without prejudice against or in favor of any person. I cannot sanction "patent rights" in a learned and liberal profession. I fear the operation of the new invention; and, whether valid or not, I have given my reasons, my honest humble opinion. In closing, I am constrained to say, "tempora mutantur et nos mutamur in illis", for this could not have survived its birth in any other age.

CLAUDIAN. (17)

By no means did the critical material constitute the total of the early comment in the Boston Medical and Surgical Journal; in fact it made up but a minor part of the total written concerning the new subject. In May 1847 a reprint for the London Lancet in the Boston Journal gave the English impression received of the discovery. (44) Dr. Henry J. Bigelow had corresponded with a Dr. Goott of Gower street, London; and it was from this source that the major impression had been received. It informed that Dr. Charles T. Jackson and Dr. W.T.J. Morton were the holders of the patent and, consequently should receive the credit. It was further shown that to Dr. Morton was the world mainly indebted as the first successful user of Sulphuric ether as an inhalation agent for the production of adequate anesthesia.

(17) Claudian, "The potent 'Letheon'". The Boston Medical and Surgical Journal 35:514 Jan. 20, 1847.

(44) "Priority of discovery of the use of ether vapor." The Boston Medical and Surgical Journal 36:333-335 May 26, 1847.

The article stated that approximately two years previously (previous to early 1847) Dr. Morton had received the impression that a means of obviating pain was greatly desired by surgeons. At this time he, Dr. Morton, began to experiment using various agents he thought might have the desired effect. In the use of every new substance he was himself the first subject, at times not without dangerous and nearly fatal consequences.

When in school studying for dentistry he had been a student of Dr. Jackson; consequently as he was experimenting he communicated with the chemist regarding his object and received suggestions. The latter observed that he had once seen sulphuric ether in concentrated form produce an effect very much like the one Dr. Morton was evidently desiring. As soon as Dr. Morton heard the suggestion he ran home. Once there he immediately locked himself in his room, took out a watch, and proceeded to administer this agent to himself. Inhaling the ether freely he soon began to feel "approaching insensibility"; and soon the sponge fell from his hand, and he lost consciousness. When he fully recovered he found, "to his inexpressible delight", that he had been unconscious for eight minutes.

"As soon as he was able to leave the room, he was anxious to try the ether on a patient. A stout, healthy man presented himself to have a tooth extracted. The ether was inhaled; the tooth extracted; and the patient asserted that he had been entirely unconscious of pain. Other operations followed, and Dr. Morton became satisfied of the safety and efficacy of ether vapor. This was the month of September, 1846." (44)

Dr. Morton now applied himself to the construction of a suitable apparatus for the administration of the "ethereal vapor". When this had been

done he sought out Dr. John C. Warren, Surgeon of the Massachusetts General Hospital, not telling the latter of what the agent consisted.

Immediately other surgeons became interested and watched several tooth extractions using the procedure to eliminate pain. Among the observers was Dr. Henry J. Bigelow. He became so satisfied as to the safety of the procedure that he consented to have his own daughter's tooth extracted while using the substance. Dr. John C. Warren and Dr. Hayward used it in two "capital operations" without apparent marked untoward results.

"The merit of having suggested the inhalation of ether to Dr. Morton as an agent promising to supply the object he was seeking is due to Dr. Charles T. Jackson; nevertheless, the latter did not himself witness its application until several weeks had elapsed after Dr. Morton had put it to the test of actual experiment and succeeded." (44)

The medical profession began almost immediately to experiment and note the clinical effects of ether. As rapidly as the flood of criticism flowed into the periodical, so rapidly many times as much material appeared reporting the results of observation.

By December 23, 1846 W. Clay Wallace of New York had noted that "when the vapor of ether, sufficiently diluted with atmosphere air, is inhaled, it causes irritation upon the epiglottis, a sense of fullness in the head (vasodilatation), and effects analogous to those caused by the protoxide of nitrogen." (51) Furthermore he noted that when ether is mixed with air the

(44) op. cit.

(51) Wallace, W. Clay, "Remarks on the inhalation of ether previous to surgical operations." The Boston Medical and Surgical Journal 35:435-6 Dec. 23, 1846

the mixture will explode. The existence of individual susceptibility, he added, indicated the need for more complete study to determine some of the contributing factors.

Many of the reports obviously misinterpreted and exaggerated some of the untoward results obtained, evidently with the purpose of instilling caution into the users of ether rather than disclaiming it, for the articles usually ended with statements such as - "We feel, therefore, that this whole matter, be it of greater or lesser value in surgical practice, should be in the hands of those who have testimonials from some one of our medical colleges that they are worthy of being intrusted - with the health and life of their fellow beings." (2)

The article quoted from written by "A Physician" cited six cases showing such "untoward" results:

"The first case - a young lady - much agitated before taking the gas at Mr. Morton's; pulse 130 - after taking it fell to 70; eyes injected; frothing at the mouth; general appearance like one going into a state of epilepsy. For some time much confused - several hours after said that when the tooth was coming out, felt as if she were having a horrid dream.

The second case - a young man appeared to have much suffering throwing his body almost from the chair. Pulse rose to 150 while inhaling; eyes injected; respiration laboring.

The third case - Miss D. took the ether and had a tooth out without pain. Left Mr. M's room about 12 o'clock; at 1 o'clock after she got home was taken delirious. This lasted all night; next morning raised blood from the lungs - about a pint; was suffering in consequence of the operation three days after.

