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Sutherland, Halliday, 1882-1960.
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Publication/Creation

Edinburgh And London : W. Green & Sons, 1911.

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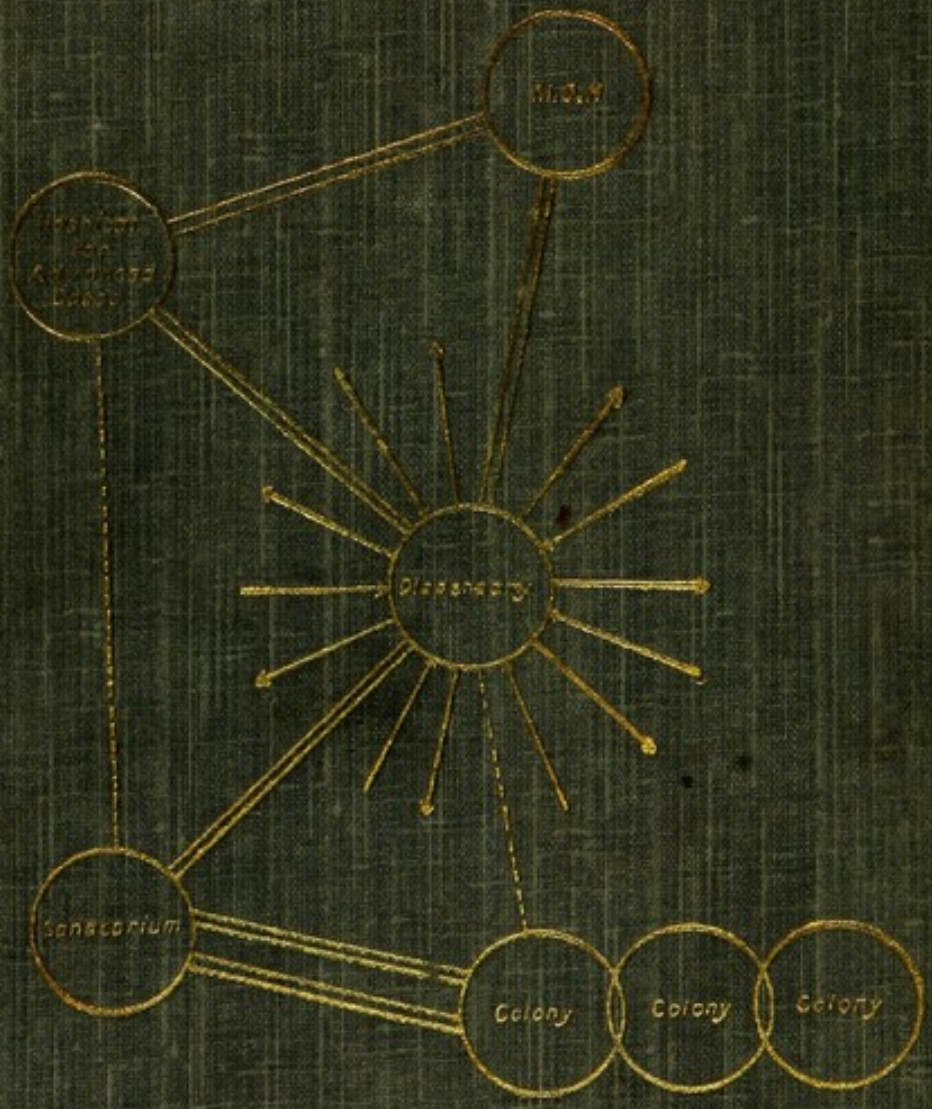
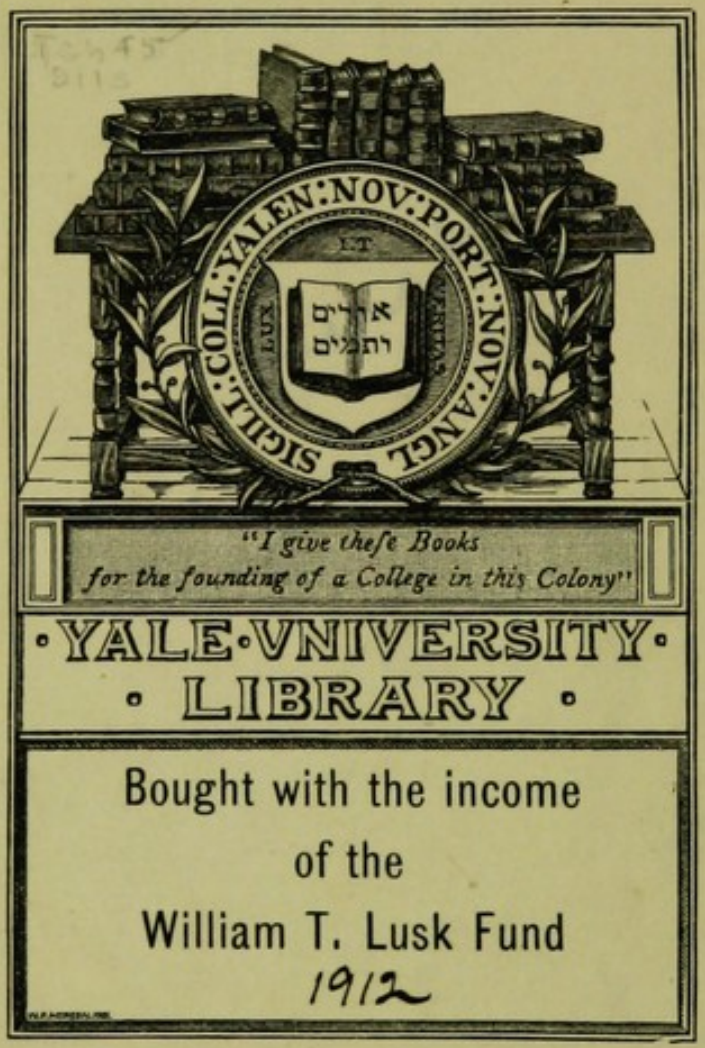
THE CONTROL AND ERADICATION OF TUBERCULOSIS





