mortality amongst adult cases. Further explanations of this will be awaited with interest, but we do not think that successful isolation can be more than a contributory cause.

Heliotherapy appears to have its greatest field of usefulness in the treatment of septic cases, and the functional results which follow its employment are often undoubtedly good. Further comment is uncalled for at this time, but it is to be hoped that in this country greater use will be made of heliotherapeutic measures in appropriate cases; that radical measures will not be hastily resorted to; that treatment in towns will be abandoned for treatment in the country or at the seaside, where feasible; and that, above all, the value of all that is implied by the term "conservative treatment" will be more thoroughly appreciated and investigated. Dr. Rollier's work is of the highest importance in directing attention to rational conservatism aided by heliotherapeutic measures.

THE PROGRESS OF THE ANTI-TUBERCULOSIS MOVEMENT.

By ROBERT SAUNDBY,

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IN introducing the National Insurance Bill, the Chancellor of the Exchequer estimated that there were in this country between four and five hundred thousand persons suffering from consumption; he stated that 25 per cent. of the money spent by the Foresters Society in sick pay was due to this disease, and that it was the cause of 75,000 deaths annually. Within recent years tuberculosis has spread from the town to the country, and we may see the havoc wrought by it among the cottagers in Scotland and Ireland, a class which formerly enjoyed remarkable freedom. Consumption attacks especially young adults just when they are most valuable to the community. When the father or mother of a young family breaks down with tuberculosis, the social injury resulting far exceeds the mere loss of life. It is said that one out of every three deaths among males between the ages of fourteen and fifty-five—that is, during the best working period—is due to consumption. The burden of invalidism, moreover, may be even a greater social evil than death itself, and we must add to this the impaired efficiency caused by crippling from tuberculous diseases of bones and joints occurring in

childhood. Finally, we cannot leave altogether out of account, in considering the injury caused by this disease, disfigurement such as is due to lupus and the scarring which follows extensive glandular abscesses, although we may not be able actually to assess the damage in pounds, shillings, and pence.

Past and Present Attitude to the Disease.

We may be surprised to find that in past days these evils resulting from tuberculosis were borne so patiently by our predecessors, and without any systematic effort to get rid of them, although there is reason to believe that the forms of tuberculous disease were then even worse than they are at present. But the conception that disease is preventable is one that took its origin only in modern times. It must also be remembered that it is only since Koch's discovery of the tubercle bacillus in 1882 that we have known what should properly be called tuberculosis, and how many diseases should be attributed to the same microbe attacking different organs and tissues. These vary very much; sometimes they are acute and almost uniformly fatal, as when they involve the membranes of the brain; at others slow in their progress and without danger to life, although the causes of destruction of tissue and disfigurement, as in lupus of the face. Pulmonary consumption occurs in many forms and degrees, but we have also tuberculosis in spinal disease, in hip-joint disease, in white swelling of the knee, in strumous glands, and consumption of the bowels, all caused by the tubercle bacillus and grouped under the name of "tuberculosis."

The Infective Nature of Tuberculosis.

Bygone views excluded the notion of the transmission of the disease from the sick to the healthy. In earlier times this had been recognized, and the belief has always lingered in the popular mind of Southern Europe; but academic medicine scouted the idea. Yet Laennec himself died of phthisis caused, there is reason to believe, by having inoculated himself at the post-mortem examination of a tuberculous patient. The successful inoculation with tubercle of a man who was dying from gangrene for which he had refused amputation, by three Greek physicians, Demet, Paraskeva, and Zallonis, and the publication of many remarkable cases of the communication of the disease from husband to wife, from mistress to maid, from patient to nurse, or the very remarkable instance where a phthisical midwife communicated the disease to a long series of babies nursed by her, or the experiments upon animals by making them inhale a solution of phthisical sputa, failed to alter the attitude of the profession to this question. At length the demonstration of the tubercle bacillus and the transmission of the disease to animals

by means of a pure culture, separated by scores of generations from the original source, forced the most sceptical to admit the possibility at least of its being communicable; but even then it was regarded as unusual, and so late as twenty years ago I remember being told that the proposal to install an apparatus at Brompton Hospital for the destruction of phthisical sputa met with most determined opposition from a senior member of the medical staff. It was argued that, if this view were true, the nurses and the staff of Brompton Hospital ought to have shown a high rate of disease, but it was claimed that in the fifty years that had elapsed since the foundation of the hospital nothing of the kind had been noticed.

The old general hospitals throughout the country treated a large number of consumptive patients as out-patients, but usually excluded them from the wards by a special notice on the tickets of admission. This was due neither to neglect nor to indifference, but experience had shown that these patients did badly inside the hospital, and this truth had been recognized, although the proper principles of treatment were by no means grasped. It was not until 1841 that the Brompton Hospital for Consumptives was founded, and outside London it was only in 1869 that the Ventnor Hospital was started.

The Evolution of Open-Air Treatment.

The proper principles of treatment had been taught by Dr. George Bodington, of Sutton Coldfield, as early as 1830, but made little way with the medical profession and the general public; not only in consumption, but in many other morbid conditions, the value of fresh air was not quickly grasped.

In the "Life of Florence Nightingale," there is a letter from the Crown Princess of Prussia, afterwards the Empress Frederick, dated September 29, 1866, in which she writes: "As you are such an advocate for fresh air, I cannot refrain from telling you what I have myself seen in confirmation of your opinion on the subject. . . . In a small well-kept hospital, where wounded soldiers had been taken care of for some time, the wounds in several cases did not seem to improve; the general state of health of the patients did not show any progress. They were feverish, and the appearance of the wounds was that of the beginning of mortification. In the garden of the hospital there was a shed or summer-house of rough boards with a wooden roof. The little building was quite open in front, and on the other two sides closed up with boards, but with an aperture of 2 feet all the way under the roof, so that it was like being out of doors. Six patients were moved down to this shed, sorely against their will, as they were afraid of catching cold. The very next day they were better; the fever left them, the condition of the wounds became healthy; they enjoyed their summer-

house in spite of two storms that knocked down the tables, and all quickly recovered. I had seen them upstairs, and saw them every day in the garden. The difference was incredible."

In spite of this example, it was thirty years or more before the value of fresh air began to be generally admitted in the treatment of consumption; but lately there has been a most astonishing progress in the appreciation of fresh air, particularly amongst the younger generation; they have learnt how much pleasanter it is to sleep in a room with the window wide open. Hospitals are now provided with wards entirely opened to the weather; at the Birmingham General Hospital, which was only opened in 1897, and was then supplied at great expense with warm and filtered air, experience has shown that the patients, especially the children, do better if they are allowed to spend most of their time lying outside upon the balconies. I have lived through this change of practice, and I can confess that I should not have ventured to begin these experiments. When the late Dr. A. Foxwell persuaded the Queen's Hospital Committee to give him an open-air ward at the top of the building, I imagined that it would be dirty from coal smoke and wretched from exposure to wind and rain, yet I found that not only patients who were snugly tucked up in bed, but even the nurses who had no extra covering, made no complaint.

Infection and Immunity.

We now know that tuberculosis is caused by a parasite, and there is no doubt that if we could get rid of the tubercle bacillus we should abolish all forms of tuberculosis. We are ignorant, however, of the mode in which these microbes originate—in fact, we know no more of that than we do of the origin of life itself; but the bacillus undergoes certain modifications, shown in the intensity of the disease it produces. And we know, too, that the organism that causes tubercle in human beings differs from that which sets up tubercle in cattle, while that, again, differs from the microbe of tubercle in birds and reptiles. There are differences of opinion as to the extent and importance of these variations; but while it is admitted that the microbe of cattle may cause disease in man, it is believed that that of birds and reptiles is not communicable to him. It is therefore from human beings or cattle affected with tuberculosis that infection is to be feared. This is not in either case usually communicated directly. The tubercle bacillus is quickly killed by exposure to light and air, but is so profusely distributed by the numerous sufferers from consumption that the germs are to be found in all public places and conveyances; every time a patient coughs, even without expectorating, he drives into the air minute droplets of moisture containing myriads of bacilli, so that, although extreme care may be taken to collect and destroy all expectoration, a consump-

tive person remains a constant source of infection. In fact, we who live in crowded communities may well despair to escape all risk of infection, and it is reasonably maintained that few, if any, young people in our great centres of population go free. But if this is so, the resulting lesion must be generally slight and undergo rapid healing. It is probable that, like vaccination, it determines a certain amount of protection, and that most of us owe to this our immunity. We thus see that the protection we enjoy depends upon the very prevalence of the disease we deplore; for when infection reaches a population hitherto free from the disease, they suffer extremely from its attacks, and the rate of mortality may be so high as to threaten them with extinction, as has been the case, for example, among the natives of New Zealand and in other Pacific islands.

Using the jargon of modern pathology, immunity is due to the formation of antibodies which exert their action either on the microbes or on the poisons produced by them. In either case the result is that the symptoms of disease—high temperature, rapid pulse, headache, general pains, and the like—do not occur, and the sufferer feels little, if at all, the worse for the introduction of the microbe; but there are certain people who constitutionally appear unable to form these antibodies, and these are the families in which, as we say, there is a predisposition to consumption.

In other cases the immunity, or power of resistance, may be reduced temporarily by the occurrence of some other disease, of which a common example is the way in which phthisis may attack a person recovering from typhoid fever, a disease due to an entirely different microbe. Or, again, there may be what is called the recrudescence of an old patch of tubercle which was perhaps never recognized, or had been forgotten. It may have been one of those early attacks in childhood which had been apparently healed, but the bacilli had lain dormant until, in consequence of some disturbance, such as an injury or a simple inflammatory affection, the bacilli regain their activity, and a more or less serious attack of tuberculosis is the result.

Milk as a Source of Tuberculous Infection.

Tuberculosis in children undoubtedly bears some relation to tuberculous milk; for, although it is true that they are exposed to many other sources of infection, it must also be allowed that tuberculous milk is chiefly dangerous to young children, of whom it constitutes the principal or sole diet. Milk may be rendered harmless by boiling or sterilizing, and in my opinion it has never been proved that this process in any way impairs its nutritive value; but most will agree that milk should not be sold which contains living tubercle bacilli, and that the use of cows, for milking purposes, which are suffering from tuberculosis

of the udder ought to be prohibited by law. Nothing short of such legislation appears to be likely to be effective. Dr. John Robertson, the energetic Medical Officer of Health for Birmingham, has introduced a scheme for encouraging farmers to make their herds tubercle-free, and has the satisfaction of being able to boast that twenty-two herds have been freed from tuberculosis and are now supplying tubercle-free milk. This milk costs about a halfpenny a quart more than ordinary milk, which seems a small sum if the total consumption is not large; but when this question was discussed at the General Hospital a few years ago, the adoption of tubercle-free milk involved an additional expense to the hospital of no less than £300 a year!

That there is some reason for taking precautions against infected milk is shown by the examinations made in many of the great towns, which have proved that from 5 to 10 per cent. of the samples of milk examined contained tubercle bacilli. Attempts to deal with this problem have been made by what are known as the Manchester Model Clauses, which require that all dairymen sending milk into the city must notify such of their cows as have tuberculosis of the udder, and power is given to the Corporation officials to collect samples and inspect cow-houses in all dairies in the city or from which milk is sent into the city, and, lastly, to prohibit infected milk from being so sent. But the effect is said to have been only moderately successful, and there is now a demand for legislation which would make it penal to keep cows affected with tubercle of the udder for milking purposes after the lapse of a probationary period of two or three years, during which the farmers would be expected to reform their herds. In Birmingham every cowhouse within the city is submitted to a veterinary inspection once in six weeks—a system which, with the aid of the recent Tuberculosis Order enabling cows in an advanced stage of tuberculosis to be destroyed, has resulted in a considerable improvement in the quality of the milk. Samples of milk are also taken at the railway-station, and when found to contain living bacilli, the farm from which the milk came is visited, and action is taken under the Birmingham Corporation Act, 1903, with a view of getting rid of the cow giving tuberculous milk.

Preventive Measures.

Tuberculosis is not a new disease, for Professor Elliot Smith tells me that he has seen ten cases of tubercular disease of the spine in Egyptian mummies, one of which went back as far as the First Dynasty—that is, about 3500 B.C.—several others about 2000 B.C., and others about 1500 B.C.; yet in modern Egypt tuberculosis was unknown until recently, and has made its appearance in Palestine and Egypt within the memory of medical men now practising there; they attribute its introduction to infected Russian pilgrims, and to the return of native

emigrants from America. The disease is apparently spreading rapidly, as the people have no immunity, it shows itself with great virulence, so as to cause a positive panic among the population, whose habits are by no means sanitary, and who are unprovided with means for medical treatment. What were the circumstances which caused the decline and ultimate disappearance of the disease in ancient times we do not know. It is hard to attribute them altogether to altered environment, for anthropologists and archæologists tell us that the races inhabiting the Nile Valley are essentially the same, and their mode of life has practically changed very little for thousands of years. We are obliged to admit that, like other infectious diseases, tuberculosis occurs in waves, which have their rise, their period of maximum height, and that this is followed by a fall. We see this sequence in such diseases as plague, influenza, cholera, and typhoid fever, but the interval of time is short, lasting at most over a few decades ; with tuberculosis it apparently extends over centuries. There is evidence that we are now in the period of decline, as during the last half-century there has been a fall in the death-rate from pulmonary tuberculosis of at least one-half. In the latest (1912-13) annual report of Dr. Arthur Newsholme, the Medical Officer of the Local Government Board, we are told that the death-rate has fallen 25 per cent. as compared with the decennium 1891-1900, so that there is much to encourage the hope that great results may be expected from the present combined effort. Either the virulence of the infection is subsiding or the resistance of the population is increasing. Although it is impossible to attribute the improvement to sanitary efforts alone, as the fall in the death-rate preceded by a good many years the alteration in the conditions of life on which we can at present justly congratulate ourselves, it affords no argument for relaxing our defensive measures, but, on the contrary, encourages us with a hopeful prospect of success, now that the assault is weakening and the enemy is beginning to retire.

Hygienic Housing and Town Planning.

In the first line of preventive measures is the improvement of the housing of the people, a principle which has no more strenuous advocate than Dr. John Robertson, Medical Officer of Health for Birmingham. So many houses of the poor are built back to back, and consequently are ill-ventilated, devoid of sunlight, in many cases damp, without sufficient water-supply, and therefore affording little inducement to their inhabitants to keep their dwellings and persons clean. During the year 1912 closing orders were made in 1,262 Birmingham houses, and Dr. Robertson says the people are showing a laudable desire to get away to the outskirts, where better houses exist. There is a limited number of workers whose occupations require them to live near the

centre of the city, and for these provision ought to be made by municipal effort if private enterprise fails. The number of such persons is continually undergoing reduction either by the transference of factories to the outskirts or by vastly improved and cheapened means of communication. This reminds me of the saying once addressed by George Stephenson to an incredulous working-class audience, that the time would come in which the working men would find it cheaper to ride than to walk. He thought this would be brought about by the railways, but it has certainly come to be true in the present day with the network of tramways which enables all working people to get to and from their work with a minimum of expense and loss of time.

It should be the aim of each municipality to have their suburbs planned so that houses suitable for artisans' dwellings may be found within a reasonable distance, and so built that each house possesses a due amount of air and sunlight. Smethwick has not overlooked this matter, although its area is somewhat thickly populated; on the west, adjoining Warley, steps have been taken for planning 330 acres, but there is a much larger plot belonging to Oldbury and adjoining to the Smethwick area, for which the Urban District Council of Oldbury is promoting a comprehensive town planning scheme. The two together will form a very respectable space saved for future development. Those who remember what the country used to be only thirty years ago between Smethwick and the Lightwoods must regret that there was no Town Planning Act in operation to save this pretty part from the fate which has overtaken it. Your great neighbour Birmingham has made a beginning with town planning, and the energetic philanthropy of Mr. John Nettlefold anticipated the action of the city by starting the model village at Harborne. That, too, was preceded by Mr. Cadbury's successful experiment at Bournville, although, as that is, I believe, limited to the employés at the cocoa factory, it is hardly comparable with a town planning scheme which offers houses to all persons able and willing to pay the rents. Two years ago I opened an exhibition of this kind at Hull, and in the course of the speeches reference was made to a garden village which had a population of 2,000, where phthisis had remained unknown, although, according to the average, at least four cases should have developed in the time. In addition to improvements in dwellings there have been great changes for the better in factories, many of which have been recently rebuilt in healthier situations and with far greater provision for natural lighting and ventilation. It is the object of the sanitary reformer to abolish slums, but we must remember that slums are to a large extent made so by the people who live in them. The houses have not always been bad; in many cases they have been occupied at one time by a quite superior

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class of tenants, and their degradation has been due as much to the people who live in them as to any inherent condition. No one wishes to see the working classes living in large barracks, but yet there is a class for whom buildings on the Rowton House plan may be the only possible means by which to provide them with decent surroundings, and in this way offer them a step towards recovering their self-respect.

Before leaving the question of houses, I must not omit to say that where they have been inhabited by tuberculous patients they may remain a source of infection to succeeding tenants. It is, therefore, most important that thorough disinfection of such houses should be undertaken by the sanitary authority, and this should be regarded as equally necessary as after scarlatina and smallpox.

Tuberculosis and Poverty.

The relationship of tuberculosis to poverty has been statistically demonstrated over and over again, but poverty is a complex condition by no means explained by a wages scale. It is determined much more by spendings than by earnings. We hear a great deal about the increased cost of living, yet most things are cheaper than they were forty years ago, while wages are considerably higher; and we hear far too little about judicious spending, the art of marketing, and the value of food. There is an insurmountable prejudice against any food that is cheap.

I do not mean to deny that there is a good deal of poverty, but there is far more bad management and wastefulness. No doubt, if there was better management in this respect, there would be an improvement in health and more money in the Savings Bank; but as a community we can do nothing to raise the rate of wages, or to enable those who earn money to spend it more wisely.

The Compulsory Notification of Tuberculous Cases.

In the direct attack on the problem of tuberculosis, one of the most powerful weapons is compulsory notification of the disease. It was probably wise to proceed gradually, by making it at first voluntary, and after it had been found that there was no serious interference with the principle of medical secrecy or the rights of patients, it was easy to make it compulsory. I believe that this has met with, on the whole, little if any opposition, and that there has been hearty co-operation on the part of medical practitioners. When the name and address of the patient has been obtained, the case is visited by the tuberculosis nurse, and she obtains all the facts of the case, which are kept for reference in the register at the office. In many cases the private practitioner is glad to hand over the treatment to the Tuberculosis Medical Officer, who makes a careful examination of the patient and also of the other

members of the family, so as to detect any early cases of the disease, is present. Many consumptive patients are able to work, and are bread-winners or housewives whose presence at home can be ill spared; so that if it is possible so to arrange that they can have many, if not all, the advantages of sanatorium regimen at home, it is obviously the best thing to do. Shelters, which cost from £4 to £10 apiece, are lent by the local authority, and even bedsteads and bedding will sometimes accompany them. These shelters can be erected wherever there is a backyard or garden, and the nurse can soon put the patient in the way of arranging the sleeping accommodation so as to be quite comfortable. This plan is, of course, only suitable for cases in a certain stage and under special conditions.

Sanatorium treatment is suitable for early cases only. Intermediate cases may be treated at home, but advanced cases may need to be removed to a special hospital. They are a serious source of danger to others, especially when they live in poor homes where they must occupy a bedroom with others, and require such nursing and attendance which would preclude them from being placed in a shelter outside. There may be, also, insufficient means to supply them with the food and nourishment they require, and the whole family may, by the presence of one inmate, be dragged down into poverty. Under such conditions it is better that the case should be removed to what is called a "hospital for advanced cases." Berlin has already 500 beds for advanced cases, and is about to double the number; Edinburgh has 198 beds, besides a farm colony; Birmingham has only 52 beds, which became available since the beginning of February. So that, judged by the local standard, Smethwick will not be far behind.

The Protection of Children.

Provision must always be made for tuberculous and tuberculously disposed children. In every large centre open-air schools should be provided, and there ought to be an effort made to deal with children crippled by tuberculosis on lines similar to that of the Birmingham Cripples' Union. This society, with the financial assistance of Mr. George Cadbury, has established at the Woodlands, Northfield, a sort of open-air sanatorium, where children may be kept for about two years. They receive education, and are discharged with their deformities corrected. A London society has adopted a less expensive plan of boarding out the children in country cottages, where they are visited by some lady resident in the neighbourhood and by the local doctor, who are generally found willing to give their services for the benefit of the little patient. No doubt any necessary operations must be carried out in hospital, and it can only be at a certain stage that the case is suitable for this kind of treatment; but it is not desirable to keep a

child in hospital for two years, nor can it do much harm for children, at the age at which these troubles usually occur, to be deprived of education for a few years.

TUBERCLE VACCINATION : THE PROTECTIVE RÔLE OF THE BOVINE BACILLUS.

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It will be admitted that with a micro-organism so ubiquitous as the tubercle bacillus, we cannot afford to ignore questions of immunization and protection at the same time as we are directing our efforts towards its elimination. The latter goal must still be far from us, and while we are pressing towards it, other issues of importance demand our serious consideration. Of these the most vital to us, living in crowded communities, is the question of acquired immunity from constant slight contact with the germs of disease, and the thesis I propose to defend in the present paper may be shortly stated as follows: That until human sources of infection can be practically eliminated, or artificial immunization becomes an accomplished fact, infection with the bovine bacillus through the use of a well-mixed milk remains our best ally in the campaign against tuberculosis.

This proposition will be best considered under four headings, followed by a short conclusion.

1. *Among Crowded Communities, Infection with the Tubercle Bacillus, whether of Human or Bovine Source, cannot be avoided.*—The high incidence of tuberculosis was first impressed upon the world by the well-known figures of Naegeli of Zurich, but it now appears that a still higher frequency of tuberculous lesions found at autopsy has come to light from still earlier studies—namely, those of Bollinger and Müller for the years 1881 to 1888. They found tuberculous lesions in the following percentage of cases:

Age.	Percentage showing Tuberculous Lesions.
0 to 1 year	12.25
1 to 2 years	28.5
2 to 3 „	36.9
4 to 5 „	61.9
6 to 10 „	40 to 50
10 to 11 „	85.0

These figures come nearer to the modern section statistics of Hamburger and Sluka (Vienna) and of Müller (Berlin); and though it is to