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SIR ROBERT PHILIP AND THE CONQUEST OF TUBERCULOSIS*

BY

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I am not here to honour Robert Philip, since that is for me impossible. His achievements for the benefit of his fellow men are set far above my power to add or detract. Indeed, if anyone is honoured here to-day it is I. I am honoured by the Royal Victoria Hospital Tuberculosis Trust, who have granted me the privilege of delivering this lecture as a memorial to their great founder; and I am honoured by the President and Council of the Royal College of Physicians of Edinburgh, who have permitted me to present my tribute to Robert Philip in the College of which he was one of the famous presidents of the past.

My task is threefold: firstly, I shall attempt to assess Philip's contribution to the control of tuberculosis; secondly, I propose to consider what still remains to be done before his dream of the eradication of tuberculosis comes true; and, thirdly, I intend to comment on the effects of recent trends on the co-ordinated tuberculosis scheme he created.

The Growth of the Edinburgh Scheme

Philip's greatest work was accomplished and his own greatness recognized long before I met him, and I have to go back in medical history to the year 1882 for the commencement of my appraisal. For it was in that year that Robert Koch discovered the tubercle bacillus and Robert Philip graduated in medicine. Doubtless the 36 people who were present when Koch delivered his famous paper on the aetiology of tuberculosis were greatly impressed with the clear, logical, scientific statement that they had heard. The famous postulates could not fail to excite the admiration of the trained observer: the identification of the bacillus in any type of tuberculous discharge; the separation of the bacillus from other organisms; the growth of the bacillus in culture; the inoculation of the culture into animals producing tuberculous lesions; and the recovery of the bacillus from the lesions so produced. All this was surely proof enough of the infective nature of tuberculosis, but its general acceptance was slow. Four years later a new edition of the principal British textbook of medicine still spoke of the infectivity of tuberculosis as a matter of doubt—acute and chronic phthisis would be shown to be varieties of the same disease only "if Koch's discovery of the tubercle bacillus should be confirmed" (Fagge, 1886).

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There was, however, one young man who immediately saw the greatness of the issues very clearly—in a way not common among men less than a year qualified. Philip propounded to his teachers a new doctrine. Clinical examination and what then passed for treatment were not enough. All relevant information should be gathered in what he called a "directory of tuberculosis." An account of the patient's environment must be recorded and, where possible, defects corrected. The patient should be taught, since he was the subject of an infective disease, how to prevent the infection spreading to others. All those in contact with the patient should be examined. Advice for the guidance not only of the sufferer but for the whole family should be issued. These new ideas did not commend themselves to his teachers, and he met much passive and even active opposition. All the more remarkable, therefore, that he succeeded, with the help of a voluntary committee of management and of a few professional friends, in establishing the Victoria Dispensary in Edinburgh in 1887, at a time when he was not quite 30 years of age. When so young a man could do that, small wonder that much else besides should follow.

The rest of the story is well known: the building of the Royal Victoria Hospital and the opening of the first colony, both under the aegis of the voluntary committee which later became the Royal Victoria Hospital Tuberculosis Trust. The City of Edinburgh made its contribution in the provision of beds at the City Hospital, and later in financial grants towards the work of the dispensary. By 1912 the Edinburgh Co-ordinated Anti-tuberculosis Scheme had become so well known that the Government set up a Departmental Committee to report on the general policy for the country as a whole. The result of their deliberations was the famous Astor Reports (1912-13).

It was in these reports that the principles of policy were laid down, and it is to these reports, therefore, that we must now turn for the next step in our appraisal of Philip's work.

In general, the reports recommended the adoption of the Edinburgh model for the United Kingdom. They described in detail the two essential units of the scheme. The first unit consisted of the dispensary for case-finding and assessment, treatment and aftercare, prevention and education. The second unit provided institutional treatment and comprised the sanatorium for early cases whose working capacity was likely to be restored, the hospital for advanced cases, the open-air school, and