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A SERIES OF INTERNATIONAL STUDIES

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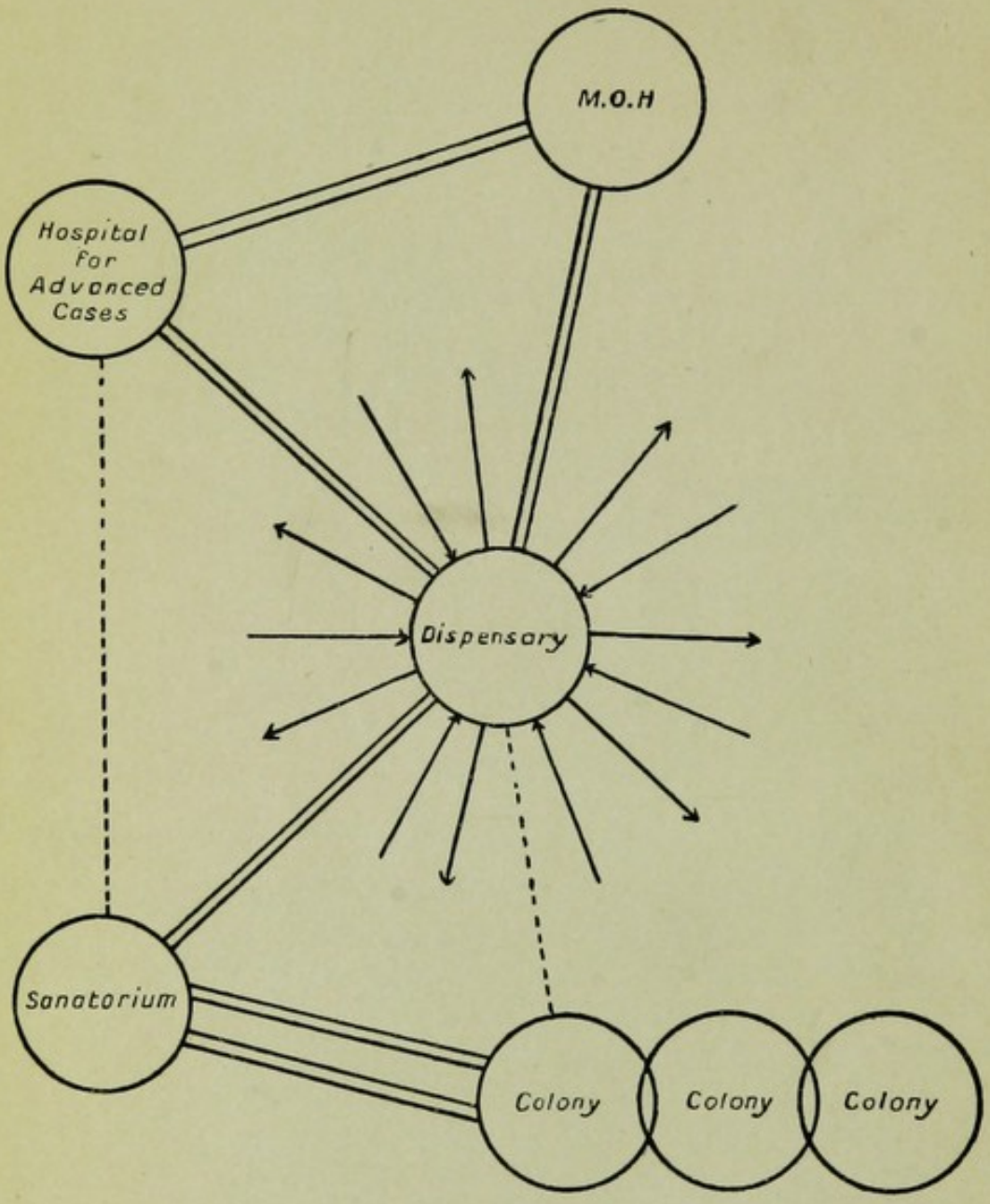

General Plan.

THE CONTROL AND ERADICATION OF TUBERCULOSIS

A SERIES OF INTERNATIONAL STUDIES

BY MANY AUTHORS

EDITED BY

HALLIDAY G. SUTHERLAND, M.D.

MEDICAL OFFICER TO THE ST. MARYLEBONE ANTI-TUBERCULOSIS DISPENSARY

EDINBURGH AND LONDON

WILLIAM GREEN & SONS

MEDICAL PUBLISHERS

1911

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TO

R. W. PHILIP

FROM

PUPILS AND FRIENDS

OPEN LETTER TO R. W. PHILIP, Esq., M.A., M.D.,

Fellow of the Royal College of Physicians of Edinburgh; Honorary Fellow of the Gesellschaft für Innere Medizin, Vienna.

Sir,—In asking you to accept this work on the Control and Eradication of Tuberculosis we do so, not only as a tribute to the pioneer in this field of medicine, but also in the hope that these studies, bearing the impress of your teaching, and contributed by writers of many nations, may advance the movement in this and in other lands.

Among the anticipations and foundations of your work the light of Läennec on the pathology of a malady still hopeless was obscured by vague terms. An earlier plea in a "Letter from a Physician in the Highlands" to his friends in London for the healing property of open air lay unheeded, to be revived by George Bodington in a sanatorium, soon closed amid ridicule, as at Belfast in the life and practice of Henry MacCormac, yet to be carried out within living memory among the Mountains of Silesia by Brehmer, and amid the lakes and pines of the Adirondacks by Edward Trudeau. It was the discovery of Koch that defined the basis of all advance.

Engaged at the time in research abroad, you realised the vast issue, and returned to Edinburgh to establish and elaborate the method which now bears your name. Of that system this book is an exposition.