The fourth case - Miss R. was strangely excited but had a tooth out and felt no pain. Was taken delirious soon after she left Mr. M's room in a shop; had to be carried home, and remained in that state for three days, in great restlessness, and friends afraid to leave her alone.

(2) A Physician, "Ethereal vapor." The Boston Medical and Surgical Journal 35:472-473 Jan. 6, 1847.

The fifth case - a young man clerk in a store - returned to the store - after being absent for two or three hours, rushed violently from the street; then out again and returning till at last he fell senseless on the floor. When aroused sufficiently he said he had taken ether at Mr. M's.

The sixth case - a young woman, aged 18, - repeated the experiment - inhaled the vapor, but when the operation commenced, consciousness was so restored that she had great pain; - her head immediately felt confused and painful. She did not know how or when she returned home - whether alone or with someone to guide her. She was much agitated, weeping and sighing, and did not recover from the effects in all the next day." (2)

Quite obviously the results in these cases cited can easily be explained by observing that the patients were in all probability dismissed before they had completely recovered from the effects of the gas, and were often allowed to go free when in the first plane of anesthesia.

In June, 1847 Buckminster Brown M.D., Boston reported at length "on the Pathological and Physiological Effects of Etherization" and summarized much of the knowledge of the agent thus far gathered. He found the agent of much use in the alleviation of the "agonizing suffering" of cases which were not helped by opiates, at the same time leaving the mental processes clear. He cites a case in which he used ether successfully to "soothe the distress and relieve the dyspnoea of a patient dying of phthisis." He also noted the existence of "various individual idiosyncrasies", and that the agent might have amazing and unforeseen effects. (11)

He reported the results of his studies show that ether acted first as a stimulant by exciting the medulla oblongata and the medulla spinalis (as evidence of this be cited the occurrence of stimulation of respiration and

(2) op. cit.

(11) Brown, Buckminster, "On the pathological and physiological effects of ethereal inhalation." The Boston Medical and Surgical Journal 36:369-378 June 9, 1847.

circulation) which, in turn, communicated their effect via the vagus and spinal nerves. The secondary effects of ether, he noted, were narcotic. The loss of sensation he stated always preceded the loss of motion in corroboration of the experiments of M. Flourens. In the early stage of etherization the special senses were in a functional state after general bodily numbness had supervened. During his discussion two cases of M. Velpau's are cited. In one of these the subject being totally insensible to pain sat up and watched the progress of the operation. The other case, that of a young physician, took great pleasure in experimenting upon himself, rendering himself analgesic very rapidly without becoming unconscious, and sticking pins and lancets into his flesh without feeling it.

Dr. Brown concluded that "insensibility of the cerebrum" did not take place until late, and that the special senses were among the last to disappear. He also mentions one physiologist as suggesting that there might possibly exist an organ or center in the brain devoted peculiarly to pain sensation. "The peculiar function of the spinal cord is materially affected. When the patient is completely etherized there is entire relaxation of all voluntary muscle while those which act from their own inherent contractility, the uterus etc., still preserve their natural energy." (11) This indicated the influence of ether on the medulla spinalis and the fact was taken advantage of by physicians to reduce dislocations and set fractures. He did make one mistake, however, in stating that the power of the medulla spinalis was not completely depressed as shown by the maintenance of the sphincter tone.

(11) op. cit.

He concluded this part by stating that "should the inhalation be continued a sufficient length of time producing a check in respiration" its immediate consequence would be death.

"To form our conclusions from what we have thus far been able to gather it is apparent that the cerebellum (sense of equilibrium) is the first to yield. Next in succession, the cerebral ganglia become partially inactive, the spinal cord, and nearly at the same moment the ganglia of special sense; lastly, the medulla oblongata." (11)

As to reports of progress in France, the article contained many direct and indirect statements. A.M. DuBois, "a well known accoucheur", had immediately called the agent into use in the alleviation of the pain of those who must undergo instrumental delivery, and M.M. Boux, Velpau, Malgaigne, Amussat, and others immediately employed it in cases. We are informed that the agent was employed so that the physiological pains of ordinary labor might be mitigated. A.M. Ducros stated further that if sulphuric ether were mixed with extract of belladonna the cough and irritation might largely be eliminated. He used this mixture in the arresting of the cough in phthisis.

"We have seen," says M. Flourens, "by my preceding experiments what is the action of the ether on the spinal marrow. When we submit an animal to the action of the ether, the spinal marrow loses in the first place its power (as a conductor) of sensation; and secondly, its motor power. - Soon the moment arrives when both sensation and motion are abolished, yet the animal continues to live; he respire still. How is this effected? It was to obtain an answer to this inquiry that my experiments upon the medulla oblongata were instituted.

"The first experiment upon a dog - We submitted the animal to the inhalation of ether. At the end of thirty-five or six minutes the phenomenon of etherization having appeared, we laid bare first, a portion of the spinal marrow, and then the medulla oblongata. This done, we pricked the posterior

(11) Op. cit.

columns of the spinal marrow; we pinched; and we cut the posterior columns; and the animal felt nothing. We pinched the anterior root, and there was a slight movement. The inhalation was then continued some minutes more. These elapsed, we again pinched the anterior roots and the animal did not move. We pricked and cut the anterior columns of the spinal cord; still he remained motionless. The spinal marrow had then lost its properties of sensation and of movement. We then explored the medulla oblongata. Upon pricking it the animal uttered a cry, and at the same time there was muscular contraction in the cervical region.

