THE CONTROVERSIAL OPINIONS OF PRESENT DAY INVESTIGATORS IN RESPECT TO THE PROTECTION AFFORDED BY PRIMARY TUBERCULOSIS AGAINST CONSUMPTION

by

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In undertaking a discussion of this nature, it is well to preface the main subject with definitions of the two diseases to be considered. For this classification it is believed that the one given by Dr. J. Arthur Myers[1] is acceptable to most all investigators and is as follows:

1. The childhood or primary type of tuberculosis is often developed in children, but may occur at any time in life, providing that the individual has not been infected previously with tubercle bacilli. "Childhood" type then follows first infection, while the "adult" type or consumption follows reinfection, since the latter is usually seen in adults although it may occur in children.

2. The first infection type may be found in any part of the lung, while consumption usually occurs first in the area of the apex, frequently just below the clavicle.

3. In primary infection, the hilum and tracheobronchial lymph nodes are involved early, while in the reinfection type these nodes are not frequently involved.

4. In "childhood" tuberculosis, both in the lung and parenchyma and in the regional lymph nodes, the lesions usually become caseous and later calcified.

> In this type cavitation is rare, and there is little tendency to fibrosis. Whereas in "adult" tuberculosis there is a marked tendency for caseous lesions to become excavated and for fibrous tissue to occur.

Since the oldest and most common opinion among tuberculosis workers is that primary tuberculosis affords protection against consumption by virtue of the development of immunity, let us consider first the opinions of those investigators who uphold this belief. Then, by way of refutation, let us follow with investigations of equally outstanding men who are of the opposite opinion.

Of all the investigators who adhere to the older opinion, Calmette is probably the most outstanding. It is his opinion that the establishment of a small, non-progressive tuberculous focus in the body develops a certain degree of immunity against a subsequent infection.[2] Since it is obvious that the dosage of a spontaneous infection in childhood cannot be controlled, it is his belief that the employment of an organism of fixed characteristics producing a non-progressive disease may be ideal as a vaccine. Calmette claims that his culture, known as Bacillus Calmette-Guerin, (B.C.G.) is most suitable for this purpose, since when it is inoculated into babies it establishes a non-progressive focus in the lymph nodes, thus producing immunity.

This Bacillus Calmette-Guerin vaccine resulted from the isolation, by these two men, of a tubercle bacillus from a calf in 1908.

After five years of cultivation on a glycerin-potato-bile medium devised by these investigators, it lost its pathogenicity for all laboratory animals.[3]

Since 1924 Calmette has been giving this vaccine, orally, to newborn infants. He gives three doses, each consisting of one centigram of fresh vaccine, given one-half hour before feeding, and repeated at forty eight hour intervals. He claims that within a few weeks or months after this vaccination the infant will react to tuberculin. That is, he will develop an allergic reaction. But this reaction, Calmette believes, is not indispensable for the establishment of an immunity to reinfection, since the allergic reaction is dependent on the development of a few giant cells, which are reabsorbed and soon disappear without leaving any trace. A tuberculin allergic reaction, then, according to Calmette, is not essential to the establishment of immunity. However, when this skin reaction is present it does indicate immunity. Further, it is Calmette's opinion that this allergic reaction should be provoked in children of all ages and in adults when it is not present and when its absence can not be explained by some physiological or pathological reason. To induce this reaction B.C.G. should be employed subcutaneously in one inoculation, with 1/40 to 1/20 mgm. (depending on age) and only in those in whom the absence of allergy is demonstrated by negative Pirquet, or some other intracutaneous procedure, after two tests given at weekly intervals. He believes that such vaccination should doubtless reduce the ravages of tuberculosis in the near future.[4]

In supporting his employment of Bacillus-Calmette-Guerin

vaccine on new born infants, Calmette states that statistics show that the mortality from all causes among the non-vaccinated children (birth to four years) was 21.4 per cent (of which 15.9 per cent were tuberculous) while the mortality from all causes among vaccinated children was only 11.9 per cent (of which 3.4 per cent were tuberculous). These figures were obtained from 2,368 vaccinated and 4,854 non-vaccinated children from one to four years of age, all born and brought up in tuberculous surroundings. Calmette states further that statistics reveal that when Bacillus-Calmette-Guerin vaccine has been given systematically over a period of years, as has been done in certain French and Rumanian cities, the general mortality will diminish to about one-half and sometimes to two-thirds. In France, alone, 132,000 children have been vaccinated from July 1924 to January 1929. In no instance, he claims, has a deleterious effect been noted following its use.[5]