"Take thou the writing . . . . . .
. . . . . .
If any light burn in the imperfect page,
. . . . . The praise is thine."

Your Pupils among the Contributors.

PREFACE

THE purpose of this book is stated in the Open Letter to Dr. R. W. Philip. A preface is necessary to record our regret at the death of Professor Arloing of Lyons, whose last contribution to Medicine appears in these pages. Grateful acknowledgments are due to Colonel R. L. A. Pennington for translation of the French, to Miss E. Djürberg for that of the Norwegian, to Dr. Robert Govan for valuable assistance in the correction of the work in proof, and to the Publishers for their kind attention as the volume was passing through the press.

THE EDITOR.

LONDON, *October* 1911.

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CONTENTS

PAGE

Open Letter to Dr. R. W. Philip vii

CHAPTER I

Introduction—The Edinburgh System (Professor E. Béraneck) . . 1

CHAPTER II

The Extent of the Disease and the Sources of Infection (Dr. Halliday Sutherland) 5

CHAPTER III

The Edinburgh System—Principles and Methods (Dr. W. Leslie Lyall) . 24

CHAPTER IV

The Tuberculosis Dispensary—Functions and Organisation (Dr. D. J. Williamson) 31

CHAPTER V

The Tuberculosis Dispensary—Methods of Work and Results (Dr. D. J. Williamson) 49

CHAPTER VI

The Sanatorium: Conception, Construction, and Administration (Dr. James J Galbraith). 70

CHAPTER VII

The Sanatorium: Methods of Treatment (Dr. Halliday Sutherland) . . 92

CHAPTER VIII

The Theoretical and Practical Basis of Tuberculin in Treatment (Professor E. Béraneck) 105

CHAPTER IX

PAGE

One Aspect of Tuberculin Treatment (Dr. E. Bauer) 119

CHAPTER X

The Physiology of Digestion in its Application to Dieting in Tuberculosis (Professor John Malcolm and Dr. James J. Galbraith) . . . 125

CHAPTER XI

Open-Air Schools (Dr. W. E. Goss and Dr. Halliday Sutherland) . . 142

CHAPTER XII

The Place of the Farm Colony in Treatment (Dr. A. H. Macpherson) . . 152

CHAPTER XIII

The Hospital for Advanced Cases (Dr. A. Maxwell Williamson) . . 157

CHAPTER XIV

Public Health Aspects of the Edinburgh System (Dr. A. Middleton Hewat) . 169

CHAPTER XV

The Administrative Control of Pulmonary Tuberculosis (Dr. W. Leslie Mackenzie) 180

CHAPTER XVI

The Tuberculosis Laboratory 193

I. Present Biological Problems (Dr. A. E. Porter) . . . 193

II. Anti-Tuberculous Vaccination of Bovines (the late Professor Arloing) 220

III. A Critical Study of Serum Agglutination and the Ophthalmic Reaction in Tuberculosis (Dr. Fernand Arloing) . . 229

CHAPTER XVII

The Anti-Tuberculosis Movement in Canada (Professor J. George Adami) . 233

CHAPTER XVIII

The Anti-Tuberculosis Movement in South Australia (Dr. J. Ernest Good) . 241

CHAPTER XIX

PAGE
The Anti-Tuberculosis Movement in South Africa (Dr. David P. Marais) . 246

CHAPTER XX

A Note on Tuberculosis in India (Captain E. D. W. Greig, I.M.S.) . . 249

CHAPTER XXI

The Anti-Tuberculosis Movement in the United States (Dr. Lawrason Brown) 256

CHAPTER XXII

Administrative Measures for the Control of Tuberculosis in New York City (Dr. Hermann M. Biggs) 278

CHAPTER XXIII

The Movement in the State of Massachusetts (Dr. Vincent Y. Bowditch) . 288

CHAPTER XXIV

The Movement in Pittsburgh (Dr. W. Charles White) 299

CHAPTER XXV

The Movement in Germany, Austria, and Hungary (Dr. W. Fornet) . 314

CHAPTER XXVI

The Movement in Russia (Dr. A. W. Nikolsky) 331

CHAPTER XXVII

The Movement in Italy (Dr. G. Sandison Brock) 342

CHAPTER XXVIII

The Movement in Scandinavia and Denmark 355
I. Norway (Dr. Klaus Hanssen) 355
II. Sweden (Dr. Sture Carlsson) 362
III. Denmark (Professor Saugman) 371

CHAPTER XXIX

PAGE
The Movement in Switzerland 376
I. The Genesis, Development, and Results of the Movement (Dr H. Carrière) 376
II. The Anti-Tuberculosis Dispensary at Neuchâtel (Dr. C. de Marval) . 386

CHAPTER XXX

The Movement in the Netherlands (Dr. W. G. Van Gorkom) . . 393

CHAPTER XXXI

Fons et Origo—The Origin and Progress of the Edinburgh System . . 397
I. Bibliographical and Chronological 397
II. A Selection from the Writings of Dr. R. W. Philip . . . 400
Progressive Medicine and the Outlook on Tuberculosis . 400
Public Aspects of the Prevention of Consumption . . 427

CHAPTER I[1]

INTRODUCTION—THE EDINBURGH SYSTEM

BEFORE the actual cause of tuberculosis was known, it was recognised that this terrible malady was induced by concentrations of human beings and by the usually deplorable hygienic conditions under which such concentrations are obliged to live. Since the world-renowned discovery of the tubercle bacillus by Koch we have a clear perception of the manner in which this micro-organism multiplies and claims new victims under the favouring atmosphere of a defective hygiene.