"Second experiment upon a dog - At the end of twenty-five minutes the animal appeared completely etherized. We laid bare the spinal marrow, and pressure upon one of the posterior roots produced a slight degree of pain. The etherization was continued, and in two or three minutes more, upon again pinching the posterior roots, he felt nothing. We pricked and cut the posterior columns; still there was no pain. We passed to the anterior roots and columns; we pinched, pricked, and cut them, and the animal remained motionless.

"This immobility; this insensibility of the spinal marrow being established, the medulla oblongata, already laid bare, was then examined. On touching it there was a marked trembling of the animal from head to foot; at the same time there were very manifest contractions of the cervical muscles. I then divided the medulla oblongata at the point which I call the vital knot of the nervous system, and that which happens under similar circumstances to an animal who is in his ordinary state, occurs also to the animal who is etherized, viz., the sudden abolition of all respiratory movements in other words, sudden death.

"Third Experiment upon a dog - As soon as the animal appeared etherized, I again laid bare the spinal marrow and the medulla oblongata. There was the same loss of feeling and of motion in the spinal marrow and the medulla oblongata, and in the same sudden death upon a section at the vital point in the latter. I will not add new experiments. Who does not see that the solution for which I sought is found. The spinal marrow loses its principles of sensation and movement; yet the animal still lives, because the action of the medulla oblongata survives the action of the spinal marrow. In other terms, when we submit an animal to the influence of the ether, the nervous centers lose successively their force in a given order. First, the central lobes, that is to say intelligence, is lost. Then, the cerebellum, that is to say the equilibrium of the movements of locomotion; then, the spinal marrow, or the principles of sensation and of movement; and, lastly the medulla oblongata survives alone in its action. It is on this account that life still continues." (11)

M. Flourans then states that he repeated his experiments using the agents hydrochloric and nitric ethers which differed from sulphuric ether only

(11) op. cit.

in the rapidity with which they produced their results. Alcohol, he states, when inhaled is only successful in inebriating the subject, but not in satisfactorily abolishing either the sensations or the motions. He then ends with the warning "that it will be necessary for the surgeon to have constantly in mind that the ether which drives away pain can also drive away life."

Some of the experiments reported were theatrical but offered little new. One report from Montreal consisted of administering ether to a dog until it was rendered unconscious. (38) The ear was then severed with no evidence of pain sensation. At the same time an incision was made extending from one hind leg up the back to the neck, and then half of the skin of the body was removed. Later, after the dog had recovered, the remaining ear was removed with much evidence of pain.

Another dog was "skinned alive", the quivering flesh seared with a white hot poker, deep incisions made in the back, a leg severed excepting for arteries and nerves, a cruciate incision made in the abdomen, the intestines cut, the thorax laid open, and ribs broken - without any evidence of pain sensation. Then the animal was allowed to recover sufficiently so that he began to lick his wounds. Following this it was strangled. (38)

Other men used themselves as subjects and recorded the effects, subjective and objective, upon their bodies as they inhaled. In this way accurate and immediate knowledge of the progress of early anesthesia was gotten. I have in mind a quotation from the writings of a M. Gerdy of France telling of his sensations as he administered sulphuric ether to himself.

(38) Nelson, Horace, "Experiments with the sulphuric ether vapor." The Boston Medical and Surgical Journal 36:401-402 June 16, 1847.

(38) id.

"I submitted myself to the inspiration of air charged with ether. The sensations which experienced in the throat caused me at first to cough, but being resolved to resist this, I readily triumphed over so petty an obstacle. The prickling and cough gradually ceased. From this moment I experienced a sensation of numbness with heat, as if alcoholic and inebriated vapor were mounting to the brain. This numbness spread itself quickly. Commencing in the feet and toes, it extended to the limbs and at the same time to the loins etc. It increased rapidly at each inspiration. It was accompanied in the sensible organs by a feeling of agreeable heat, by a sensation of vibration similar to that which we experience on touching a vibrating body. These impressions, when they have arrived at their acme, produce an obtuse impression very agreeable and full of voluptuousness, an impression analogous to that of intoxication. The numbness caused by ether is similar to that which arises from hydrochlorate of morphia or opium. It is this numbness which, blunting the general susceptibility, diminishes pain during operations.

"Sight is not sensibly affected by the numbness, for I read some philosophical signs by a feeble light, at a moment when I was powerfully benumbed. Hearing was more altered; it became less and less distinct as the inebriety augmented, and became more and more clear and distinct as this disappeared. In truth it was easy to believe that the noises were growing more and more obscure because they were becoming more distant, and that they afterwards became clearer because they approached. Notwithstanding this, the more profound the numbness, the greater resonance produced by sound; but this intensity did not render it more clear. I am well assured that the senses of smell, of taste, of tact properly so-called, were not paralyzed by the general numbness which I experienced, but I felt the eyelids were heavy, a desire for sleep, and above all a wish to abandon myself to the delights with which I was infatuated. However, either because these phenomena had reached their greatest degree of their development, or because I wished to observe myself until the last moment, I would not yield to the seductions which enticed me, and did not fall asleep. I continued to study myself, and as I examined my sensations I directed my attention to my intellectual function. I remarked then that with the exception of the vibratory sensation of numbness, which rendered my general tactile and pain obtuse, with the exception of the ringing in the ear which prevented my distinguishing perfectly what I heard, my perceptions and thoughts were very clear, and my intelligence perfectly free. My attention was also very active, my will firm, so firm that I willed to walk and I walked that I might observe the state of my locomotive powers. I then discovered that my muscles were a little less sure and precise in their movements, somewhat similar to those of a person slightly intoxicated, or who is at least rendered giddy by alcoholic drink. With the exception of pronunciation, which was embarrassed and slow, the other functions of the animal economy did not seem to be sensibly altered. My pulse, examined at the moment when I was most benumbed presented no marked change from a healthy standard." (11)

(11) op. cit.