S. A. Petroff,[6] who has done considerable research on the biological characteristics of a strain of Bacillus-Calmette-Guerin vaccine, claims that in a series of guinea pigs which he inoculated with the Calmette vaccine he found that a small number of the animals developed progressive tuberculosis. With second and third cultures, he observed typical progressive tuberculosis in about two per cent of the guinea pigs which had been inoculated subcutaneously or intraperitoneally. He explained the virulence of the Bacillus-Calmette-Guerin organism in some of the animals on the basis of "bacterial dissociation", by which he claims that in almost every bacterial culture there are found variants - one which is called the S and the other is called the R. The former is

non-pathogenic while the latter produces fatal disease. Petroff claims to have been able to dissociate thesd two types of colonies from Bacillus-Calmette-Guerin cultures. He calls to one's attention the fact that other investigators, such as Medlar-Sasano, Dreyer, Hans Mich, Hormaeche, Korschun, Hutyra and Watson have increased the virulence of Bacillus-Calmette-Guerin by various methods.

Petroff recalls the Lubeck disaster which followed the vaccination of 248 babies with Calmette's vaccine, of whom 78 died of tuberculosis. Although those who endorse this type of vaccination immediately concluded that contamination with virulent human type organisms must have been responsible for the deaths, Petroff goes on at length to show that such contamination was very improbable.

In refuting Calmette's statistics Petroff claims that although in France, alone, hundreds of thousands of babies have been vaccinated by his method, there are records of only 6,820 whom he claims have not been carefully observed. He further states that investigators have found that only approximately six per cent of those who received Bacillus-Calmette-Guerin developed skin hypersensitiveness. Therefore, he concludes, if skin allergy has something to do with or is closely related to immunity then Calmette's method seems to be efficient in only six per cent of the children.

Petroff also claims that the vaccinated babies were selected cases, that the ignorant would not permit such experiments. The vaccinated babies were isolated for from four to six weeks thus preventing

exogenous infection and allowing for the development of natural resistance. Such was not the case with the controls who were not isolated and who came in contact with infection from their parents long before they developed normal resistance.

In conclusion Petroff states:[7]

> "There is not an iota of scientific evidence to show that babies vaccinated with bacillu-Calmette-Guerin will not in time develop clinical tuberculosis. No living organism is stable; today it may be non-virulent but after passing through a suitable environment it may regain its virulence and in time become a menace to the person who has been vaccinated. A low level of acquired resistance obtained by the implantation of living micro-organisms is all that we can expect. Shall we pay the price for such a resistance by infecting the whole human race?"

Calmette explains Petroff's results with his guinea pig inoculations were due probably to a source of error, in that spontaneous tuberculosis may have developed in their guinea pigs since they were in a locality where tubercle bacilli are widespread.[8] Calmette states further that Petroff's results are not in accord with the numerous experiments carried on at the Pasteur Institute of Paris, the Robert Koch Institute of Berlin, by R. Krause and Gerlach of Vienna, by A. Ascoli in Milan, by Zlatogoraff and Tzeknowitzer at Kharkoff, by Silbersmith in Zurich, by Lyle S. Cummins at Cardiff and C. Chagas of Rio de Janeiro. In

none of these laboratories has any observer reported upon the development of fatal tuberculosis in an animal inoculated with the Bacillus-Calmette-Guerin strain.

Also, contrary to Petroff's conclusions, Calmette says that no one has been able to augment the virulence of the Bacillus-Calmette-Guerin either by successive passage in susceptible animals, by testicular inoculation in guinea pigs, by reducing the vitamins in animals, by producing an intoxication or infection by bacterial toxins or mineral poisons, or by an added bacterial poison.

In conclusion Calmette says:[9]

> "We do not feel that we are going beyond the limit of prudence in suggesting that the Bacillus-Calmette-Guerin vaccine should be extensively employed especially when dealing with infants born or brought up in suspected or in tuberculous families. The vast experience already gained should justify this opinion."

Let us now leave this particular conflict of opinions and consider the investigations of another oustanding tuberculosis worker, who, like Calmette, adheres to the older opinion, and whose investigations have shown the following:

1. The approximate incidence of primary tuberculosis among young adults.
2. The great dangers nurses encounter while caring

for tuberculosis patients, and

3. Corroboration of Calmette's argument for the use of Bacillus-Calmette-Guerin vaccine.

This investigator is Johannes Heimbeck of Oslo, Norway, who has made an extensive study of tuberculosis among nurses. Heimbeck reports[10] that this work was begun in 1924 by Dr. Olaf Scheel. The plan was to obtain Pirquet tests from the newly admitted probationers and to keep them under observation thereafter.