Allowing that all civilised nations have recognised the importance of removing those conditions which favour the extension of tuberculosis, Scotland has incontestably been the first to systematically and completely organise the anti-tuberculosis campaign. Dr. Philip, of Edinburgh, was the originator of that noble and generous crusade. At a period when the attitude of public bodies in Europe was strongly marked by inertia, this distinguished doctor and philanthropist saw clearly that the struggle against this redoubtable scourge must inevitably be carried on by social organisation, and with Dr. Philip rests the glory of the conception and realisation of a complete equipment against tuberculosis, dating from 1887. This now approaches perfection, and may well serve as a universal model. It was, in fact, in the year 1887 that Dr. Philip created that new institution, "the Anti-Tuberculosis Dispensary," which has rendered such inestimable services. From the outset he invested this dispensary with its prophylactic agency, and thus constituted it the first of the operations against tuberculosis. On the Continent the fact that the Anti-Tuberculosis Dispensary emanates from Edinburgh, and is the work of Dr. Philip, has too long remained unrecognised. Now, however, complete justice is done to this savant; this is illustrated by the fact

[1] Translation by Colonel R. L. A. Pennington.

that the dispensary "Emile Roux," due to the initiative of Professor Calmette, of Lille, was only established in 1900.

The creation of the Anti-Tuberculosis Dispensary merits of itself the gratitude of the civilised world, but in the struggle against the disease Dr. Philip was not content to rely on that one institution alone, however great its practical value. From the year 1887 onwards he faced, with singular clearsightedness, the solution of the social problem of tuberculosis. That solution is made dependent on:—(1) The Anti-Tuberculosis Dispensary; (2) the Sanatorium for Indigent Curable Cases; (3) the Hospital for Advanced Cases; (4) the Farm Colony for Convalescents; and to these must be added administrative measures, such as notification, assistance to indigent workers and their families, etc. Dr. Philip has made it clear in numerous publications and addresses that we can only hope to extirpate tuberculosis by the harmonious action of the various measures referred to.

Shortly after the creation of the Anti-Tuberculosis Dispensary there was founded the Royal Victoria Hospital. This latter is an original conception, admirably adapted for ærotherapy. In addition to a large building, with accommodation for general hospital requirements, kitchen, dining-room, etc., there are a series of small pavilions, each capable of housing sixteen patients. Each of these pavilions is raised from the ground on short supporting pillars, and is so arranged in ground plan as to admit the maximum air and sunshine to all parts equally. The original design of the Royal Victoria Hospital merits close study on the part of sanatorium builders, as it is better suited to the treatment of the disease than our usual class of caravanserai.

A study of the annual reports of the Royal Victoria Hospital affords much valuable instruction. It was formerly, and is still held to be, an article of faith that climate must be the main factor in the choice of locality for a sanatorium; consequently, in order to secure a favourable climate, sanatoria are frequently constructed far removed from the localities they are intended to serve. Without denying the importance of climate, Dr. Philip regards fresh air as of primary importance in treatment, and considers that this is usually obtainable within easy reach of the majority of indigent cases, who are thus better kept under surveillance. For this reason the Royal Victoria Hospital was founded at the gates of Edinburgh, and the results are in no way inferior to those obtained by other sanatoria in elevated localities, which enjoy so-called irreproachable climatic conditions. One advantage of the Edinburgh plan is that it admits of the reception of out-patients in

the sanatorium, where they benefit during the day by an open-air life and good nourishment; in the evening they return to their homes for the night.

The anti-tuberculosis equipment created in Edinburgh has already justified its establishment. During the decennium 1897-1906 the mortality from pulmonary tuberculosis in Edinburgh shows a diminution of 42 per cent., and the pioneer of this world crusade against tuberculosis may well be proud of such a result.

Unquestionably, if the measures existing in Edinburgh were applied universally, the extension of the disease would be prevented, and within a measurable time this scourge would become extinct. Dr. Philip considers that public bodies, and especially municipal bodies, should organise the campaign. This is as it should be, but it must be remembered that it is only the large bodies which possess sufficient financial resources to establish satisfactorily the equipment on the Edinburgh model. At the same time the small towns should hardly be expected to adopt an inactive policy simply because their financial status prohibits the establishment of so complete a system as is possible in a town like Edinburgh. I should judge that the solution of this problem may be sought in the closer co-operation between the State and municipal and private corporations, which would render possible a more vigorous and effective campaign. Unfortunately we have not yet arrived at this point, and in many countries the anti-tuberculosis movement is still incomplete and badly co-ordinated. In this respect the education of public bodies as well as that of citizens is far from complete. Municipalities are too often satisfied that they have fulfilled their duties by the erection of sanatoria or by the foundation of dispensaries alone. Still one sees decided progress, for both Governments and private societies are beginning to realise more clearly that complete co-ordination of all parts of the system is indispensable to combat the disease effectively.

In this respect the attitude of Germany is significant. After having declared the sanatorium to be the one and only method of combating tuberculosis, Germany has realised that this means alone is insufficient, and she has completed her anti-tuberculosis equipment on the lines of the Edinburgh system. In Switzerland, allowing for what has already been accomplished, much remains to be done before we can see the establishment of the Edinburgh system in our populous and industrial cantons. Let us hope sooner or later to succeed. The seed sown by Dr. Philip twenty-three years ago in Edinburgh has borne

fruit, and little by little his ideas have advanced through the civilised world. It is sincerely to be hoped that the public bodies in the different countries may become more and more inspired by the Edinburgh example to wage a war of extermination against tuberculosis, a war which shall result in complete victory over this baneful disease.

E. BÉRANECK.

CHAPTER II

THE EXTENT OF THE DISEASE AND THE SOURCES OF INFECTION

Tuberculosis in the United Kingdom—Considered as an Infective Disease—Economic Considerations—Loss in Wage-Earning Power—The Sources of Infection—Growth of Knowledge—The Nature of the Parasite—Pathogenic Action of the Bacillus—Philip's Classification of Pulmonary Tuberculosis—Sources of the Parasite—The Two Theories—Tubercle Bacilli of Human Sources—In Sputum—In Droplets of Secretion—Pulmonary Tuberculosis as a House Disease—Absence of Infection in Sanatoria—Tubercle Bacilli of Bovine Sources—Bovine Bacillus Lethal to Man—Findings of Royal Commissions—Bovine Bacilli in Human Tuberculosis—Infrequency of Infection from Bovine Sources—Avian Tubercle Bacilli—The Means whereby Man is Infected—Congenital Inoculation—Inoculation by a Wound—The Respiratory System—Direct and Indirect Infection by Inhalation—The Alimentary System—Vehicles of Infection—Direct and Indirect Infection—Animal Experiments—Intestinal Tuberculosis in Childhood—The Unity in the Means of Infection—The Basis of the Edinburgh System.