These were the reports of experimental results, for the most part carried out in the strange and bewildering world of the laboratory. A greater number of articles cited many series of cases attesting to the successful use of ether in the offices of dentists or physicians, - and in the hospitals.

Dentists, because the patent holder was one, became the first agents, and early reports, although scant, came from such individuals. Many were the reports of successful tooth extractions and of cases in which the agent - dentist had acted as anesthetist for operations. One rather amusing report told of a woman who needed to have her remaining teeth pulled and was dreading the prospect. Upon being told that this could be done painlessly with the use of "letheon" she decided, in desperation I imagine, to try it. The next morning when the dentist arrived at her residence he found six or eight of her friends gathered to witness the procedure. Among them were one or two physicians. The ether was administered and nine teeth were extracted. The patient was then allowed to recover. Her first remark was "one of regret that she had gone through all the necessary preparation and that not a single tooth had been taken out". One half hour later the patient was again anesthetized and the remaining eight teeth removed. Immediately afterwards the patient and the witnesses, including the physicians present, were well satisfied as to the success of the "letheon". (32)

It is from amidst the case reports appearing in the Boston Medical and Surgical Journal that bits of further information are to be found.

(32) Kimball, Horace, "Use of Letheon - seventeen teeth extracted." The Boston Medical and Surgical Journal 35:489-490 Jan. 13, 1847.

Case after case was published attesting to the successful use of ether. Arms, legs, thighs, and digits were reported painlessly removed. Superficial tumors of the neck, arm, chest, jaw, and thigh disappeared as the patient dreamed whereas pain and terror had been the usual accompaniments of extraction. As a typical case report I cite the removal of a tumor, which covered nearly the half of the front of the right thigh.

The patient lying upon a bed, the vapor was administered by Dr. Morton in the presence of Drs. Charles T. Jackson, Reynolds, J.V.C. Smith, Flagg, Gould, Shurtleff, Lawrence, Briggs, Parsons, and others. After he had breathed the vapor for three minutes his head fell - he appeared insensible. The operation was then commenced. At the first stroke of the knife he clapped his hand on the wound, but I immediately seized and held it during the remainder of the operation, though not without some difficulty in consequences of his struggles. The operation was completed in two or three minutes, and the patient remained quietly on his back with his eyes closed. On examination the pupils were found to be dilated; the pulse was not materially affected. After he had lain for about two minutes I roused him by the inquiry, "How do you do today?" to which he replied, "very well thank you" - He said he believed he had been dreaming. - "Do you feel any pain?" "No." - I then inquired if he had felt any pain during the operation, to which he replied in the negative. He soon recovered his natural state, experienced no inconvenience from the inhalation, was remarkably free from pain, and in three days went home into the country. (55)

During the observing of these cases to be reported one can note that the clinical signs produced were being recorded. In one "instance the respirations of the letheon produced obvious narcotism, attended with a pulse of 130, dilated pupils, stertorous breathing, and a suffused countenance, red eyes etc., with a convulsive tremor of the limbs, ending in muscular relaxation when the full effect was induced." (34)

(55) Warren, John C., "Inhalation of ethereal vapor for the prevention of pain in surgical operations." The Boston Medical and Surgical Journal 35:375-379 Dec. 9, 1846.

(34) "Letheon in New York." The Boston Medical and Surgical Journal 35:520-522 Jan. 20, 1847.

From the time it first appeared upon the medical scene it was urged that due to the apparent violent reactions and profound effects that it produced ether should never be used in the minor surgical procedures such as tooth extractions in the fear that more than a reasonable amount of harm might be done in the process. In major operations a different situation existed. Alleviation of pain and reduction of muscle spasm were necessary and because of this it was recommended to use ether. Rapidly tentative rules of indications for use were set up. It was suggested that ether should never be administered to children or the aged. Individuals of nervous excitability were to be warned against use. It was suggested that persons predisposed to paralysis, convulsions, or other nervous diseases should not be allowed to inhale the vapor. Vascular congestions of the vital organs, especially the brain, were termed conditions making use hazardous. In addition, only with "one who is assured of possessing sound lungs and general good health, could ether be employed safely." (34)

Reports soon indicated some of the possible unfortunate effects of ether or of the ineffectiveness of the substance. Some suggested that the use of ether prevented prompt and natural healing. Cases were reported of possible deaths due to the new agent. Among the first of the possible accidents and accompaniments of ether inhalation observed was an instance in which respiratory obstruction and cyanosis were noted. Describing the patient, "his breathing was once or twice laborious, the abdomen heaving a good deal, but withdrawal of the tube from his mouth quickly removed this state. His

(34) Op. cit.

face, and even the whole surface of the skin, was somewhat purple most of the time." (49) In this same article an instance was cited of a chronic alcoholic who was not affected by ether inhalation and experienced much pain; the possible cause was ascribed to his habits.