The observations were carried on in the Ulleval Hospital, municipal hospital in Oslo, containing about 1500 beds of which approximately 300 are for tuberculosis patients most of whom are advanced cases of pulmonary tuberculosis. Heimbeck, therefore, points out the ample opportunities for the student nurses to become infected with tuberculosis.

The observations were recorded separately for each year since 1924. The results for the first three years show the following:

1. One-half of these women 21 years of age, two-thirds of whom came from towns and one-third from the country, gave a positive Pirquet reaction and this fact has been confirmed year after year.
2. Overwhelming morbidity of tuberculosis among those who first gave a negative Pirquet reaction, and the slight morbidity among those who had a positive Pirquet to start with.

Among the probationers of 1924, 17 of the 51 who started with a negative Pirquet reaction eventually contracted the disease while there was only one case among the 58 starting with a positive reaction. In the class of 1925 there were 21 cases among the 72 giving a negative reaction and one case among the 42 giving a positive reaction. In the class of 1926, 15 cases occurred among the 62 with an initial negative reaction and one case developed among the 52 with an initial positive reaction. All these nurses were thoroughly examined when they entered the hospital and were found to be healthy, thus differing from each other only in their Pirquet reaction.

Of all the tuberculosis diseases in all the year groups from 1924 to 1930, inclusively, there were 81 cases, 10 being among the 372 nurses originally giving a positive reaction, and 71 being among those first giving a negative Pirquet reaction.

Heimbeck maintains, therefore, that the conclusion to be drawn from the fate of the nurses who started with a positive reaction is that these nurses exhibited a minimum morbidity since they were exposed to the identical infection which caused such a great morbidity from tuberculosis among those who started with a negative reaction. Hence, since all other conditions were equal, the resistance of the positive reactors against infection in the hospital can be attributed only to their previous infection, which must have produced immunity against new tuberculous infection. This immunity, revealed by the Pirquet test, thus confirms Koch's and Romer's demonstration of the immunity against reinfection of an animal infected with tuberculosis.

Heimbeck concludes then, like other investigators of his opinion, that such an immunity produced by a natural infection might be replaced by an artificial benign infection which, like the natural one, manifests its immunizing effect in a positive Pirquet reaction. For the production of such an artificial infection he believes it possible to use Bacillus-Calmette-Guerin, since it differs from the tubercle bacillus only in that it cannot be virulent. Pirquet's tuberculin reaction, then, in a healthy person, is to be considered as a sign of immunity. Subcutaneous vaccination with Bacillus-Calmette-Guerin is harmless, Heimbeck believes, and as a rule produces immunity often associated with allergy. In persons living in tuberculous surroundings and giving a negative Pirquet reaction, such subcutaneous vaccination, in the opinion of Heimbeck, is the sovereign means of preventing tuberculosis.

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In a subsequent communication, in discussing the efficacy of Bacillus-Calmette-Guerin vaccine, Heimbeck states that since January 1927 all student nurses in the Oslo Kommunale Sykehus who enter on their course with negative Pirquet reactions are vaccinated subcutaneously with Bacillus-Calmette-Guerin. Of 164 subjects so vaccinated 104 of them subsequently gave a positive skin test. Of the 104 three per cent developed tuberculosis, while among the 60 maintaining negative reactions, 26.6% developed tuberculosis. These observations extended over a period of two to four years.

J. Arthur Myers of the University of Minnesota who, it may be said, is the leader of the newer school of thought on this subject stat-

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es: that in a personal communication from Heimbeck dated August 1932 the

latter called his attention to the fact that out of 454 student nurses who, as probationers, were positive tuberculin reactors, 15 have developed tuberculosis but none have died. Myers assumes that these patients had survived their primary infection and that the 15 had developed the reinfection type. Therefore, he maintains that this is a selected group, and that the findings arein keeping with his at the Lymanhurst School. He declares that ten or more years must elapse before one can observe the final effects, believing that more cases will develop in the interim.

Myers further states that among the 253 girls who entered Ulleval Hospital with a negative tuberculin reaction but upon exposure later reacted positively, 78 have developed evidence of tuberculosis as a result of their initial exposure. He contends that this is the result one should expect since 35 of these cases had erythema nodosum and 20 had evidence of pleuritis, which are signs and symptoms of primary tuberculous infection. Therefore, Myers explains, these girls were developing their primary infection which made them allergic upon their initial exposure and for them exogenous or endogenous infection resulted in the reinfection type of tuberculosis, which caused the death of seven fairly early. Myers claims that the reamining 253 girlw who became tuberculin positive are potential cases of the destructive forms of tuberculosis, and in each decade of life some of them will fall ill with tuberculosis and a few ill die as a result of exposure they received while caring for tuberculous patients.

With regard to Heimbeck's use of vaccination with Bacillus-

Calmette-Guerin as an attempt to protect the students, Myers sees the possibility of not only immediate but also remote dangers from the introduction of tubercle bacilli in the human body. It is his belief that a safer method consists in protecting students against exposure to tubercle bacilli through medical asepsis.

Another prominent tuberculosis worker who, like Calmette and Heimbeck, adheres to the older belief is William H. Park. Park assumes[13] that hypersensitiveness to tuberculin and relative immunity to tuberculous infection usually develop together. Also he believes that resistance to reinfection may outlast hypersensitivity, thus concurring in Calmette's belief set forth earlier in this paper.

Park advocates Bacillus-Calmette-Guerin vaccine to be given to a child who is believed to be not yet infected or at least not seriously so, as shown by the negative tuberculin test, and thus bring about the child's first tuberculous infection in a safe well calculated manner. He does believe, however, that the first infection may be so massive, or the child so susceptible, that it does not cease in the primary stage but progresses to the chronic forms.

Park's results with his Bacillus-Calmette-Guerin vaccine show:

1. Of 224 children vaccinated parenterally there were no deaths from tuberculosis, although 85% of these children showed a positive tuberculin test at some time.
2. Of 272 children vaccinated orally, among whom

the frequency of positive reactors was much more rare, there were three deaths from tuberculosis. This rate, however, was lower than that for the controls.

E. K. Geer[14] has carried on investigations similar to Heimbeck's into the incidence of tuberculosis among student nurses at the Ancker Hospital at St. Paul, Minnesota, which hospital devotes 215 of the 975 beds to patients with tuberculosis.

His records show that 42 nurses from a total of 934, or 4.5%, had developed tuberculosis from 1920, 28 either during training or shortly after. Of the 32 probationers entering training in September, 1928, 10 gave positive reactions and 22 were negative. At the same time of the 147 nurses making up the higher classes in the training school 143 gave positive tests while only 4 were negative.

Geer is convinced that the non-reacting nurses who come in contact with tuberculous patients are in a more precarious situation than the reacting nurses, in view of the inadequate medical aseptic measures now employed in most tuberculosis institutions, and because the former nurses have not had the protective infection of childhood. He substantiates Heimbeck's report that thus far it is largely those who originally gave negative reactions in whom tuberculosis develops, in some instances very shortly after exposure. He does not feel, however, that Heimbeck's use of Bacillus-Calmette-Guerin vaccine for his non-reacting nurses is the correct approach for prevention of consumption.

It is Geer's conviction that the most important thing is to protect nurses from frequent and massive doses of tubercle bacilli and to this end there should be careful general supervision of working hours, adequate food and opportunities for rest and recreation, and rigid contagious technique when nurses are on duty.

E. L. Opie[15] has reported some interesting post mortem statistics regarding the pathological evidence of first infection in association with active pulmonary tuberculosis. He reports the following:

1. Focal tuberculous lesions which have undergone calcification and are recognizable on x-ray films of the excised lung are present in the lungs of 98% of white adults who have died from diseases other than tuberculosis. This report is based on 115 cases. In one-fourth of these cases the lesions were of very small size (covering an area less than 25 square mms. on the x-ray film). In one of every ten adults the healed lesions were as extensive as those which in children not infrequently cause fatal tuberculosis.
2. Latent or unsuspected apical tuberculosis (secondary or "adult" type without signs and symptoms of disease) has been found in the lungs of one out of every five white adults examined. Opie based this report on 16 cases. He states that

these apical lesions are invariably accompanied by evidence of a pre-existing focal infection which has had its origin in childhood. The character and extent of the focal lesions do not differ from those of similar lesions found in the lungs of adults who have died from diseases other than tuberculosis.

3. He further reports 19 cases of active "adult" pulmonary tuberculosis in all of which there is evidence of a preceding tuberculous infection. Calcified foci of healed tuberculosis are present in the lung substance, and in the adjacent lymph nodes. These calcified lesions found in the lungs of those who died of phthisis or consumption were usually less extensive than those found in the lungs of adults who have died from other causes (covering in approximately half of the x-ray films an area less than 25 sq. mm.)
4. When acute miliary tuberculosis has occurred in adults it has not been accompanied by calcified lesions within the lungs, and the pulmonary lesions in these instances, unlike phthisis, have had the characteristics of a primary infection.

Opie concluded from these observations that general tuberculosis dissemination occurs because the adult has not been made resistant

by infection acquired in childhood.

In later reports,[16] however, Opie states that first infection does not confer an immunity which cannot be overcome by massive infection.[17] Also, he says that this protection afforded by first infection in ineffective since in adolescents exposed to continued contact with the disease, reinfection of the adult type often ensues. He believes that with continued exposure to tubercle bacilli or even with repeated casual contacts with them, sensitivity and presumably resistance is maintained, but long continued exposure to the immediate environment of a person who is expelling tubercle bacilli may overcome this resistance.

That primary tuberculosis does produce some immunity, hence protection against consumption,[18] Opie explains that:

> "Pulmonary tuberculosis for adults.....
> is the result of new infection and pursues a chronic
> course, because some immunity induced by preceding
> disease still exists."

Having now considered the work of prominent investigators of the "old school", it is well to begin the "other side of the story", with a report of C. A. Stewart's investigations pertinent to this question.[19] Stewart reports is based on the records of 84 consumptive patients examined at the Lymanhurst School for Tuberculous Children at Minneapolis, Minnesota. These cases include all the consumptive patients found in a group of slightly more than 10,000 children examined at Lymanhurst. No cases were omitted from the report unless the diagnosis was still pending

or uncertain. His report follows:

1. Four cases gave negative tuberculin tests and had normal roentgenograms of chest when first examined. Therefore, the evidence at that time indicated that there had been no primary tuberculous infection. However, on reexamination 3,6,7 and 10 years later, respectively, each of these four patients was found to have consumption. No other information was available on these cases, so Stewart concluded that they were valueless as far as reaching any conclusion, in this relation, was concerned.

2. Nineteen children who when first examined reacted positively to tuberculin and also had roentgenogram evidence of consumption present in various stages, Therefore, these records too were valueless in so far as they showed the relationship of primary infection to consumption.

3. In 25 children parenchymal infiltrations characteristic of reinfection pulmonary tuberculosis was found by x-ray and, without exception, the individual tuberculin reactions were positive. Additional pulmonary lesions were visualized which were deemed insufficiently characteristic and conspicuous to warrant their identification as calcified scars of primary tuberculosis. In 16 cases these scars

were present in the hila glands, and in the form of Ghon tubercles with calcification of regionally related lymph nodes in the remaining nine children. Therefore, these results show that primary and reinfection tuberculosis are found coexisting in certain children when first examined. Stewart believes that these observations provide circumstantial evidence indicating that primary tuberculous infections fail to prevent the development of consumption.

4. Thirty Six children, when first seen, gave positive tuberculin reactions and on roentgen examination their films were normal in nine cases, revealed calcified hilus glands in 14 cases, and in the remaining 13 cases Ghon tubercles associated with calcified hilus glands were demonstrated. In no instances was evidence of reinfection tuberculosis found in this series of 36 children at the time of first examination. Subsequently, these 36 cases were followed and repeated examinations were made. After varying periods of observation a reinfection type of tuberculosis developed, in each child of this group. At the time of this report, 9 of these children were at home on bed rest therapy, 5 were on pneumothorax treatment, 12 were in sanatoria, 8 had died and contact with the remaining two had been lost.

"Thus"[20], Stewart states, "approximately 43 per cent of a group of 84 consumptive patients seen at Lymanhurst provide definite proof that their primary tuberculous infection failed to prevent consumption from developing at some later date."

William H. Park[21] explains Stewart's results by stating that the development of consumption in his 84 cases was not surprising since 81% of these children had definite infrafamilial exposure which naturally rendered them a highly dangerous and highly selected group. It is Park's belief, then, that exposure was the determining factor. The fact that 44 of the 80 children who gave positive reactions already had the "adult" type of tuberculosis when first examined bore out this belief.

Park maintains that in order to compare two groups, one tuberculin positive and the other tuberculin negative, from the point of view of immunity all other conditions must be constant. The data in Stewart's report show that these prerequisites were not fulfilled.

J. Arthur Myers, in discussing his 12 years of experience at Lymanhurst studying tuberculosis in children[22] states that the clinical picture of tuberculosis usually appeared in the teens and twenties, and almost without exception in the bodies of those who had previously reacted positively to tuberculin. From this he concludes that primary tuberculin does not afford protection against consumption or adult tuberculosis. On the contrary, it is Myers' conviction that primary infection is detrimental rather than beneficial. He states that the tuberculin reaction is caused by allergy which, in turn, was caused by primary infec-

tion or tubercle formation and provides no immunity. Further, he says that this allergy is a dangerous element in tuberculosis.

Myers states[23] that it is his belief that immunity does arise from primary infection and results in the ability of the tissues to hold bacilli subsequently gaining entrance to the body wherever they lodge and thus, instead of being swept off to the regional lymph nodes, they remain for the most part in their place of lodgement where they multiply and produce disease. However, although this is his own belief, he feels that this question of the presence or absence of immunity can be answered only by personal opinion since there is no definite test for it.[24] He maintains that whether a large number of people are immune to tuberculosis because they have a positive tuberculin reaction and no clinical evidence of the disease can be determined only after these people are observed all their lives and die of some other disease.

At the present time, according to Myers,[25] tuberculous infection is not universal among adults, as manifested by negative tuberculin reactions. This fact permits of the study of those people who react negatively until they reach adult life. This situation presents itself in the case of medical and nursing students who remain tuberculin negative usually until their junior or senior year in school. After exposure to active cases of tuberculosis some of them present positive tuberculin reactions, which are +++ with a 0.1 mgm. dose of tuberculin, thus indicating a high degree of allergy. As time passes lesions develop in the chest which apparently do not differ from those developing following first infection with tubercle bacilli in the chests of infants and children (accord-

ing to Myers). Myers, however, believes from his own observations that pleurisy with effusion occurs somewhat more frequently in young adults than in children, although he admits that his series is not large enough nor have observations been carried on for a sufficient length of time for him to come to a definite conclusion. In the group which he has observed so far, however, there has not been a single case of "galloping consumption". These findings, then, would tend to contradict the older belief that it is good to have a positive tuberculin reaction by the time one reaches adult life, and that an adult is very unfortunate without such a reaction since he will develop miliar tuberculosis or galloping consumption if he comes in contact with tubercle bacilli.

Myers[26] believes that the primary infection of tuberculosis is benign because of the very strong inherent resistance. However, because of the allergy or hypersensitivity to the protein contents of tubercle bacilli manifested by the body tissues during the development of this primary infection the human body, subsequently, will react entirely differently when it comes in contact with tubercle bacilli, either from an endogenous or exogenous source. Therefore, he concludes that the best solution for tuberculosis control appears to be in preventing the primary infection. In other words, danger from tuberculosis begins with and remains as long as allergy is present.

Myers feels that although a great many people in the teen ages and early twenties have died of a rapidly progressive consumption (as shown by Opie's statistics given previously in this paper) without having received a primary infection, no one can be certain of what the

tuberculosis history had been, since no periodic tuberculin tests or x-ray films had been made.

In summarizing Myers' views, he does not contend that no immunity develops in tuberculosis, since the presence of this immunity seems to have been well established by numerous investigators such as Koch, Romer, Krause and Opie.[27] He does contend, however, that the immunity established is not sufficient to afford adequate protection against illness and death from tuberculosis. Furthermore, he believes that the human body is far better qualified to resist tuberculosis before the so-called protective infection develops than it ever is afterwards, unless this first infection becomes completely burned out and its effects eliminated. While first infection type confers immunity which may tend to influence the chronicity of the reinfection, Myers believes that this immunity is of slight value since the reinfection type cannot develop except on a basis of first infection, and in a certain percentage of these reinfection cases the disease progresses so as to result in illness and even death.

As a climax to Dr. Myers' arguments it seems fitting to quote him as follows:

> "Can instances be cited wherein tubercle formation which results in a positive tuberculin reaction protects against clinical tuberculosis? If so, should we not be cautious ere we arrive at the time when there will be too few tubercle bacilli left to go around? Thus, many would be unprotected and in

> great danger if exposure should come. If such a danger is a reality, would it not be better to stop the slaughter of tuberculous cattle, to stop isolating patients with tuberculosis, and teach them to spread their bacilli about, in order that all persons will have an opportunity to secure that most important protective dose of tubercle bacilli?" [28]

Does primary or "childhood" tuberculosis afford adequate protection against the development of consumption? It is obvious that this question cannot be answered now. Today is for investigation and the discussion of opinions, as has been attempted in this paper only in the form of a brief resume. Tomorrow will come the answer, since more time and more investigations are essential to the answering of this query.

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