Tuberculosis in the United Kingdom

Tuberculosis, an infective and preventable disease, is responsible for one-ninth of the total death-rate of this country. Pulmonary tuberculosis, the major form of this malady, claims over fifty thousand victims every year in the United Kingdom, disables at least one hundred and fifty thousand more, while there are probably over five hundred thousand infected persons, constituting a problem for medical and sanatory consideration. It is the direct cause of one-eleventh of the pauperism in England and Wales, a charge on the State of one million sterling per annum.

As an infective disease we may consider tuberculosis in relation to other preventable diseases against whose prevalence large sums are annually expended. In the following table (Table I.) are stated the number of deaths in 1907 from the most common diseases prevalent in the United Kingdom.

TABLE I.

Number of Deaths in the United Kingdom from—

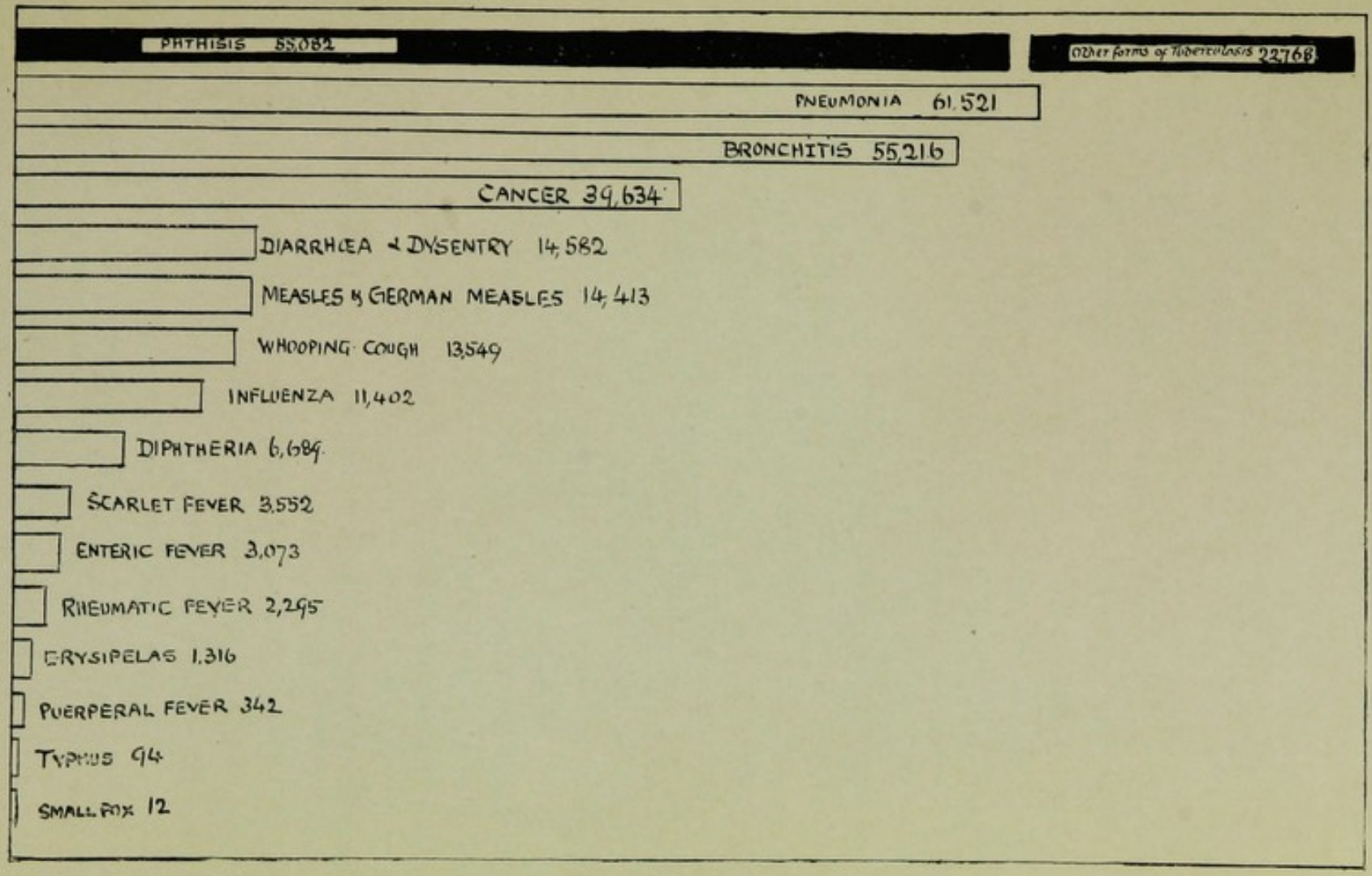
	England and Wales.	Scotland.	Ireland.	Total.
1. Smallpox	10	1	1	12
2. Typhus Fever	24	14	56	94
3. Puerperal Fever	214	87	41	342
4. Erysipelas	1,033	191	92	1,316
5. Rheumatic Fever[1]	2,024	112	159	2,295
6. Enteric Fever	2,344	367	362	3,073
7. Scarlet Fever	3,220	233	99	3,552
8. Diphtheria	5,732	674	283	6,689
9. Influenza	9,257	425	1,720	11,402
10. Whooping-Cough	10,255	2,485	809	13,549
11. Measles and German Measles	12,672	1,154	587	14,413
12. Diarrhœa and Dysentery[2]	10,658	2,177	1,747	14,582
13. Cancer[3]	31,745	4,551	3,338	39,634
*14. Bronchitis	42,204	5,167	7,845	55,216
*15. Pneumonia[4]	46,967	10,452	4,102	61,521
16. Phthisis[5]	39,839	6,415	8,828	55,082
16. Other forms of Tuberculosis	16,262	3,655	2,851	22,768
All Causes of Death	524,221	77,296	77,334	678,851

* These headings unquestionably include many deaths from Pulmonary Tuberculosis.