The better case reports which appeared were those telling of the use of ether in obstetrics. Ether was quickly put into use in this field to reduce the pain and discomfort associated with labor. It was reported that ether actually helped in the use of forceps, for it produced a relaxation of the perineal muscles. On the other hand others maintained that no appreciable diminution in the force or frequency of uterine contractions was produced. A case was cited to show that the use of ether made the performance of craniotomy for hydrocephalus simply and easily done. (14) Many were the women who attested to the analgesia and the amnesia resulting from the use of ether during labor - A case of the successful use of ether in the stopping of eclamptic convulsions was briefly reported.

"I have recently used ether in a case of puerperal convulsions previous to delivery. Mrs. M. - aged 46 years, seven months advanced first pregnancy, of firm health, was attacked at 12 o'clock, night, without any previous warning, with convulsions. They were of the epileptic character, and recurred very frequently with scarcely any parturient effort; - indeed it was a question whether pregnancy existed or not. At 10 A.M. I applied the ether on a warm sponge, until she had inhaled an ounce. She had no more convulsions, the parturient effort increased regularly, and at 1 P.M. she was safely delivered of a dead foetus. She had been wholly unconscious from the first fit, and so continued for two days subsequent to delivery." (13)

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- (49) "The Letheon at St. Bartholomews Hospital." The Boston Medical and Surgical Journal 36:268 April 28, 1847.
- (14) Channing, W., "A case of inhalation of ether in instrumental labor." The Boston Medical and Surgical Journal 36:313-318 May 19, 1847.
- (13) C.J., "Use of ether in midwifery." The Boston Medical and Surgical Journal 38:198-199 April 5, 1848.

All was not entirely well for the use of ether in obstetrics, however, for besides the strong and effective moral argument against the use of the substance on the basis that it reduced natural pains that God and nature had intended should be, there were more tangible possible contra-indicants proposed. From Paris came a statement that there was an increased incidence of puerperal fever following the use of ether. Post-partum hemorrhage was said to be increased with the use of ether. When ether was used over a prolonged period physicians noted that the breath of the newborns had an ether odor; at least one case of difficulty in initiating breathing was reported. There were no fatal results reported due to the last mentioned objection, however, and to counteract statements of this kind statistical reports were published to show that infant and maternal mortality were actually decreased when ether was used. Here is a short report.

According to Dr. Churchill's estimate, the mortality of the children in breech presentations, after making allowances for causes which may have influenced the result, is 1 in $3 \frac{1}{3}$. In forceps cases, it is 1 in every 4 or 5. In case of turning, the mortality of the mothers is 1 in 15, of the children rather less than 1 in 3. Among these cases which I have related, one of the children was delivered in turning, three by forceps, and one was a breech presentation. In these five cases the mothers and children did well. (46)

At this early time cases were reported of successful use of this new plaything in every conceivable condition, but, those instances in which ether was used for the relief of spastic conditions were in the majority. Convulsions in children and colics of all kinds were successfully treated. One of the most amusing was the report of the successful treatment of delirium tremens in a robust Irishman who, after the first ten minutes trial immediately jumped up and began to rave all over again when the mask was removed. (50)

(46) Putnam, C.G., "On etherization in labor." The Boston Medical and Surgical Journal 38:9-11 Feb. 2, 1848.

(50) Upham, J.B., "Case of delirium tremens." The Boston Medical and Surgical Journal 36:518-519 July 28, 1847.

Success. Success was the undeniable result shown in these reports. Immediately three men, each with his corp of champions, carried on a violent quarrel in an attempt to gain official recognition as "the discoverer". Dr. Charles T. Jackson, Dr. William T.G. Morton, and Dr. Horace Wells. Each tried to have his name entered alone and above all others. Little did they know that the rightful credit was eventually due to Dr. Crawford W. Long, a country practitioner, as the first user of ether as an anesthetic agent in an operation, and who had done this very thing in 1842, but who had given no publicity to his discovery. To Dr. Horace Wells is conceded the first practical use of nitrous oxide, -- and that is all. The New Englanders had no knowledge of Dr. Long's existence and carried on a bitter battle both at home and abroad.

Of these three contenders Dr. Morton was in the best position. His name was mentioned supreme in both the initial paper appearing in the Boston Medical and Surgical Journal on November 18, 1846 and in the original summarizing article appearing in England. Because of this there was not any argument between him and Dr. Jackson as to who was the first administrator of the patented "letheon". Rather it was this; had Dr. Morton, as an independent investigator successfully followed through on the suggestion of a substance by Dr. Charles T. Jackson, or, had he been but the servant of Dr. Jackson following his master's orders? Regardless, it was true that the discovery was firmly associated with Dr. Morton's name and it remained for others to upset him from his questionable point of vantage. As we have progressed with our story the arguments used by Dr. Morton have been given in the main. There is one bit more of evidence for him not already mentioned that might well be included. It appeared in an article by Dr. John C. Warren in December 1846.

