

TO ROB CONSUMPTION OF ITS TERRORS.

ONE of the valuable results of modern bacteriological investigation has been the demonstration of the communicable character of some diseases which had not before been generally so regarded, and to this class tuberculosis belongs. The entire history of tuberculosis from the earliest times, when properly interpreted, constitutes a broad demonstration of its communicability. The positive proof of its nature, however, was wanting until the remarkable researches of Dr. Robert Koch, published in 1882, conclusively established the causal relation to it of a living germ, called the tubercle bacillus. The observations of Koch have been confirmed by experimenters in every country in the civilized world, and the results of all agree in confirming his conclusion, namely, that the sole exciting cause of tuberculosis is the tubercle bacillus. It follows as a necessary logical sequence to this conclusion that the disease is communicable and therefore preventable.

Tuberculosis is very widely distributed in all countries of the world, and affects both human beings and animals. It may occur in any organ or tissue of the body, but most frequently involves the lungs, and is then known as pulmonary tuberculosis, or, more commonly, as pulmonary consumption. In this form it is very prevalent.

It is desirable at the outset that a correct conception should be obtained as to the character of the knowledge afforded by bacteriological investigations. The popular impression exists to no small extent that the belief in the communicable character of tuberculosis is a matter largely of opinion, regarding which equally competent and well-informed medical men may differ. As a matter of fact the knowledge of the causes and manner of transmission of consumption is exact and complete, based on the most careful and convincing experimental observations, and there can be and is no difference of opinion among those who are conversant with the scientific facts. It seems necessary to make this clear; for the objection is heard on all sides that germs, as active agents in the production and dissemination of disease, really exist only as phantoms in the minds of over-imaginative and impractical bacteriologists.

The evidence of the causal relation of the tubercle bacillus to tuberculosis may be summarized as follows:

A peculiar germ called the tubercle bacillus is constantly present in the diseased tissues of men and animals suffering from tuberculosis. This germ can be readily distinguished, by its morphological characteristics and its reaction to staining fluids, from all other micro-organisms; it is never present in any disease excepting tuberculosis; it has been grown or cultivated in proper substances outside the living body for long periods of time; and when the growths or cultures suspended in distilled water are used for the inoculation of susceptible animals, the same disease, tuberculosis, is produced, with the same changes in the tissues; and in these diseased tissues the same germ is present with the same morphological appearances and the same staining reactions. Finally it has been shown that no other kind of living or dead thing can or does produce this disease, when used for such inoculations.

When the tubercle bacilli gain entrance to the body they produce small new growths or nodules, called tubercles. These tubercles tend to soften, and the discharges from the softened tubercles, containing the living germs, are thrown off from the body. In consumption the expectoration is partly composed of the softened tubercles, and contains the germs often in enormous numbers. It has been shown that in some cases of pulmonary consumption many million tubercle bacilli are discharged in the expectoration in the course of a single day. The germs thus thrown off do not grow outside the living human or animal organism except under artificial conditions, although they may retain their vitality and virulence for long periods of time. After being discharged, the sputum frequently becomes dried and pulverized and then suspended as dust in the air. Thus the air in rooms which have been occupied by consumptive persons becomes infected and capable of producing the disease when inspired by healthy individuals. It has been shown experimentally that the dust removed from the walls, mouldings, and pictures in rooms in private houses and in hospital wards and hotel bedrooms, which have been occupied by consumptive patients, is capable of producing the disease, when used for the inoculation of susceptible animals.

It has also been abundantly established that tuberculosis may be transmitted by meat or milk from tubercular animals. The milk glands in milch cows often become affected with the disease when their lungs are involved, and the milk from such animals may

contain the tubercle bacilli and is capable of producing the disease. Among stall-fed dairy cows 70 or 80 per cent are sometimes found to be affected with tuberculosis. Boiling the milk or thoroughly cooking the meat destroys the germs. Although the meat and milk from tubercular animals constitute actual and important sources of danger, the disease is acquired, as a rule, through its communication from man to man.

As the tubercle bacilli do not multiply outside of the living body, excepting under artificial conditions, and as it has been proven experimentally that the disease is due to these germs, it follows as a necessary sequence that, when the disease occurs, it must be produced by the same individual germs that have been thrown off by some other human being or animal suffering from tuberculosis.