[1] Excludes Rheumatism of Heart, but includes Acute Rheumatism of Heart.
[2] Includes Epidemic Diarrhœa or Infective Enteritis, Diarrhœa (undefined), Dysentery, Enteritis, and Gastro-Enteritis.
[3] Includes Carcinoma and Sarcoma.
[4] Includes Lobar and Broncho-Pneumonia.
[5] Pulmonary Tuberculosis and Phthisis not otherwise defined.

During the above year smallpox, also an infective and preventable disease, claimed but twelve victims in this country, and it were well to consider the organisation of smallpox isolation hospitals in every town and county, the huge legislative machinery created by the State for vaccination, and the sums annually expended against the prevalence of this disease, while against these measures we may compare the comparative apathy as regards tuberculosis, with its annual death-roll of over seventy thousand lives.

An important point of distinction between pulmonary tuberculosis and the more common infective fevers—measles, whooping-cough, scarlet fever, and diphtheria—is that the latter claim the majority of their victims under the age of 10, while the mortality from pulmonary tuberculosis is highest during the working years of life. No one would minimise the pathos of deaths in childhood, but in their consequences these are incomparable to those occurring in working adult life. The child has no responsibilities, the adult has. Money has been expended



COMPARATIVE MORTALITY FROM THE MOST COMMON PREVENTABLE DISEASES IN THE UNITED KINGDOM, YEAR 1907.

on his maintenance, education, profession or trade, and he has taken on the further responsibility of founding a home and family. He has issued an endowment assurance to the State, which can only be regarded as paid up when his children are self-supporting, and he himself by his industry is independent in old age.

The argument is at times brought forward that so long as unemployment exists the loss to the State from deaths in adult life is minimised, as the places of the workers are taken by those who would otherwise be unemployed. In such a proposition there are three economic fallacies. If a worker who held his place in open competition be cut off by a preventable disease, and his place is taken by another who would otherwise be unemployed, it is obvious that the standard of competition has been lowered. Further, the replacement of a wage-earner in no way mitigates the suffering entailed to his dependants. Moreover, whether his place be taken or not, the loss to the State is the same. When an army is in action, and the losses in the firing line are made up by reserves, the reduction in strength is still as before. The loss of a wage-earner, in as much as it does not extend the total available producing power of the country, the only economic cure for unemployment, is a loss to the State.

The Sources of Infection

In ascertaining the sources of infection in a bacterial disease it is necessary to consider—firstly, the nature of the parasite; secondly, its sources; and thirdly, the means whereby man is infected.

The Growth of Knowledge.—From the earliest days of medicine down to the beginning of the nineteenth century there existed a widespread suspicion of the infectivity of tuberculosis, and here and there throughout the centuries the idea was enunciated that the consumptive created an infectious environment, or that the flesh of tuberculous animals might be noxious to man. Thus Galen (130-200 A.D.) held it dangerous to pass a day in the neighbourhood of a tuberculous patient, and in Spain during the sixteenth century there were legislative provisions against infections from this source. As far back as the fifteenth century the laws of Munich prohibited the sale of tuberculous meat, but these ordinances were not stringently enforced until the early years of the eighteenth century, when the erroneous belief became prevalent that tuberculosis was identical with syphilis, and on this opinion being dispelled in 1783, the sale of tuberculous carcases was permitted by the central health authority in Berlin. At the beginning of the nineteenth

century a general doubt arose as to the contagious nature of tuberculosis, and the tubercular diathesis, without which it was assumed the disease could neither attack nor spread, came to be regarded as the determining factor in its causation. Such instances illustrate the darkness which shrouded the ætiology of tuberculosis for eighteen centuries.

In 1810, in France, Bayle published the results of one of the most brilliant, careful, and complete researches ever recorded in pathology, which demonstrated the essential nature of the morbific process in tuberculosis, and in 1811 Läennec further developed this view of the unity of the tuberculous process — that every manifestation of the disease in man or in animals was due to one and the same cause. He believed there was a primary tuberculous substance which had the power of building up "tuberculous tumours" of a gelatinous nature if it were transplanted to suitable tissues, and was thus possessed of infective properties. It is to be remembered, however, that in the teaching of Bayle and Läennec infectivity was interdependent upon the presence of a special diathesis.

These views produced a profound impression upon the medical thought of that time, but it was not until 1865 that the infective nature of tuberculosis was experimentally demonstrated in France, where Villimin proved the possibility of inducing the disease in an animal by inoculation with the infective material from another, not only of the same, but also of different species. So firmly did Villimin believe in the infectivity of tuberculosis that he considered the pulmonary tuberculosis of which Läennec died to have arisen from the infection of a wound twenty-one years prior to its onset. In 1882 came the brilliant discovery of the tubercle bacillus by Koch, proving beyond all question the bacterial and infective nature of this disease.

I. The Nature of the Parasite

Pulmonary tuberculosis and every other form of tuberculosis in man and in animals is due to the tubercle bacillus, an organism measuring $\frac{1}{24000}$ of an inch in length, consisting of a single cell, and classed amongst the lowest known forms of life. The zoologist would include them with the Infusoria, the botanist with the Algæ. From animal life they differ in reproduction by direct division into two similar organisms, while from plant life they are distinguished by the absence of chlorophyll.