the working colony; and in all these places education in its widest sense was to be stressed. The adoption of the Edinburgh Co-ordinated Scheme almost in its entirety was a great triumph for a great man, and it is not surprising that soon after the publication of the Interim Report Philip received the honour of knighthood. I suspect, however, that Philip was not completely satisfied with everything in these reports. I think, for instance, that he was very concerned about the way in which treatment and prevention were separated, and I am sure (recalling his lectures of later years as I do) that he was responsible for the sentence, "Effective treatment leads to prevention and effective prevention leads to diminished need for treatment." This is, if possible, even more true to-day than it was then, since modern chemotherapy is perhaps the most important preventive measure yet devised. Before the chemotherapy era at least 65% of respiratory cases were discharged from institutional treatment still expectorating tubercle bacilli. To-day only 3 to 5% are so discharged. As a result the number of infective cases at home is steadily diminishing. In my own area of Dumfries and Galloway that figure is now as low as 1% of the register, and a similar result is quoted from Edinburgh (Crofton, 1957).

There is another point which I know troubled Philip. The Astor Reports, having divided the tuberculosis service of the country into the two separate units, led to the creation of the two distinct categories of tuberculosis specialists—namely, the tuberculosis officer of the dispensary and the medical superintendent of the sanatorium. This division was certainly not in accordance with the Edinburgh model, where it was fundamental that the dispensary physician was also clinical chief of the associated institutions. Philip was absolutely correct, since all workers should take part in both sides of the service, and one of the good things the National Health Service has done is that it has returned to the original conception of Philip and gone a long way to eliminate the artificial division created by the Astor Reports.

Another matter in which the Astor Committee rather parted with Philip was in the siting of sanatoria. Philip always maintained that the sanatorium should be "under the eye of the citizens." The report agreed with this conception in principle, but stated it would increase the cost of the sanatorium site and that "a more isolated position is usually advisable." How Philip must have detested this loophole, for thus it came about that sanatoria were commonly built in inaccessible places, creating endless administrative problems which beset us to this day, and which could all have been avoided if his guidance had been followed.

A further point in Philip's scheme which was never universally adopted was the institutional separation of the early from the advanced cases. I myself was always most unhappy about this arrangement, and when I had a clinical charge of my own abolished it, since patients always knew the ominous distinction between being allotted a "hospital" as distinct from a "sanatorium" bed. But I can see the reasons for Philip's plan, and can see so clearly his mind at work. He always took what he called the broad view. Individuals meant less to him than the campaign, and if the separation of the advanced sufferers from the curable cases were to mean—as he believed—more efficient management of the greater number of patients, then that was how it had to be.

Happily the distinction has now almost vanished. Therapeutically there is no such thing as an advanced case of tuberculosis; therefore the sanatorium and hospital are one, and all are called hospitals. In a way this is a pity. The word "hospital" means a place for the care of the infirm. The word "sanatorium" means a place for the cure of disease. We are dropping the wrong word.

Bovine Tuberculosis

In the same year that saw the Interim Report of the Departmental Committee Sir John Fraser (then Mr. Fraser) published his famous work on the relative frequency of bovine and human tubercle bacilli in tuberculous disease of bones and joints in children, and Dr. Mitchell published parallel observations on tuberculous cervical glands. It is not surprising, therefore, that a large part of the Final Report (1913) dealt with bovine tuberculosis, and that in the following year the Milk and Dairies Acts were passed. This legislation aimed at ensuring the purity of milk supplies, but on account of the first world war the operation of the Act was postponed in Scotland until 1925, though the preparations for the grading of milk were made under an order of June, 1923.

Philip did not wait for the legislation. He decided to demonstrate in advance to the public and to the farming community alike that tubercle-free milk of the highest grade of purity could be marketed, not as a subsidized project, but as a strictly run commercial proposition. In this he was, as ever, loyally supported by the Royal Victoria Hospital Tuberculosis Trust. The Gracemount Farm Scheme was begun, and in it Philip and the Trust were aided successively by the practical knowledge of Dr. J. C. Simpson and of Mr. John Johnstone. The plan was a great success, and there can be no doubt that much of the progress made since that time has been due to the bold experiment Philip began in 1922. At that time half the milk in the country came from cows which were infected with the tubercle bacillus. Now only 2% of the milk produced in registered dairy farms is not guaranteed to be tubercle-free.