There exists a very strong popular belief in the hereditary character of tuberculosis. The minds of most people have been impregnated with this idea from earliest childhood. It is, however, a belief entirely without scientific proof. While it cannot be denied that there is a possibility, in the rarest instances, of direct transmission at birth, yet the evidence of this having ever occurred in the human being is exceedingly doubtful. In families where the disease is supposed to be inherited, it does not appear in the offspring soon after birth, but only after several months, or, more commonly, after many years. Parents do not transmit the disease itself to their children, but they may transmit a constitution which is particularly susceptible to this kind of infection. This inherited susceptibility simply renders the individual a more easy prey to the germs when once they have gained entrance.

The frequent occurrence of several cases of pulmonary tuberculosis in a family is, then, to be explained, not on the supposition that the disease itself has been inherited; but that it has been produced after birth by direct transmission from some affected individual. Where the parents suffer from tuberculosis, the children, from the earliest moments of life, are exposed to the disease under the most favorable conditions for its transmission, for not only is the dust of the house likely to contain the bacilli, but the relations also between parents and children, especially between mother and child, are of that close and intimate nature especially favorable for the transmission by direct contact.

While the tubercle bacillus is the sole exciting cause of pulmonary tuberculosis and of every other form of tuberculosis, it must not be

assumed that it is the only factor in the causation of this disease. In every infectious disease it is the relation between two opposing sets of forces, which determine the question of susceptibility or insusceptibility to infection. These forces are, on the one side, the number and virulence of the germs which at a given time gain entrance to the body of the exposed individual, and on the other side the resistance of the body to these germs or the power of the body to throw off or destroy them. The resistance depends largely upon several factors, such as the avenue of entrance of the germs (*e.g.*, the alimentary tract, respiratory tract, etc.), the vital condition of the parts with which the germs come immediately in contact, and the state of general nutrition. In a large number of individuals the natural resistance to the tubercle bacillus is so great that under such conditions of exposure as exist ordinarily, the disease is not contracted.

While tuberculosis is communicable, yet it is communicated with far less facility than many other diseases, which are more properly called contagious. Ordinarily, for its transmission, long exposure to infection, and intimate association with the infected individual, are required, unless, because of some peculiar conditions, the natural resistance has been much reduced. Influences which depress the general vitality, or which produce more or less chronic affections of the air-passages, increase the susceptibility. Foul air, unhealthy occupations, food poor in quality or insufficient in quantity, impaired nutrition, defective ventilation, certain climatic conditions, heredity, bronchial and pulmonary inflammations, and especially fatigue from nursing consumptives, all act as important factors in creating a soil which is favorable for the development of the tubercle bacillus when once it has gained entrance. These factors act as predisposing causes by reducing the resistance to the germs: but they are only predisposing causes; no one of them nor all together can produce the disease unless the real exciting cause, the tubercle bacillus, is superadded.

A vast amount of evidence can now be adduced to show that consumption is comparatively rare among those who live an out-door life under normal and healthy conditions, while, on the other hand, it becomes more and more common among those whose occupations involve prolonged confinement in a more or less vitiated atmosphere. Mortality tables showing the percentage of deaths from consumption in 1,000 deaths from all causes in persons pursuing different occupations, show the influence of occupation and confinement in a vitiated atmosphere in the production of this disease. For every

1,000 deaths from all causes, 103 farmers die of pulmonary tuberculosis, 108 fishermen, 121 gardeners, 122 agricultural laborers, 167 grocers, while among tailors the mortality rises to 290, and among drapers to 301. Out of every 1,000 deaths among printers and compositors, 461—or nearly 50 per cent of all—result from consumption. Finally, it is said that among the Cornish miners more than 600 out of every 1,000 die of this disease. The mortality is highest in those occupations which involve confinement in an atmosphere in which are suspended fine particles of dust of some kind. These particles of dust set up inflammatory affections in the bronchi and lungs, and thus a susceptibility to the disease is created. Confinement indoors, in badly ventilated apartments, with many fellow-workmen, some of whom almost certainly have tuberculosis, involves constant exposure to infection. The air of the workrooms becomes infected by the dust from dried and pulverized tubercular sputum which has been discharged upon the floor; and the tubercle bacilli which are thus inhaled find everywhere a fertile soil for their development. Epidemics of tuberculosis have been reported in factories as the result of such direct transmission from some employees, who were suffering from the disease, to others. In the municipal electrical works in Paris, Arthaud found that 32 workmen out of 38 employed were tuberculous. Four of these cases were of long standing, and had apparently infected the others; at least 23 had contracted the disease after entering the factory.

Under certain conditions, especially where there is impaired nutrition or there are local affections of the respiratory organs, persons may be easily infected with tuberculosis. In New York hospitals (where consumptive patients are admitted to the same wards with those suffering from other diseases) I have repeatedly seen persons admitted for other diseases contract tuberculosis in the ward, and leave the hospital cured of the original affection, but suffering from well-developed tuberculosis, or remain, only to die from the latter disease.

In considering the means to be taken for the prevention of pulmonary consumption it is important that a clear conception should be first obtained as to its prevalence and curability and the possibilities of its prevention. From both a sanitary and economic standpoint, all other communicable and preventable diseases sink into relative insignificance when compared with this one. If as many deaths occurred daily for one month from Asiatic cholera in New York as regularly occur from pulmonary consumption, the city would be well-nigh

depopulated from the panic resulting. It has been shown that one-seventh of the total mortality of the civilized world is due to tuberculosis, and one-fourth of the deaths occurring during the working period of life is caused by it. Over 30,000 deaths were reported to the New York City Health Department as having been caused by the tubercular diseases during the five years ending January 1, 1893. Of these more than 26,000 were caused by pulmonary tuberculosis. The average mortality is about 100 a week. As compared with this, the total number of deaths caused by the other infectious diseases, including small-pox, typhus fever, typhoid fever, scarlet fever, diphtheria, measles, and whooping-cough, was only a little over 21,000, or about two-thirds of the number produced by tuberculosis alone.

One of the pathologists to the Vienna General Hospital (the largest hospital in the world) once said to me that there were found, in 85 per cent of the autopsies performed on persons dying in that institution, changes indicative of the existence of tuberculosis in some organ at some time in life, and in 45 per cent of the cases death was ascribed, at the autopsy, directly to this disease. In similar examinations in the charitable hospitals in New York I have found that in more than 60 per cent of persons dying from all causes in these institutions tubercular lesions were present, and in about one-half of these cases the direct cause of death was to be ascribed to tuberculosis. The mortality tables of the Mutual Life Insurance Company of New York for a period of thirty years show that more than one-third of all deaths occurring among its policy-holders during early manhood are due to pulmonary tuberculosis or consumption.

In public institutions of various kinds, where there is over-crowding, want of cleanliness, poor ventilation, and poor food, the mortality often assumes frightful proportions. Baer's statistics of the mortality in the prisons of Europe show that in Austria, during a period of four years, 61 per cent of all deaths were due to tuberculosis, and that the average mortality throughout the world in prisons varies between 40 and 50 per cent of the whole number. In the monasteries of Bavaria 50 per cent of the young postulants who enter these institutions in perfect health, coming from various portions of the country, die within a few years, from pulmonary tuberculosis. Cornet has shown that for a period of fifteen years the mortality among males in the prisons of Prussia was 45.82 per cent of all deaths; in females 49.33 per cent. He directs attention to the fact that the

mortality in prisons from tuberculosis between the ages of twenty and forty is five times that of the general population at these ages. He ascribes this excessive mortality to want of cleanliness in the cells, and infection therefrom, combined with insufficient ventilation and exercise, and want of variety in food.

The mortality statistics of New York city show that in 1892 more than 20 per cent of all deaths occurring in persons over twenty years of age were ascribed to pulmonary tuberculosis, aside from a large number due to tuberculosis affecting other organs than the lungs. The mortality from tuberculosis is far higher in many of the cities and countries of the Old World than in America. This is undoubtedly due to the fact that here the cities and houses are newer, the infection is not so widely disseminated, and the lower classes live under better sanitary conditions, have more and better food, and are subjected in their homes to less overcrowding than is the case in Europe. As one would surmise, if the disease is communicable, these factors are all important in its dissemination.

The people in general are so familiar with consumption and its great mortality, it is so insidious in its nature and often so slow in its progress, that they are comparatively indifferent to its ravages, and often unwilling to take simple and easily applied measures for its prevention.

Evidences of infection do not rapidly follow exposure to the disease, nor is it usually possible to say with certainty that the infection of an individual occurred at any given time. Weeks or months may elapse, after infection has actually occurred, before the first symptoms of the disease appear, and then these symptoms, which are really due to an incipient tuberculosis, are more often ascribed to a cold which has persisted, or to a bronchial affection, overwork, malaria, and a dozen causes and conditions other than the real one, tuberculosis. After symptoms have continued for a long time, finally a careful examination of the sputum or chest reveals the presence of well-established and perhaps far-advanced pulmonary tuberculosis. Months or even years often have passed since the time of actual infection. The result is that in a large proportion of cases, when finally the nature of the disease has been determined, it has already become so firmly established, has involved so much tissue, and has undermined so much the general health, that complete and permanent recovery is impossible, or attained only after long residence in a favorable climate, surrounded by the best conditions. Hence the popular impression that consumption is an almost certainly fatal disease.

The fact remains, however, that the disease *is* curable, and is curable in a large proportion of cases, providing only that its nature is recognized early, and proper measures are then taken to prevent its extension. Among the poorer classes, where economic considerations render it impossible for them to remove to a favorable locality, or to enter a properly equipped sanitarium, the ultimate result, when the disease has become well established, is usually unfavorable; and yet the results of autopsies in the charitable hospitals in New York and elsewhere have shown that in a considerable proportion of cases of incipient tuberculosis, even among persons living under the most unfavorable conditions, the disease becomes stationary or retrogressive. In my own autopsies performed in the New York charitable hospitals, I have found that in about 30 per cent of the cases dying in these institutions from other diseases, there were present more or less extensive changes due to the existence of tuberculosis at some period in life. In most of these cases the disease had long since become stationary. It has been noted in the autopsies at the Paris morgue that in 15 per cent of the cases of sudden death from injuries and accident there are present the evidences of cured tuberculosis. There can be no question that consumption may, almost as a rule, be completely and permanently cured among the well-to-do classes, if the nature of the disease is recognized early, and the persons remove temporarily or permanently to favorable climates or localities.

It has been frequently stated that the discoveries of modern bacteriology have been without practical value, and that we are no better prepared to-day for the treatment and cure of infectious diseases than before the days of bacteriology. This is far from being true. In reply it may be said that the science of medicine is to find its consummation, not in the cure, but in the prevention of disease; and all the discoveries in bacteriology have tended in this direction. They have given precision to our knowledge of the causes of the infectious diseases and the methods of their dissemination, and so have made possible the employment of intelligent and efficient means for their prevention. This is particularly true of tuberculosis. The knowledge we now have of the causation of tuberculosis makes possible the formulation of perfectly efficient means for its prevention. Of the infectious diseases it is without question one of the easiest to prevent, and, when thoroughly established, one of the most difficult to cure.

The duties of State, municipal, and sanitary authorities in this

matter are clear and specific. Comprehensive and efficient means should be at once taken for the prevention of tuberculosis. These means should consist in educating the people as to the communicable character of the disease; in instructing them in the measures to be taken to render the sputum innoxious; in the systematic employment of bacteriological examinations of the sputum for the early diagnosis of tuberculosis; in the proper disinfection of rooms occupied by tubercular patients before they are again occupied; in the establishment of public hospitals for the segregation, isolation, and treatment of the consumptive poor; in the enactment of regulations which shall forbid the employment of tubercular persons in such occupations as shall expose others to danger; in the adoption of sanitary regulations to prevent the dissemination of infection by means of tubercular sputum in places of assembly; in the governmental inspection of dairy cattle, and the destruction of those found to be tubercular.

Sanitary authorities in numerous places throughout the world have already taken measures looking to the restriction of this disease. The government of Prussia has published a series of general recommendations for the prevention of tuberculosis. The Minister of the Interior at Wurtemberg has issued instructions regarding measures to be taken against the spread of tuberculosis in public institutions. The Ministry of the Interior of Russia has also taken similar action. The Michigan State Board of Health has officially declared it a contagious disease, and included it among those in which compulsory notification is required. And finally the New York city Health Department has recently determined to inaugurate at once advanced measures for its active sanitary surveillance and the Department of Charities and Correction has at the same time signified its intention of setting apart a hospital for the exclusive treatment of consumption as it occurs among the poor.

Too much stress cannot be laid upon the importance of the proper isolation of the consumptive poor in institutions intended for this purpose, and it is exceedingly desirable that these institutions should be established outside of New York, where the conditions for recovery are more favorable than they can be in the city. If properly equipped sanatoria supported by the city could be placed among the pines on Long Island, a large proportion of the cases of incipient tuberculosis occurring among the poor, who are now unable to leave the city, might recover there, whereas, under the present conditions in the city hospitals, the disease almost certainly terminates fatally. Many of

the insane under the care of the Department of Charities and Correction of the city of New York have very wisely been transferred to such institutions on Long Island, and there seems to be no good reason why similar institutions should not be established for accommodating the poor afflicted with this disease. It is especially among the poor that the greatest danger of transmission exists, and the isolation of these patients in proper institutions would not only make it possible to give them the best medical care and the best chance for recovery, but would also diminish proportionately the dissemination of infection throughout the city, and so the number of new cases.

The cry has been raised again and again that for humanity's sake pulmonary consumption must not be pronounced a communicable disease, and the friends of patients often declare that they prefer to expose themselves to the chance of infection rather than to have their dear ones banished, or treated as if they were plague-stricken; but this is all the sheerest nonsense. A person suffering from pulmonary consumption may be absolutely free of danger to his most intimate associates or his immediate surroundings, if only the sputum is disposed of with scrupulous care. The sputum, and the sputum alone, in some way is the source of danger; and common sense, good sanitation, humanity, and even the requirements of simple cleanliness, demand that this should be destroyed or rendered harmless. Dr. Lawrence Flick, of Philadelphia, who has studied this subject carefully, has expressed the firm conviction that with our present knowledge we have it in our power to completely wipe out pulmonary tuberculosis in a single generation, and he adds: "Were half the energy which is being spent in the almost hopeless task of searching for a specific cure for tuberculosis devoted to its extermination, the accomplishment would be assured."

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THE PRODUCTION OF GOLD: IS THE SUPPLY SUFFICIENT?

THE great period of gold production was during the fifties; during the sixties it was very large; but after 1871 it steadily decreased and reached its lowest point in 1883. Since 1883 the output has steadily increased. During the years of decreasing production many became frightened at the increased demand for gold, both as money and for other uses. It was then that Bismarck spoke of it, with some degree of appropriateness, as being like too scanty a blanket, for which every one struggles and which makes people squabble.

Professor Soetbeer, an acknowledged authority, has shown that, of the large production of the decade 1851-1860, fully 80 per cent was used as money, but that of the smaller product of the half-decade 1881-1885, only 25 per cent was used as money, 75 per cent having been hoarded or used in the arts. And although the production has steadily increased since 1883, Professor Suess, of Vienna, a celebrated geologist, a translation of whose latest book, "The Future of Silver," was recently printed as a Senate document, states that the annual production of gold is now almost all if not entirely used in the arts and hoarded, and that in the near future the production will decrease permanently, and so seriously that gold cannot continue to be used as a money-metal in the course of a few centuries. Let us see.

The total production of gold in 1892 may be put at \$138,000,000, which is more than the average of the great years between 1850 and 1860. This total sum is composed as follows: Australia, \$33,870,000;¹ United States, \$33,000,000;² Africa, \$25,101,054;³ Russia, \$24,709,362;⁴ China, \$3,000,000;⁵ other countries, \$18,331,049.

¹ From the Annual Report of the Director of the Mint, which has a well-deserved world-wide reputation for accuracy. ² Ibid. ³ Official returns.

⁴ From an authentic report made to the "Frankfurter-Zeitung." The figures for Russia and Africa differ somewhat from those in the Report of the Director of the Mint for 1892, but in his last Report (for the year ending June 30, 1893), which appeared after this paper was written, he gives substantially those given above. ⁵ These figures may possibly be enlarged to \$5,000,000.