The tubercle bacillus can produce tuberculosis in man, the anthropoid apes, monkeys, bovines, canines, felines, pigs, birds, reptiles, and fish, and has thus a vast capacity of inducing disease throughout the entire animal kingdom. It can multiply in birds whose body temperature is far above that of man, and in cold-blooded animals in whom the temperature is far below that of mammals. Thus the bacillus from a tuberculous turtle will flourish at freezing-point, while that from birds grows at 45° Centigrade. Outside the body it can grow on a variety of artificial media—blood serum, glycerine agar, egg, potato, and bouillon, on which media it shows morphological and chemical differences according to the source from which the bacillus was derived. Such facts indicate a marvellous adaptability on the part of this organism.

Pathogenic Action of the Bacillus.—When the tubercle bacillus has overcome the tissue resistance of a susceptible organism, there follows a specific disease the effects of which may vary from inflammatory and degenerative changes in lymphatic glands to the profound systemic intoxication of advanced pulmonary tuberculosis. In this disease the local lesion in the lung may be comparatively unimportant as compared with the generalised toxæmia from the products of the bacillus. It is more than twenty years since this view of the essentially constitutional nature of the disorder was first advanced by R. W. Philip.

"Although the disease has a local seat, the significance of the local process is small compared with that of the constitutional disturbance which is speedily superadded. In invading the lung tissue the tubercle bacillus interferes with the function of the lungs, and may lead to a variety of local accidents of varying degrees of gravity. But of still greater importance are the constitutional effects which are traceable to the influence of the bacillus and the toxins which it elaborates."

Philip's Classification of Pulmonary Tuberculosis.—From the foregoing conception of the disease it is apparent that any classification is inadequate which relies largely upon the stages of anatomical change within the lung, and takes but little cognisance of the patient's general condition. On the other hand the classification of R. W. Philip gives due expression to local and systemic lesions, and is therefore the symbol of a definite clinical entity. As a paraphrase were but a detraction from the incisiveness of his teaching, the following is quoted from the Address in Medicine at Belfast:—

". . . The prognosis and treatment of a given case are governed by the degree of systemic intoxication rather than by the extent of local change. For, on the one hand, the local change may be extensive, and

yet the prognosis remain comparatively good because of the absence of systemic disturbance. On the other hand, the local lesion may be relatively slight and yet the prognosis be serious because of the disproportionate degree of intoxication. On that account, I prefer a classification which gives approximately just expression to both the local and the systemic disturbance. Adopting the symbol L for the local or lung lesion, and admitting three stages as in the classification just referred to, we may speak of L_1, L_2, L_3. To express systemic involvement, I use the symbol S. By the simple device of combining variously capital or small letters, the diagnosis can be expressed with reasonable accuracy. Thus, taking an early process in the lung, we can state the various possibilities as L_1s, that is, an early local process, with relatively slight systemic disturbance, or, L_1S, that is, an early local process with equivalent systemic disturbance, or l_1S, that is, an early local process with excessive systemic disturbance. It matters not what degree of local change be present, whether L_1 or L_2 or L_3, the same principle of classification is available. Thus L_3s indicates a case of extensive lung disorder with vomica formation, but comparatively slight systemic intoxication, while l_2S indicates a case where, with the local process one of infiltration only, systemic intoxication is excessive. The presence of complications is indicated by the symbol + followed by the lesion, for example, l_2S+ent. tub., *i.e.* the case just described with complicating tuberculous enteritis."

II. The Sources of the Parasite

The scientific study of the sources of tuberculosis dates from Koch's discovery in 1882 of the specific micro-organism, to which he held was due every manifestation of the disease, whether it occurred in man, bird, or beast. This was shortly followed by Erhlich's discovery of the special staining properties of the bacillus, and seemed to leave no doubt as to the identity of the organism which caused such ravages among the human race and among the bovines. Since then, however, two great theories have been promulgated—the one that bovine tuberculosis constitutes a danger to man, the other that it is a distinct, and so far as human beings are concerned, an innocuous disease. According to this view the human consumptive is the one source of danger.

The Two Theories.—Tuberculosis in man and in cattle was regarded as one and the same disease until in 1896, and later, in 1898, Theobald Smith in America drew attention to certain morphological differences

between the tubercle bacilli from bovine and human sources. The bovine bacillus is short and straight, grows less vigorously on artificial media than does the human, but retains its characters through several sub-cultures, while the human tubercle bacillus grows more quickly, and is long and slender. In 1901 Koch and Schutz, after a series of inoculation, feeding, and inhalation experiments on animals, concluded that bovines are not susceptible to human bacilli, and as a deduction from this Koch announced in London in 1901:—"That (1) tuberculosis of man and the cow are different, and that tuberculosis of the cow can not be conveyed to man; (2) that the regulations concerning milk, butter, and meat made against tuberculosis of animals and its transmission to man are not necessary."

This theory is a deduction, based on two facts which Koch believed to be experimentally verified—that the bacilli of human and bovine sources are distinct species, and that the bovines are not susceptible to human infection. In the intervening years a vast amount of experimental work has shown both these premises to be erroneous.

Such is the origin of the greatest scientific controversy of modern times, in which many points are apt to be overlooked, as the protagonists of both schools are inclined to assume that the proof of one proposition implies the negation of another. It is intended here to make a plain statement of the sources of infection, and it will later be shown that however varied these may be, there is one essential unity in the means whereby man is infected.

Tubercle Bacilli of Human Sources.—During certain stages of almost every case of pulmonary tuberculosis the patient is discharging the infective material, chiefly by the respiratory system, although the excreta are now known to contain the bacillus. The expectoration of these patients contains the virus, and such patients are therefore, during the course of the disease, disseminating tubercle bacilli. These are distributed in two vehicles—in the sputum itself, and also in small droplets of secretion expelled during the act of coughing.