The Control of Tuberculosis

When Philip began his scheme in 1887 the number of deaths from tuberculosis (all forms) in Scotland was 10,275. The corresponding figure for respiratory tuberculosis was 7,418, and we may safely assume that a great many more were registered under some other diagnosis. In 1956 the figures were 801 for all forms and 715 for the respiratory forms of the disease, and I believe that very few additional deaths from tuberculosis are now certified as due to some other cause. This astonishing decline in the mortality from what was for long the most important cause of death is one of the most remarkable chapters in the story of medical progress.

Philip's aim was the control and eradication of tuberculosis. He was so confident that the scheme he had evolved would, if vigorously pressed, help to achieve this result that in 1913 he stated that "in a reasonably progressive community the 'passing of tuberculosis' should practically be an accomplished fact in a generation and a half." Calculated from 1913, a generation and a half brings us to the year 1958. Although he foresaw (Philip, 1913), chemotherapeutic developments in "combinations which may prove efficacious," two unexpected world wars and the cohort effects of the depression between have nevertheless made his prophecy somewhat over-optimistic. Despite this, the prediction of 45 years ago is so nearly true as to be yet another example of his remarkable prescience.

When a result is expected, and follows accurately measures designed to bring it about, it is natural to suppose that the two things are cause and effect. I believe it is so in this instance. Philip naturally liked to stress the effect of the anti-tuberculosis campaign, but in his analysis of the

causes of the decline in mortality he was quite fair. Tuberculosis he regarded as a sensitive index of the public health, and therefore the decline was due to a variety of *factors of general application*. There was the slow but sure rise in the standard of living and in the standard of education of the country. There was health legislation starting from the Local Government Board in 1871, the Public Health Acts of 1875 and 1897, the National Health Insurance Acts in 1912, the establishment of the Ministry of Health and the Board of Health for Scotland in 1919. But in addition to all these general measures two *special factors* operated. One was the diminution, by the elimination of susceptibles, of an epidemic of tuberculosis which had lasted 200 years or more. The other was the anti-tuberculosis campaign. The former factor was, in virtue of its nature, more effective in causing the decline of tuberculosis mortality in the nineteenth century, and was in the twentieth century losing its effect. But nevertheless the decline actually accelerated in the twentieth century, and this might reasonably, therefore, be deemed to be due to the effect of co-ordinated effort in the fight against tuberculosis. So ran Philip's argument, which I believe to be correct. Statisticians, however, have their doubts about its validity, and some consider that it is only in the recent chemotherapy era that a truly accelerating decline has taken place.

Be that as it may, the annual number of deaths at the present time is trifling. The annual number of new cases is still formidable, but is largely due to improved diagnosis, as is shown by the increasing proportion of early cases among those notified. These trends, combined with effective treatment, have led to an enormous saving of life, and we are fully justified in concluding that tuberculosis is now under control. This tremendous achievement has been due in very large measure to the firm purpose and sure vision of Robert Philip.

The Eradication of Tuberculosis

Let us be under no illusion as to what follows. The control of tuberculosis and the eradication of tuberculosis are two very different things. We now have to choose whether to be content with present progress and hope for the best, or whether to call for the tremendous effort which will be required for the elimination of the disease.

There can be only one answer to this, and we who have inherited the problem must aim at eradicating tuberculosis as speedily as may be. Philip's principles will remain the basis of the future intensive campaign, though certain requirements have changed and new techniques developed.

Four aims require to be restated and re-examined: (1) the prevention of infection in those not infected; (2) the prevention of the consequences of infection in those who are infected; (3) the discovery of all unknown cases; and (4) effective treatment and aftercare.

1. The Prevention of Infection

Prevention depends on the removal of active sources of tubercle bacilli, whether they be human or bovine. I have already referred to the successful campaign against tuberculosis in cattle and do not intend to discuss it further. There is still much to be said, however, concerning the elimination of human infection.

In the first place, prevention depends both on early diagnosis and on effective treatment. These are considered below, but meantime let me say that diagnosis if it is to be early, and treatment if it is to be effective, require not only a good physician, be he specialist or practitioner, but a good tuberculosis health visitor as well. The health visitor occupies a key place in the service, and the value of her work ever since Philip appointed his first two visiting sisters in 1887 has been so great that a special tribute is needed here in acknowledgment. As the years have passed, the scope of the tuberculosis health visitor's work has increased.

For example, she now has to deal with domiciliary chemotherapy, and especially with the chronic active case whose bacilli are resistant to all drugs, and she also has important duties in connexion with vaccination by B.C.G.

B.C.G. Vaccination

Calmette was, of course, very anxious to have Philip's support for the B.C.G. campaign and to extend it to this country in the nineteen-thirties. But Philip (1931) was extremely cautious as regards both the duration of protection and the possibility of risk—"Unfortunately by reason of the conditions of the [French] experiment we must remain in the dark for a considerable time yet." This darkness, however, has been resolved, and we now know that B.C.G. is virtually harmless and gives a high degree of protection for a period variously estimated at from five to ten years. The rationale for its continued use in this country may be stated as follows.

Our racial resistance has been slowly built up over two hundred years or more. It seems, however, that in the absence of natural tuberculous infection such resistance can be lost much more rapidly than it was gained (Heaf, 1956). Thus a few infective individuals could do great damage in a susceptible community. To minimize the consequences of this decline in resistance the widespread use of B.C.G. vaccination is indicated, and should continue until the opportunities for natural infection are so low that protective immunization is not worth while. Until that time comes, the groups more especially requiring protection are the tuberculin-negative adolescents, to whom medical officers of health offer vaccination before leaving school, and the tuberculin-negative contacts of active cases. These contacts should include doctors, nurses, and medical students.

How long should we go on with the policy of protective immunization? For the protection of contacts, vaccination is clearly needed so long as cases of active tuberculosis can be discovered, but for the mass vaccination of adolescents the answer is not so obvious.

We do not know as much as we would like to know about the level of tuberculous infection at different ages. Most of the available information in Scotland relates to the year 1954. Murray, Petrie, and Williamson (1955) tested 93.5% of the Musselburgh schoolchildren and found that 47% of those aged 13-14 years reacted to tuberculin. The corresponding figure for the whole of Scotland based on pre-B.C.G. testing in 1954 was 46% (Macgregor, 1957). This figure may well be only approximate, since it is based on tuberculin-testing a smaller percentage than Murray and his colleagues achieved of the total children in their last year at school. Again, various methods of testing, and, of course, many different observers, were involved, but the estimated figures for Scotland and the accurate figures for Musselburgh correspond so closely that they probably afford a reliable guide to the level of tuberculous infection at that time.

At the age of 18 information is very difficult to obtain, but N. W. Horne (1957, personal communication) found that 57% of nurses (not including those already vaccinated by B.C.G.) reacted to tuberculin. By the age of 24, 75% of the population reacted to tuberculin. The last figure is based on reports by Verney (1955), Giannini and Sloan (1957), and Imrie and Gemmill (1956).

Now we know that the number of children aged 14 in 1954 was 75,000 (Registrar-General). According to the information quoted above, 40,000 of those children did not react to tuberculin, but within the next 10 years, if the present rate of infection be maintained, 21,000 more will have converted. The number of persons subsequently developing tuberculous disease may be calculated in two ways: either as a percentage incidence (4%) of the number of converters, or as a morbidity rate for non-reactors (1.94 per 1,000 per annum). In either case it seems that of the non-reactors leaving school in 1954, about 800 would develop clinical tuberculosis within, say, 10 years or so, unless protected by B.C.G.

In order to prevent these cases—or most of them, since even vaccinated subjects (0.34 per 1,000 per annum) develop tuberculosis—40,000 children would have had to be immunized, or 50 persons vaccinated for each case prevented. This is a perfectly reasonable demand on the public health services.

But the situation is changing rapidly year by year. The most detailed figures illustrative of this trend are those of Jarman (1955) in South Wales. Successive surveys in 1950–1 and 1953 demonstrated that the standardized percentage of positive reactors fell from 24.6 to 18.4, whilst the percentage of reversions increased by 13.4. These figures compared very favourably with a similar area (20.2, 18.2, and 2.2 respectively) where the same standard of intensive case-finding had not previously been carried out. It seems clear that in the short space of two to three years the chance of exposure to infection had decreased significantly as a result of intensive case-finding measures.

The latest figures (1956) for Scotland (Macgregor, 1957) show that only 20% of school-leavers now react to tuberculin, and in some rural areas—as, for instance, Dumfries and Galloway (S. K. Drainer, J. B. Shiel, and H. B. Brown, personal communication, 1957)—the figure is only 12%. At the present rate of progress we may quite soon reach the stage at which only 5% of school-leavers will react to tuberculin and only 10% of the population will react at the age of 24. Under these circumstances we would require (on the present population basis) to vaccinate over 72,000 school-leavers each year to prevent approximately 150 cases of tuberculosis, or 480 cases vaccinated for each case prevented. At that stage, having regard to the efficiency of modern methods of treatment, prevention by B.C.G. would become unnecessary. It may well be the treatment of the tuberculin reactor rather than the vaccination of the non-reactor that will become the important part of our programme. In other words, we must increasingly direct our energies towards preventing the consequences of infection—namely, the development of tuberculosis in later years.

2. Prevention of the Consequences of Infection

Despite the fact that B.C.G.-vaccinated school-leavers develop tuberculosis at the rate of 0.34 per 1,000 per annum, we press for vaccination, since without it tuberculosis would arise for a number of years at the rate of 1.94 per 1,000 per annum (M.R.C., 1956). It is a peculiar thing, therefore, that as yet we make no comparable effort on behalf of the school-leavers with the very strongly positive tuberculin reaction, for whom the corresponding morbidity figure is 2.93 per 1,000 (M.R.C., 1956). This seems to be illogical. If it is correct to *prevent* tuberculous infection in order to prevent tuberculous disease, surely it is also correct to *treat* tuberculous infection in order to prevent tuberculous disease.

The treatment of tuberculous infection is not new. Philip (1925) began it over 30 years ago. When the tuberculin-positive child showed signs of vague ill-health, or when the strongly positive reactor showed none, treatment was begun. Possibly two things were wrong with Philip's method. The first was that no genuine chemotherapy was available—only tuberculin; the second, that he called his procedure, perhaps a little pretentiously, “anticipatory detuberculization.” This altitloquence aroused more criticism than most of his work, and the method was soon forgotten by all except a few of his pupils.

Philip always maintained that the pattern of mortality from tuberculosis in later life was set by the prevalence of infection in childhood, though he never adduced statistical proof of this statement. Proof came many years later through the cohort method of epidemiological study by Frost (1939) and Springett (1952). Brooks (1957) therefore concluded that under these circumstances it would be almost negligent not to treat tuberculous infection in early life. Such treatment is now being given. Heaf (1956) uses a combination of isoniazid and *p*-aminosalicylic acid. Waring

(1954) uses isoniazid alone. What the best procedure will prove to be, and what results will be achieved, must await the publication of controlled trials. Meantime Mitchison (1957) suggests that three groups of persons are suitable for prophylactic treatment. These briefly are: (a) individuals with increased exposure to tuberculosis, especially if transient; (b) recent converters; and (c) any tuberculin reactors in countries in which the incidence of infection has been reduced to a very low level. The last of these, Mitchison considers, offers the best chance for the final elimination of tuberculosis.

So it seems that Philip was right after all. How delighted he would have been to see his ideas vindicated. But I suspect that his pleasure in the rediscovery of his method would be somewhat diminished by the dropping of his elegant term “anticipatory detuberculization” in favour of the more prosaic “chemoprophylaxis.”

3. The Detection of all Undiscovered Cases

Philip's teaching was that “we cannot wait for patients to present themselves at out-patient departments. We must search them out in their hiding-places” (Philip, 1909). This became the principal burden of dispensary practice, and especially of contact examination.

Two special methods of case-finding have, however, been developed. For one of these Philip was largely responsible, and in the other he was not.

The Tuberculin Test as a Case-finding Measure

Philip recommended regular tuberculin tests from infancy onwards. The child reactor became not only himself the subject of clinical interest but also the index case in the search for tuberculosis among family contacts. Once again Philip was ahead of his time. That particular method of case-finding could hardly be said to be of practical service in a country where 80% of the children aged 15 showed a positive tuberculin test. The method was more appropriate where there was a lower level of infection. The first major demonstration of this procedure was carried out in Cyprus. It was inspired by Philip and sponsored by the National Association for the Prevention of Tuberculosis, of which Philip was a founder member and for so many years Chairman of Council. The field work was undertaken by the late Noel Bardswell (1937, 1938–9), who based his search for tuberculosis in adults on tuberculin-testing the school population.

The level of infection in this country is now low enough to permit the method to be used effectively in school entrants, of whom only 1% (Doig, 1957) to 9.8% (Minto, 1957) are infected. MacDougall, Mikhail, and Tattersall (1953), for instance, were able to trace the source of infection in school entrants to a hitherto unknown case of pulmonary tuberculosis once for every 250 tuberculin tests performed. There is no doubt that we shall see much success from this type of case-finding provided home-visiting of contacts is carried out intensively enough.

Mass Radiography

Mass radiography has, of course, developed since Philip's day, though as one who pressed strongly for pre-employment examination for those entering industry (Philip, 1927) he doubtless would have welcomed such an important technical development. Mass radiography is the principal means of detecting cases of pulmonary tuberculosis among the apparently healthy. During the first eleven years of the service (1944–55) over two million examinations were carried out in Scotland and over 10,000 active cases discovered—a rate of 5 per 1,000. This is a very important contribution to the work of the chest service, not only from the point of view of early diagnosis but also of efficient therapy and prevention.

But it is not enough. Macgregor (1957) has pointed out that, of all the new cases of respiratory tuberculosis notified in 1954, only 13% were discovered by mass radiography.

The percentage for 1955 was 15. Most of these are probably discovered in the pre-symptomatic phase, but, even if we allow for the fact that some of the contact group are also diagnosed while apparently healthy, it seems unlikely that in Scotland as a whole as many as one-fifth of all new cases are discovered before symptoms have begun.

We do not know the number of undiscovered infective cases in Scotland. It must still be large, since over 6,000 new cases of tuberculosis have been notified annually of recent years. Various attempts have been made to determine the size of the "infective pool." The nearest approach to x-raying the whole of a defined population was achieved in Annandale, Dumfriesshire, where Cochran, Clayson, and Fletcher (1957) x-rayed 95.1% of 8,650 persons. In all, four surveys have x-rayed 90% or more of the populations concerned. Two of these were carried out in South Wales (Cochrane *et al.*, 1952, 1956) and two in Dumfriesshire. These investigations surveyed a total population of about 35,000. The combined results showed that for the industrialized areas the level of previously unknown infective tuberculosis was 2.2 per 1,000, and for rural areas 0.8 per 1,000. If we apply these rates to Scotland we may suggest that the "pool of infection" consists of about 6,000 persons.

This may well prove to be an underestimate when the full details of the recent Glasgow survey are available. We already know, however, the figures for clinically significant tuberculosis. In the Glasgow survey there were 9.5 per 1,000 and in the two Dumfriesshire surveys 2.7 per 1,000. If these figures are confirmed, I suggest that there are 23,000 unknown cases of clinically significant tuberculosis in the adult population of Scotland, and therefore 8,000 may well be infective.

Whether mass radiography, as at present practised, can discover these cases within any reasonable period of time is extremely doubtful. The available facilities are insufficient even for the large centres, so that the small burghs and landward areas (comprising nearly half the population) are virtually unexplored. Even in those places where mass radiography is in routine operation the problem is how to secure the attendance of that section of the people which has not hitherto volunteered.

There would appear to be three methods by which the service could be broadened and made more effective. These are: (a) the large industrial survey; (b) the small community survey; (c) group radiography.

The Large Industrial Survey.—This is the intensive type of campaign recently carried out with such great success in Glasgow. It was a superb effort of propaganda and organization, with mobilization of reinforcements for the city's chest service from other areas. The detailed results will be awaited with lively interest. Preliminary results indicate that 76% of the population of the city were x-rayed, a truly remarkable achievement. Clearly, however, the resources of Scotland are inadequate for this type of campaign to be more than a special occasion, for which quite exceptional arrangements were made to deal with an exceptional problem.

The Small Community Survey.—This is necessarily a more prolonged type of survey, which up to the present time has proved itself especially suited to securing a very high response in populations of up to 20,000 people. The successful surveys in Annandale (95.1%) and the Vale of Glamorgan (94.6%) have been commented on already. They were based on census-taking and conscientious home-visiting. The second survey by Cochran, Clayson, and Fletcher (the results of which are at present being analysed) showed that in the part of the town where a census and home-visiting were completed a 92.5% response was obtained, but in that part where no home-visiting was done and only the usual propaganda methods were relied on the response was 70% (figures provisional). It is, in my opinion, this painstaking small survey carried out as part of the chest service and extended area by area with careful home-visiting which offers the best prospect for the future.

Group Radiography.—This implies an admission that the mass radiography service is unable to x-ray a sufficient percentage of the population—or, alternatively, that financial resources are insufficient for it to do so—and should increasingly be used to examine those groups in which a high incidence of disease is expected or in which an isolated sputum-positive case could do considerable damage. This possibility is one requiring thorough investigation.

4. Efficient Treatment and Aftercare

To-day treatment is more effective than it has ever been, and conversion of sputum from positive to negative can almost always be assured. There are very few cases indeed, however advanced, that will not convert with six or nine months' chemotherapy. Provided, further, that treatment is conscientiously maintained for two to three years, even the most serious case may well become arrested. So far as the less serious cases are concerned, the controlled trial co-ordinated by Kay (1957) on behalf of the Research Committee of the Tuberculosis Society of Scotland showed that such patients need not cease work provided efficient chemotherapy can be maintained. For patients requiring rest in bed a controlled trial has recently been reported from Glasgow by Kennedy (1957). Results after six months indicated that, except for adolescents, such patients improved clinically and radiologically as much at home as in hospital provided all received efficient chemotherapy. Certain wider aspects of care work and prevention were, however, more difficult at home. This was not surprising, but the trends illustrated in these reports are indicative of the highly efficient standard of modern chemotherapy. Follow-up results will be awaited with great interest in order to assess the frequency of relapse in evaluating domiciliary treatment as contrasted with hospital treatment.

Relapse is, however, a diminishing problem. In the pre-chemotherapeutic era 27% of admissions to Dumfries and Galloway Sanatorium were on account of relapse. Last year this figure was 15%. These cases, however, were late relapses from the days when no chemotherapy was available or was given in a way we would now only regard as bad or suspect. In no case was relapse noted in which previous treatment had been regarded as correct. Nevertheless, tuberculosis has long been considered to be a chronic relapsing disease, and we still do not know how permanent chemotherapeutic cure may be. Consequently aftercare and supervision are increasing in importance.

An unsolved problem concerns the emergence of *drug-resistant organisms*. In my own area pre-treatment sputum testing has been carried out for the last three years and no patient with primarily resistant organisms has yet been found. But Fox and his colleagues (1957), in a nation-wide survey, estimated that 1 in 20 of the newly discovered cases of tuberculosis shows some degree of bacterial resistance. The problem has arisen, in part, from our own ignorance of chemotherapeutic methods some years back, and in part from lack of co-operation by patients. In Britain these drawbacks are now diminishing, but where tuberculosis is a much more serious problem, as in the underdeveloped countries, the almost inevitable emergence of resistant tubercle bacilli on a wide scale will be a serious menace. In this country, however, very few newly resistant strains should now emerge through defective treatment, and, indeed, there would be little excuse for this occurring.

In surveying these trends in prevention, ascertainment, and treatment, I think we may conclude that so far as treatment is concerned the prospects for eradicating tuberculosis are good, but in relation to finding the unknown case, on which depends successful prevention, we have still a long way to go.

Future Developments in the Tuberculosis Service

Finally, we must consider what the implications are of recent trends on the future of the service which Philip built up. The impact of these developments will be considerable.

Institutional Treatment

I recalled to your memory earlier in this lecture Philip's prophecy in 1913 regarding the passing of tuberculosis in a generation and a half. In 1927 in his Presidential Address to the British Medical Association in Edinburgh he repeated this prediction by saying that when the next meeting was held in Edinburgh (the date of which is now known to be 1959) tuberculosis would be largely a memory of the past. He elaborated this forecast and said that "in proportion as it is recognized that tuberculosis may be prevented or, at least, that the worse consequence of infection may be anticipated and averted, the scheme of remedial institutions which are immediately necessary because of the ignorance and neglect of the past will undergo progressive modification and curtailment." We are now witnessing the fulfilment of Philip's prediction exactly as he foretold.

There is, in my opinion, no real substitute for learning in the sanatorium "the physiological principles which make for health," but increasingly early diagnosis combined with modern chemotherapy has meant—as we have seen—that some patients do not require sanatorium treatment. A recent report on the Future Service for Tuberculosis and Diseases of the Chest in Scotland (1957) suggests that 25% of new cases are suitable for treatment at home. The report further indicates that by 1960 less than half the institutional beds in use in 1955 will be needed.

Dispensary or Chest Clinic

The diminishing trend in institutional work is not reflected in out-patient work, which is, on the contrary, increasing steadily. The available returns show that in the five years 1951–6 an increase of almost 30% in clinic attendances was registered. This has partly been due to the same factors which led to a diminished demand for in-patient treatment. In addition, chest clinics in collaboration with local health authorities are enlarging the scope and frequency of contact examinations. Any or all of the methods in which we considered that mass radiography might develop would throw an enormous amount of extra work on the clinics, which would increase still further if we look forward to the planned development of prophylactic chemotherapy. Lastly, but of more immediate consequence, there is a mounting awareness on the part of general practitioners of the possible significance of unexplained chest symptoms. For all these reasons the chest clinic is increasing in importance, and this trend will continue.

"The Chest Service"

It is significant that in recent years the word "dispensary" has been by common consent dropped, since it no longer indicates the functions of that institution, and has been replaced by the term "chest clinic." This change implies the recognition of the fact that the scope of the clinic is broadening. Whilst all forms of tuberculosis continue to be referred there, the clinic now is a special department to which practitioners are referring patients with all manner of respiratory disorders for investigation. Patients are no longer sent "to exclude tuberculosis" but for the diagnosis of any condition affecting the respiratory system.

The same tendency is observable in sanatoria. For years a proportion of non-tuberculous cases have been treated in sanatoria, but usually the shortage of beds prevented this type of work on any appreciable scale. Now that beds are freely available, however, practitioners are sending increasing numbers of patients suffering from many respiratory complaints—usually, however, the more chronic types—to sanatoria, in some of which special non-tuberculous chest units have been opened.

So we find that the scheme built up so many years ago by Sir Robert Philip is expanding its functions in a manner which would, I think, have pleased him. Indeed, he himself foresaw just such a development (Philip, 1918), and the provisional order relating to the chair of tuberculosis made it possible, when desirable, to include allied diseases within

the scope of the department. What was provided for in the academic sphere may well be fostered also in clinical practice. Indeed, the machinery of the chest hospital and chest clinic, springing as it does from the old tuberculosis service based on Philip's "physiological principles," is especially suited to the treatment of many respiratory disorders. So long as we maintain that old tradition, coupled with modern developments, we have all the necessary equipment for a broad and effective chest service, and it is to this amalgamation of tuberculosis and allied diseases that we must now address ourselves. Perhaps this development will be a step towards the reintegration of tuberculosis with general medicine, whence it came when Philip started his co-ordinated anti-tuberculosis scheme in the year of Queen Victoria's Jubilee.

Conclusion

What began as a tribute to Sir Robert Philip has developed into a commentary on the problems of to-day and to-morrow. Again and again I have stressed how clearly Philip foresaw the problems not only of his time but of ours. That his endeavours have borne fruit so abundantly in many lands has been due to two great gifts, which have been called in another connexion "high heart" and "sure vision." These are qualities which all may properly envy but few may ever achieve. It is enough for me to have worked with one who had them in full measure.

When the high heart we magnify,
And the sure vision celebrate,
And worship greatness passing by,
Ourselves are great.

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The only new project noted in the 1956 annual report of the National Coal Board's medical service is a survey of the bacterial content of the air in mines. Earlier pilot studies have revealed unexpectedly high bacterial counts at the coal face, and the intention is to discover what bearing these may have on the causation of complicated pneumoconiosis and chronic bronchitis in miners. Research on cancer in coke-oven workers was discontinued in 1955, "as it had produced sufficiently reassuring and conclusive results." The report is issued from the National Coal Board, Hobart House, Grosvenor Place, London, S.W.1.