"Two or three days after these occurrences, on meeting Dr. Charles T. Jackson, distinguished for his philosophical spirit of inquiry, as well as for his geological and chemical science, this gentleman informed me that he first suggested to Dr. Morton the inspiration of ether, as a means of preventing the pain of operations on the teeth. He did not claim the invention of the apparatus, nor its practical application; for these we are indebted to Mr. Morton." (55)

The great champion of Dr. Morton was Edward Warren. He wrote several articles presenting evidence in the dentist's favor and refuting accusations made against him. In one article is a notation of Dr. Wells' claim that in 1844 he (Dr. Wells), Dr. Morton, and Dr. Jackson had had a conference in which some suggestions had been made concerning ether which had eventuated in the discovery of 1846. The author quotes Dr. Jackson as having made this statement; "I wish to state in my behalf to Mr. Dixon that Dr. Wells never said a word to me about the use of sulphuric ether or other ether vapor, not even mentioned the word ether in my presence." (52)

Dr. Wells, in laying claim to the discovery of ether stated that Dr. Morton's discovery was identical with his own and that he had disclosed this to Dr. J.C. Warren among others. Here is Dr. Warren's published answer to the claim:

Boston, January 6th, 1847.

"I hereby declare and certify, to the best of my knowledge and recollection, that I have never heard of the use of sulphuric ether, by inhalation as a means of preventing the pain of surgical operations until it was suggested by Dr. W.T.G. Morton in the latter part of October, 1846.

John C. Warren

(54) Professor of Anatomy and Surgeon in the Mass. Gen. H."

(55) op. cit.

(52) Warren, Edward, "Ethereal inhalation - Dr. Wells' claims-an discoverer." The Boston Medical and Surgical Journal 36:322-323 May 19, 1847.

(54) Warren, Edward, "The Letheon and Dr. Wells." The Boston Medical and Surgical Journal 36:260-263 April 28, 1847

The case rests for the claims of Dr. W.T.G. Morton.

Dr. M. Gay was the chief proponent of Dr. Charles T. Jackson as discoverer of ether inhalation to produce anesthesia, and the course pursued by the distinguished gentleman himself was that of an extreme and apparent modesty becoming to a professor of chemistry. "Dr. Gay shows, by testimony of Mr. Bemis, a most distinguished dentist of this city, that Dr. Jackson had conceived the plan of prevention pain in surgical operations by some direct and new agent, as long ago as the year 1842. Mr. B. remembers and testifies, also, to a remark made by Dr. Jackson at that time that he had tried this agent successfully upon himself after some accident, and he had no doubt that sulphuric ether was the means referred to. - "Dr. Wm. F. Channing - states that he had on several occasions heard Dr. J. speak of the inhalation of sulphuric ether - and that his impression is very strong that the earliest communication on this subject was in the year 1842, Dr. C. being on a geological survey with Dr. Jackson when the above remarks were made to Mr. Bemis." "Another point that is dwelt upon by Dr. Gay is Dr. Jackson's use of the sulphuric ether to relieve the very urgent pain which he experienced after an accidental inhalation of chlorine gas - the insensibility to the painful effects of the chlorine coming on, according to Dr. Gay, before the unconsciousness and continuing for some time after it had passed off." He concludes that "for this experiment under such circumstances and for having discovered the laws of the insensibility or unconsciousness which is produced by the inhalation of sulphuric ether as a matter of science and independently of its application to surgery, Dr. Jackson is entitled to the highest credit." (30)

(30) Jackson, J.B.S., "A review of Dr. Gay's statement of Dr. Charles T. Jackson's claims to the discovery of the inhalation of sulphuric ether, as a preventive of pain." The Boston Medical and Surgical Journal 36:429-434 June 30, 1847.

Other evidence brought forth attempted to show that Dr. Morton's part was merely that of an obedient follower carrying out the orders of his leader. "When Dr. Morton called at his (Dr. J.) laboratory last September (1836) to borrow a gas bag, this he intended he said to fill with atmospheric air and giving it to a patient to inhale, he hoped thus to act upon her imagination and induce her to submit to the extraction of a tooth. Dr. J. dissuaded him from this attempt, and, after some conversation communicated to him his ideas in regard to the ether. Mr. Morton was evidently ignorant of the article. - The credit to which he is really entitled is that of faithfully performing, according to his instructions, a mechanical part of an experiment of Doctor Jackson's; 'for' he had become convinced by experiments and reflection upon the subject that the inhalation of ether would render one insensible to pain. - He (Dr. J.) had induced a dentist of this city to use it, and that the result was as all the world knows it to have been." (30)

The most aggressive and the most active participant in this useless controversy was Dr. Horace Wells a dentist of Hartford Connecticut. More articles appeared as evidence for his claim than for either of the other two men - from himself; from his proponents; and even from the camp of his enemies. His claims for the discovery of the use of nitrous oxide are readily substantiated, but those for ether are meager. Edward Warren in an article refutes Dr. Wells' claims to the discovery of ether by disparagingly giving him credit for using this gas (nitrous oxide).

(30) op. cit.

"Dr. Wells has much to say about his visit to Boston in December, 1844, whither he came for the purpose of having his favorite gas tested by our surgeons. It seems that they kindly gave him an opportunity to make the trial in which he was entirely unsuccessful; surgeons, students, and all pronounced his pretended discovery a failure and a humbug - he returned home and has not from that day to this, so far as the public are informed, resumed the use of nitrous oxide gas." (54)

Dr. Wells took the controversy to his heart and his whole life was wrapped in it. He wrote numerous letters testifying for himself and his is the most direct evidence we have. In June 1847 he wrote a letter to the Boston Medical and Surgical Journal attempting to explain his position.

Sir - "I again ask your forbearance while I say a few more words respecting the ethereal controversy. In my last communication one point was left unnoticed through inadvertence. It had been stated in a previous No. of this Journal that Dr. Bennet's letter in the London Lancet says that I left America for Europe before Drs. Jackson and Morton had laid claim to the discovery. Of itself, this mistake is of no importance; but as my opponents are inclined to "catch straws" I will for their sakes explain how Dr. Bennet became wrongly impressed. When in London, I informed Dr. Bennet that I was not aware that Drs. Jackson and Morton had made claim to the discovery in Europe until I arrived there, he understanding me (as since appears) that I was not aware that they had claimed the discovery in this country.

Mr. Warren, who had been employed by Dr. Morton to vindicate his cause, seems inclined to misrepresent my sayings and doings in every possible manner. In his pamphlet just published, he affirms that I have made a variety of statements respecting the number of patients on whom I have operated with the use of the gas. I will quote a few words of this pamphlet. - 'When Dr. Wells first laid claim to this discovery, he stated that he had performed ten or twelve operations under the effects of nitrous oxide gas, soon, however, the number had increased to fifteen or twenty; next, it went up higher, and after reaching the intermediate stages, is finally set down in the London Lancet at fifty.' Now Mr. Warren professes to be a gentleman of honor. This being the case, I will explain the mystery and seeming contradiction in the above quotation for his special benefit, that his modus operandi in this controversy may be known and duly appreciated. Whenever I have specified any number of patients on whom I have operated with the gas, the date has also been given. As, for instance, in my communication where ten or twelve are named I also stated that this was done in November 1844; and where fifteen or twenty are given, I stated that this was the number prior to January 1845; and where

(54) op.cit.

fifty are given, it embraced the whole time up to the present. Now for some reason Mr. Warren sees fit to leave out my dates entirely, and write the passage above quoted; and he seems to have adopted this policy throughout the whole controversy. If he can gain any vantage ground by such means, he is entirely welcome to it.

Hartford, June 11, 1847

Respectfully, Horace Wells. (56)

Dr. Gay, in an article defending Dr. Jackson partially conceded Dr. Wells some part in the event of discovery. He stated "that gentleman (Wells) was undoubtedly, according to his statement, on the very verge of making the grand discovery, and even went so far, in Nov. 1844 as to use sulphuric ether in a case of a surgical operation; but, although he does not say so, the experiment must have been unsuccessful, as he was advised, in preference to this to continue the use of nitrous oxide with which he had previously been operating with some success as a dentist. "Then" Dr. Gay alludes to Sir Davy's having suggested the use of this (N_2O) gas in small operations, and he refers to a case in which it was also tried several years since, by some Cambridge students, the result being such as might have been expected; this gas from the violent effect which it often produces is totally unfit for surgical purposes." (30)

Dr. Wells wrote another long letter to the Boston Medical and Surgical Journal, too long to quote; it contained the petty bickering for fame which at that time the controversy had become. In addition Dr. Wells found many champions in and near Hartford Connecticut. Mr. P. W. Ellsworth wrote a letter attesting to the witnessing of the administering of nitrous oxide gas in tooth extractions, and testifying further that there had been a debate, as early as 1844, as to whether ether or nitrous oxide should be used. At this time ether had been discarded because of its unpleasant odor and the choking and irritation it produced. These same claims were substantiated by Dr. E. E. Marcy also of Hartford in the letter he wrote to the Journal.

(56) Wells, Horace. Letter from Dr. Wells. The Boston Medical and Surgical Journal. 36:421,422 June 23, 1847

(30) op. cit.

Lastly, as evidence for the claims of Dr. Wells there appeared a series of certified statements from layman and physician alike attesting to Dr. Wells' use of nitrous oxide and establishing his right to be called the discoverer of nitrous oxide inhalation anesthesia, but helping in no way his claims as discoverer of the use of sulphuric ether. I in turn present the statements for what they were and are today worth in establishing Dr. Wells' claims as the first successful user of nitrous oxide gas as an inhalation agent for the reduction of pain in surgical procedures.

First, from F. C. Goodrich, Hartford:

This may certify, that during the fall or early part of winter of 1844 (I am not positive as to the precise time), I was induced to try the experiment of having a tooth extracted while under the influence of nitrous oxide gas, which was performed by Dr. H. Wells, dentist of this city. Dr. E. E. Marcy of this city was present during the operation and suggested to Dr. Wells at that time the inhalation of pure sulphuric ether vapor, in preference to the nitrous oxide gas. The propriety of using pure sulphuric ether, the nature of the effects upon the system, were discussed at length between Dr. Marcy and Dr. Wells in my hearing. Dr. Marcy was very sanguine in his opinion of its effects upon the system, its capability of rendering it insensible to pain under severe surgical operation which he expected to perform in a few days. I make this statement, not because I wish to come before the public in connection with this discovery, but because facts identify me with it. I had much rather remain silent than have my name in any way connected with the subject under controversy; but it is an act of justice due to the parties that I should make public this fact.

Hartford, Conn. July 6th, 1847

(signed) F. C. Goodrich

State of Connecticut) Hartford, July 6th, 1847

Hartford County)

"Then personally came before me the above named F. C. Goodrich and made solemn affirmation to the truth of the facts above stated by him.

(Signed) Benning Mann, Justice of the Peace. (37)

Second, from S. Fuller M.D.

I hereby certify that Horace Wells, dentist, has for more than two years, had the reputation in this city of having made a discovery which enabled him and others to extract teeth without pain, by the use of exhilarating gas. I have conversed with several gentlemen whose reputation of honor and

(37) Marcy, E.E. Inhalation of ether to prevent pain. The Boston Medical and Surgical Journal. 36:495-497, July 21, 1847.

veracity places them above suspicion, who have had these operations performed by the said Dr. Wells in the Fall of 1844; and they assure me that the operation was attended with no pain whatsoever, There is no doubt in my mind that said Wells discovered and made the first practical application of this principle in surgical operations. By comparing dates of the several claimants, there can remain no doubt of this fact.

Hartford, Conn., March 25th, 1847.

S. Fuller M.D. (31)

Third, from G. B. Hawley, M.D.

This is to certify that during the last two or three years I have been familiar with the successful operations of Dr. Horace Wells and other dentists of this city in extracting teeth without pain by the aid of nitrous oxide gas, and he alone was regarded as the author of this discovery.

Hartford, March 27th, 1847.

G. B. Hawley, M.D. (31)

Lastly, from John M. Riggs, M.D.

I, John M. Riggs, surgeon-dentist of the city and county of Hartford, State of Connecticut, in the United States of America, being of lawful age and duly sworn, do depose and say,-- that on or about the 1st of Nov. 1844, I was consulted by Horace Wells, surgeon-dentist of the city and county as aforesaid, as to the practicability of administering nitrous oxide gas prior to the performance of surgical or dental operations. Thinking favorably of the suggestion, it was decided to make trial of the gas in question; and on the following day, per agreement, the protoxide of nitrogen was administered to Horace Wells aforesaid at his request and I extracted one of his superior molar teeth, he manifested no signs of suffering and stating that he felt no pain during the operation. Encouraged and gratified with the success of the first experiment, the aforesaid Wells and myself continued to administer to various individuals the said gas and extract teeth whilst under its influence, in the presence of several gentlemen, until fully satisfied of its usefulness and applicability in surgical operations. I furthermore affirm that the said Dr. Wells avowed his intention to communicate the discovery to the dental and medical faculty, and in pursuance of that intention, proceeded to the city of Boston, State of Massachusetts, for that purpose; whilst I continued to use the said gas with great success, the patients assuring me they felt no pain.

Hartford, March, 1847.

John M. Riggs. (31)

In May, 1848 we are informed of the death of Horace Wells in an article written by an unknown champion of his cause, signing "Justitia". Even after his death his fight for recognition was carried on by his friends and those who believed in him. In this last article, telling of his death the final argument forwarded was that "it is the principle that such a degree of

(31) Justitia. The discovery of etherization. The Boston Medical and Surgical Journal. 38:322-326. May 17, 1848.

insensibility may be safely produced by inhaling certain substances, that surgical operations may be safely performed during the continuance of that state" to which Dr. Horace Wells is entitled and for which he should be given credit for having discovered the fact of inhalation anesthesia.

" The story of the development of anesthesia now presents many interesting contrasts, from the calm satisfaction of what was considered modest achievement to the insanity and morbid ill health occasioned by greed and disappointed egotism. The lives of Crawford W. Long (1815-1878), Horace Wells (1815-1848), and William T.G. Morton (1819-1868), all to be credited more or less with the discovery of real surgical anesthesia, are filled with such human and emotional appeal as to make the story of anesthesia one of the most interesting in the development of the sciences." (33)

In 1845, when Dr. Wells went to Boston to demonstrate his new procedure, apparently the inhaler was removed too soon and the patient gave a cry of pain, bringing swift disapproval. Dr. W.T.G. Morton was present as a witness at this unsuccessful demonstration. " Wells returned in shame under the rebuke of being called an imposter. He continued to give the gas (nitrous oxide) in private, but brooding over his failure drove him insane; He committed suicide in 1848." (33)

Dr. Crawford W. Long did not publish or publicize his discovery made in 1842. Had he done so he might, unknowingly, have prevented the tragic events which occurred in Boston during the years following 1846. " Morton

(33) Leake, Chauncey D. History and development of Surgical Anesthesia. U of W. 1925.

became increasingly agitated in his attempts to push his claims for financial and honorable reward and died in 1868 in New York city from apoplexy induced by a bit of anger over Jackson's claims. ----- While Long lived in peace and happiness until 1878." (33)

In every event of this kind there are two necessary elements; the first is the discovery itself; and the second, is the publicizing of the discovery which brings it into general use. Often these two elements are contained in one and the same person, but frequently, as in this instance, they are not. Dr. Crawford W. Long is the discoverer; yet of what use was this discovery to the world when it was used only locally? These workers in New England certainly deserve recognition as the true worldly discoverers, for " if some hunter up of obsolete theories should prove that such a thing had before been thought of, or tried, still these gentlemen are entitled to the credit of having made it, for the first time, perfectly available to the suffering, and submitted it to the test of those competent to decide on its merits without being content to rest its pretensions on non-professional credulity or popular notoriety." (43)

(33) op.cit.

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DATE

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