Tubercle Bacilli in Sputum.—It has been calculated that a tuberculous patient may throw out in the sputum over four billion bacilli every twenty-four hours. As the sputum dries, and is reduced to dust, the bacilli are widely distributed. Cornet collected 118 samples of dust from hospital wards and from the rooms of tuberculous patients, and of these samples forty were found to be virulent to susceptible animals. The dust of a room in which an infectious patient had died was found to be infective six weeks afterwards. There is thus clear evidence that air-

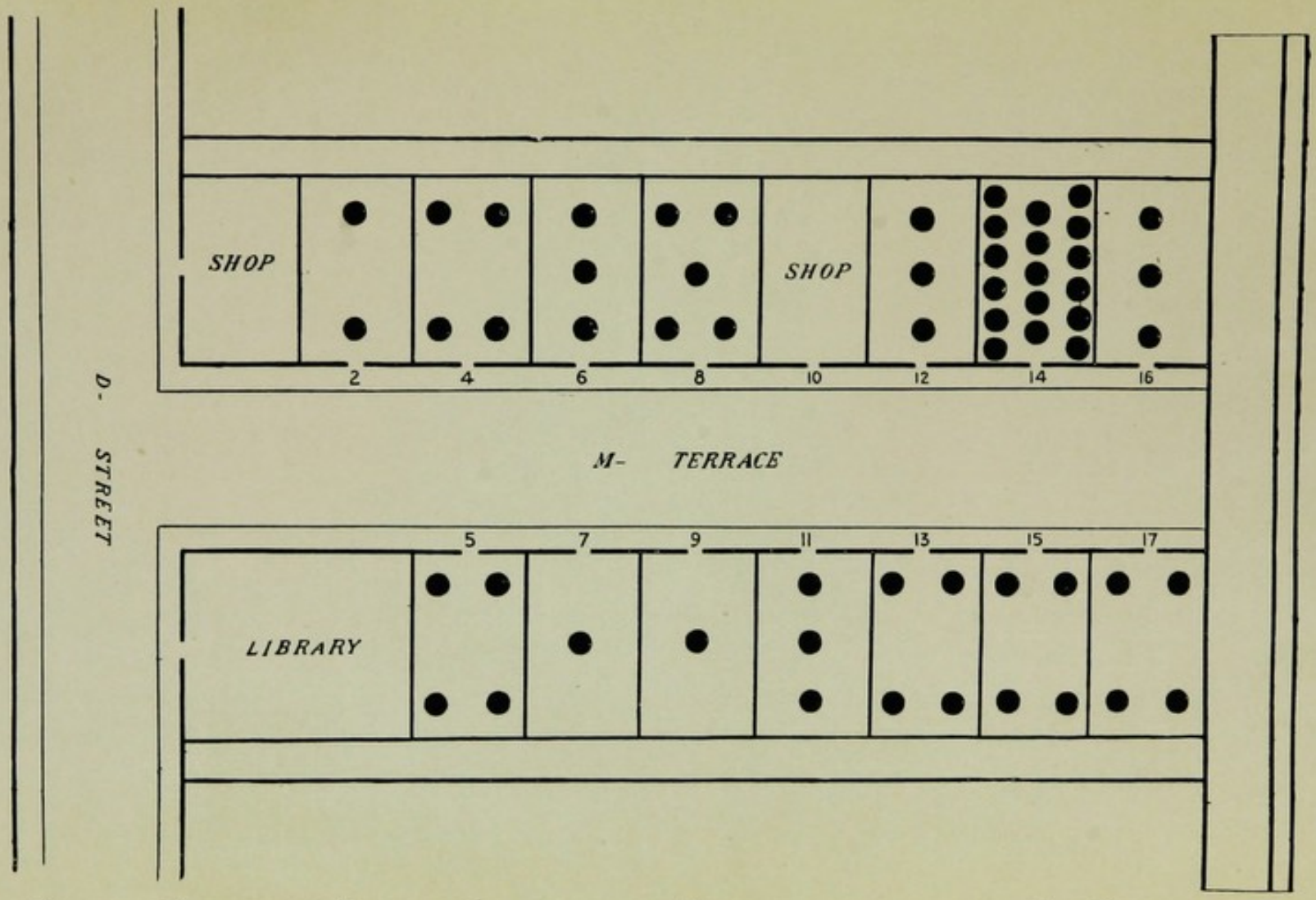
borne dust may carry the infective agent. On the other hand there are certain factors which limit the spread of infection from dried sputum. The virulence of tuberculous sputum is rapidly destroyed by drying and by exposure to sunlight, the natural enemy of the tubercle bacillus. Further, sputum when dry forms a tough, sticky substance which is with difficulty converted into dust, so that only a small portion of a mass of sputum is likely to be reduced to so fine a state of division that it would float in air. It is to be noted, however, that if kept in the dark, dried sputum is virulent even after two months.

Tubercle Bacilli in Droplets of Secretion.—When a tuberculous patient coughs he expels into the air droplets of secretion containing virulent tubercle bacilli. These droplets are rarely projected more than forty inches beyond the person coughing, and on account of their density fall rapidly to earth. The number of bacilli thus discharged is very much smaller than that in sputum, but this is no indication that the danger is less, for although the bacilli in such droplets are less numerous and more easily destroyed by natural agencies than those in sputum, there remains an infected environment for every case of open pulmonary tuberculosis.

Whatever be the actual method of infection, there can be no doubt from the foregoing that practically every case of pulmonary tuberculosis is a potential source of infection, and that bacilli of human sources must rank largely in the dissemination of the disease.

Pulmonary Tuberculosis is a House Disease.—That pulmonary tuberculosis is a house disease is shown most strikingly in the annexed diagram of its distribution in the houses of a city street, the cases being investigated from the Victoria Dispensary, Edinburgh.

An Instance of Household Infection.—To cite a concrete example of house infection, the following instance of an entire household being decimated by this disease has been recorded in the *British Medical Journal*:—"A crofter at Tarbert, Morar, had acted as a beater or ghillie in the summer season, and had lived in the same house for twenty-one years. