An Anticipation.

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To try to paint the possible conquests which lie before the workers in the field of tuberculosis were a fascinating task. With a free hand and no stint of colour, an attractive picture might readily be sketched. It is less easy to forecast accurately the lines on which advance should and will be made. The outlook of the future changes from day to day with each new discovery. An "anticipation" such as the Editor desires, while breathing the spirit of prophecy, must rest chiefly on a just appreciation of the present position. The prospect of the future is largely the reflection of the present. To conjure up what will be is to realize the natural trend of research and effort.

The Full Significance of Koch's Discovery.

Those of us who were reared in the older faith were startled by the swift intimation by Koch that tuberculosis was certainly due to inoculation by the tubercle bacillus. Before that announcement, Klencke, Villemin, Cohnheim, Klebs, and others, had indicated that tuberculosis was an infective disease ; but in practice the conception of consumption as an infectious malady played an insignificant rôle. Whenever whispers of such a view became audible, they were promptly hushed by magisterial citation of evidence to show that infection never occurred. The evidence was obtained from consumption hospitals, where consumptive patients were suitably handled.

When the tubercle bacillus was accepted as the cause of tuberculosis, there remained no room for valid objection to the infectious view. The tubercle bacillus afforded a criterion as to what should be considered tuberculous. In doubtful cases the determination of the bacillus rendered diagnosis certain. It became evident that study of the life-history of the bacillus might yield important information as to the pathology of the disease, and render possible a scientific therapeutics. Knowledge as to the distribution of the bacillus and its avenues of entrance into the human subject might lead far towards a rational prophylaxis.

It was in the autumn of 1882 that my interest was definitely awakened in the subject. I was engaged in a research on the development of the trachea in the Embryological Laboratory of the University of Vienna under Professor Schenk, of "sex" fame—an original thinker and no less distinguished histologist. One morning—I recall it vividly—the Professor called me to see his preparations of tubercle

bacillus. He was entranced with delight, and there and then indicated his belief that the discovery must lead to an entire *volte face* in our conceptions of the disease. For weeks thereafter much of our business was to stain films from discharges obtained from the wards of the general hospital.

For years, however, little heed was paid practically to the tubercle bacillus. The older generation of doctors looked askance on the new doctrine. I remember well—when I returned to Edinburgh in 1883, keen with hopefulness which the discovery inspired—the disappointment which met me at the threshold in the remark of one of the kindest of my former teachers. When I told him that I proposed devoting much of my time to the subject of tuberculosis, his rejoinder was: “Don’t think of such a thing. Phthisis is worn to a very thin thread. The subject is exhausted.”

As time went on, the full significance of the discovery grew more and more apparent. The beauty and exactness of the original work impressed men. Careful, critical observations confirmed it. Based thereon followed patient researches in an endless variety of directions as to the character—morphological and biological—of the tubercle bacillus, its life-history, the effects of this on the tissues of its host, and the histology of the induced processes. Better instruments and more delicate histological methods carried investigation forward by leaps and bounds. There resulted truer conceptions on etiology; the toxic influence of the tubercle bacillus on the human organism began to be realized; the meaning of constitutional symptoms following invasion became apparent, and death, formerly attributed loosely to advancing weakness, was traced to the elaboration and absorption of poisonous products. In consequence, larger views took shape as to the possibilities of antagonistic procedure with a view to cure, and of prophylactic measures with a view to eradication of the disease.

The vague generalities of an older faith gradually gave place to a unity of conception, which recognised in the tubercle bacillus the essential cause of all manifestations of tuberculosis, whether in lungs, bones, joints, glands, or skin, or in so-called scrofulous processes. Hereditary taint came to mean greater liability of tissue, and it was recognised that no individual, no age, no race, was exempt from infection.

Statistics quickly accumulated, showing the overwhelming extent of the ravages of the bacillus—the annual hecatombs, vaster than the vast offerings sacrificed yearly to the other acute infections, and the great crowds of men and women physically and financially ruined.

Now, happily, the tremendous significance of the tuberculosis problem begins to be realized. There are signs on every hand that the peoples of the world are looking into the question. As Professor

Charles Richet, of Paris, said to me in chatting over the matter: "This is a big social question, and not merely a doctor's affair." While not oblivious as to the needs and uses of direct therapeutics, the wider outlook of medicine must be towards prophylaxis and final eradication. Exterminate the tubercle bacillus, and tuberculosis will survive only as an historical monument.

Direct Attack on the Tubercle Bacillus.

In keeping the larger ideal constantly in sight, we do not belittle the interests of the individual patient. On the contrary, anything which tends towards recovery, even of one individual, makes towards the final extinction of the disease. In this sense, all direct attacks on the bacillus are of first interest.

Unhappily, such attempts by introduction into the tuberculous focus of antagonistic agents from without have been to little purpose. The list of drugs is immense, but the net result is not encouraging. We have found no drug which can be introduced into the circulation in sufficient quantity to prejudice effectively the development of the bacillus which does not exert at the same time toxic properties on the cells of the human body, thus tending to hasten the issue which it was hoped to avert. Whether such agent may yet be discovered, it is impossible to say. In view of the significance of iodide of potassium and mercury in syphilis and of quinine in malaria, the possibility of such discovery may fairly be kept in view.

The Tubercle Bacillus shows the Way.

Of supreme interest is the attempt to antagonize the bacillus by products obtained directly or indirectly from itself. Autopsies have revealed that tuberculous disease may be cured, as we commonly say, spontaneously. The query as to what determines spontaneous cure is one of paramount importance. Its discussion would carry us far beyond the limits of this short study. Suffice it to recall, that there is reason for the belief that the healing process is initiated by products produced *in situ* by the bacillus.

From this we may trace the dawn of tuberculin. To Koch belongs the credit of directing men's gaze in this direction. His announcement that it was possible to extract from cultures of the bacillus an agent possessed of specific properties, so far as tuberculosis was concerned, was simple and definite. Unfortunately, the announcement was heralded with too much sound of trumpet and drum, and a delicate scientific procedure was hastily tackled by an impatient crowd, both lay and medical. Accidents happened, and voices from high places began to whisper danger. The tones of alarm grew louder and louder, and the pendulum swung violently from over-sanguine expectancy to

hesitating doubt and mistrust. Thus was a method, resting on sure observations, allowed to fall largely into abeyance.

The Promise of Tuberculin.

None the less, Koch's conception of tuberculin as a healing agent has survived. At the present moment it remains a living force. I find myself in a small minority who have maintained the use of tuberculin during fifteen years since its first announcement. Throughout that period it has been employed continuously in one or other form. I am glad to have the opportunity to record in the first number of the BRITISH JOURNAL OF TUBERCULOSIS my conviction of its great significance as a curative agent. I have treated a large number of cases of tuberculosis of different organs, in most instances with satisfactory results. I have seen tuberculous larynxes pass from a state of active ulceration to complete cicatrization. I have seen agonizing dysphagia, from tuberculous involvement of the epiglottis, yield to one or two injections, so that the patient could swallow comfortably. I have seen genito-urinary tuberculosis improve remarkably. I have seen a rectal discharge of pus, to the extent of 8 to 10 ounces *per diem*, which had gone on continuously for over three years in spite of several surgical operations, yield speedily and completely to tuberculin treatment. I have a large series of cases of pulmonary tuberculosis in which, undoubtedly, the progress towards recovery was hastened by the measure. I might also cite several instances of extreme breathlessness, asthmatic in character, suggestive of pressure from without—*e.g.*, by enlarged glands—where the distressing manifestation was quickly removed by means of tuberculin. Such examples might be multiplied, did the limits of this study permit.

While far from advising hasty or blind allegiance to the method, prolonged experience makes me conclude that in tuberculin we have not only an interesting scientific principle, but also an agent of great practical significance. There is reason to anticipate still greater things as the method becomes more fully developed.

Two thoughts occur to me in this connection: Firstly, with regard to tuberculin itself, we may look for further developments in its elaboration. Certain of the toxic manifestations which have been reported are doubtless due, not to overdosage merely, but to the presence of associated toxic principles, dependent on the nature of the culture medium rather than on the tubercle bacillus directly. From this point of view, the work of Béraneck is of great interest. With remarkable devotion he has set himself for several years to the elaboration of a less toxic tuberculin. His investigations have proved most fruitful in respect of the possibility of cultivating the bacillus on a peptone-free medium. The tuberculin thus produced has well-marked

specific properties, while its toxic action is slight. From its extended employment during several years, I am satisfied that in Béraneck's tuberculin we have an agent of much therapeutic activity, whose toxicity and associated disadvantages are small.

The latest announcement in this direction is that of tulse, by Von Behring. Tulse is a clear liquid, containing in solution substances derived from the bodies of the bacilli. It may be introduced subcutaneously, intravenously, or by the stomach. By its use Von Behring claims to have established active immunization against tuberculosis. The mode of action is thus similar to that of the tuberculins. It were premature to pass a judgment on the value of what has been little more than announced. The pity is that so long an interval has been allowed to elapse between the prologue and the raising of the curtain.

The second thought which occurs is suggested by the work of Wright and others with reference to the opsonic index. The possession of an exact gauge for the regulation of tuberculin dosage is certainly desirable. This would seem to be promised in the determination of the opsonic index of the blood from day to day. The originality and delicacy of the procedure are worthy of admiration. Interesting facts have emerged regarding the variations which occur in the blood at different stages of tuberculous infection. These seem likely to throw light on several points in the pathology and therapeutics of tuberculosis, and we may look for further guidance in diagnosis and prognosis. But after comparison of results obtained where the opsonic index was determined and those obtained apart from such determination, I feel doubtful if the method can be credited with all the significance which has been ascribed to it. Prolonged experience with and without the method justifies the statement that, apart from estimation of the index, other clinical evidence is usually sufficient for the regulation both of amount and frequency of dosage.

Serum-therapy.

Turning to serum-therapy, what as to its significance in the treatment of tuberculosis? Various investigators have pursued this line of research, and have advanced claims to credit for their particular method. It must be confessed, however, that the results are disappointing. Neither practically nor theoretically does serum-therapy afford much promise. The therapeutic value of serum treatment is temporary. Its services are conspicuous in acute infections, such as diphtheria, where rapid neutralization of a powerful toxin is required. The immunity produced is essentially a passive one. In the case of tuberculosis, the only value which seems possibly predicable of serum-therapy is in relation to acuter exacerbations of fever. For such

temporary emergencies, where tuberculin is of doubtful efficacy, a serviceable serum may yet be discovered.

To sum up, the hope of successful specific treatment of tuberculosis seems to lie in some adaptation of tuberculin, with a view to production of active immunization, aided, it may be, temporarily, under conditions I have indicated, by a serum possessed of special antagonizing properties.

Cardinal Principles of Treatment.

Of accepted cardinal principles of treatment little requires to be said here. The significance of sunlight and open air is nowadays recognised by all. The marvel is that it took the world so long to admit what now seems a first principle. There is growing acceptance of the doctrine of the *universal* applicability of open-air treatment. It is realized that, as consumption occurs in all countries where it has obtained a footing, it can be treated in all climates with approximately equal success if the larger indications are fulfilled, and that, although change of climate may be agreeable and sometimes desirable, such change is not essential for cure. It is of immense importance that our people should rid themselves of the prevalent notion that the cure of consumption can only be effected under conditions which their ordinary residence and station in life will not permit them to enjoy. Hence it is highly desirable that sanatoria for the working classes should be erected reasonably near the town chiefly interested.

There is an improved conception of the dietetics of tuberculosis, and, happily, recovery from the unthinking creed of inordinate cramming, which, while leading to gain of weight, produced soft and weakly convalescents. Careful observations of metabolism have helped to direct thought in proper channels. The great value of zomotherapy—raw-meat feeding—as a means of improving intestinal metabolism and increasing nitrogen retention has been demonstrated. Sanatoria and hospitals with proper laboratories may still advantageously devote time to research in this department.

State and Municipal Responsibility.

The limits of the present study afford less space than I should have craved for the consideration of the wider aspects of the prevention—or rather, let us say, extermination—of tuberculosis. The great reduction in mortality from tuberculosis during the past fifteen years in this country and America is one of the most remarkable facts in the history of medicine. It is freely admitted that the gratifying result has been attained in part by the general advance of sanitary science and the adoption of well-devised measures directed against overcrowding and dirt, which tend to breed tuberculosis as they do other infectious conditions.

But there is abundant reason for the statement that such general measures may be greatly assisted by methods more specially directed against the tubercle bacillus. This is a question for communities—for the State, municipalities, county councils, and other local authorities. The primary need is a sufficient realization of the extent of the evil and its dependence upon preventable causes. The medical profession can do a vast deal to create a healthy public opinion on the subject. By personal influence, and by such organizations as the National Association for the Prevention of Consumption, great advances have already been made. Much more requires to be done.

Communities must more definitely face their responsibility. To erect a hospital or sanatorium with a few beds, as the case may be, is only to tinker the evil. To be effective, there must be instituted a completer anti-tuberculosis organization under the Public Health Department. Tuberculosis is rightly regarded as an infectious disease, but it presents certain features which require special consideration. It is peculiar in respect of its mode of dissemination and the conditions of environment on which this depends, peculiar in the variety of its manifestations, and peculiar in its usually prolonged course. Hence the plan of combating tuberculosis cannot be modelled entirely on those which have been found serviceable in the treatment of other fevers.

Co-ordination of Preventive Measures.

The solution of the problem requires a carefully co-ordinated plan of action. Much advantage would accrue if a uniform plan could be adopted throughout the country, and, indeed, throughout the world. Of the factors which should go to constitute a proper scheme, the following may be noted specially—viz., notification, a tuberculosis dispensary, a hospital for dying cases, a sanatorium for curable cases, and working colonies. My belief in the need for and efficacy of these several factors rests on prolonged experience. The key to complete success is to be found in their harmonious co-ordination.

Notification.

In order to obtain a sufficient conception of the extent of tuberculosis in our large centres, notification appears to me a sound and necessary measure. I am confident that compulsory notification must be appealed to for the ultimate solution of the consumption problem. All the difficulties which have been threatened in relation to it were similarly advanced in relation to notification of other infectious diseases. Such as they are, they are insignificant compared with the vastness and gravity of the evil to be combated. Till recently the practical difficulty has been the attitude of the Local Government Boards. The English

Board continues its attitude of reserve, encouraged, no doubt, by the lack of unanimity among medical authorities. The Scottish Board has recently, in its circular of March 10, 1906, taken a bolder line and declared in favour of notification. It has pronounced pulmonary phthisis to be an infectious disease within the meaning of the Public Health (Scotland) Act, 1897, and indicates that a system of notification is necessary if the Public Health Act is to be applied effectively to pulmonary tuberculosis. As is well known, compulsory notification has been successfully instituted in New York and in Norway. In the former instance, the rapid development of compulsory notification from a tentative system of voluntary notification is most instructive. Everything seems to indicate that before long compulsory notification will be widely spread throughout the world. The countries and States which hesitate meantime do but delay a certain result.

Notification must not, however, be regarded as a panacea for tuberculosis. In pressing its advantages, some would seem to imply that notification is somehow to effect the extermination of the disease. This is to take too limited a view of the situation. On the contrary, we may not conceal from our view the likelihood that notification will at once raise a number of troublesome questions as to the means to be adopted for the suitable disposal of the vast amount of tuberculous material with which every centre will have to deal.

Tuberculosis Dispensaries and Hospitals.

It is at this point that the significance of the tuberculosis dispensary becomes apparent. In any complete organization against tuberculosis the dispensary will come to play an important part. The dispensary will constitute for every town or district the developmental centre and uniting point of other agencies. It should be under the medical officer of health, but form a separate department of public health activity. It seems to me difficult to overestimate the significance of the dispensary as an instrument of preventive medicine.

It is admitted on all hands that it is the advanced or dying cases of consumption which constitute the greatest source of infection to a community. Among the poorer classes this is emphatically the case—where, it may be, one room is shared by half a dozen persons, one or more of whom may be affected with tuberculosis. The segregation of such cases is a most important move in preventive medicine. My anticipation is that soon we shall have such hospitals distributed as generally throughout the country as are hospitals for acute infectious fevers. The pronouncement of the Local Government Board for Scotland is very clear—that the “isolation of such dangerous cases is a primary duty of the local authority.”

The purpose of the sanatorium is different. It is concerned with another group of patients—viz., those who may be reasonably regarded as curable. The aims and principles of sanatorium treatment are sufficiently well known. There is much to be said in favour of the erection of sanatoria in *immediate* relationship to the centres. Such sanatoria ought not to be very elaborate or costly buildings. The results of sanatorium treatment are highly encouraging, notwithstanding statements made to a contrary effect. If treatment be undertaken reasonably early, it is the exception to find a patient who does not make satisfactory progress. The results would be more uniform if there were a completer understanding as to what constitutes an early and suitable case. The immense economic value of working men's sanatoria has been conclusively established by the facts so often cited relative to compulsory insurance against sickness in Germany.

There remains no space to speak of the benefits to be expected from the establishment of working colonies. In the course of the next few years I doubt not these will exist abundantly throughout the country. There seems much reason for the belief that such colonies in close relationship with sanatoria could be made practically self-supporting.

L'Avenir est aux Audacieux.

The time seems ripe for a great forward movement against tuberculosis. What is chiefly required to insure a successful issue is a fuller and juster conception on the part of our people as to the enormous proportions of the evil to be faced, and their intelligent insistence that the authorities will be sufficiently wise and courageous to adopt measures commensurate with the greatness of the need. Given these conditions, we may confidently look for the final extermination of tuberculosis. Here, as in other spheres, the future belongs to the brave.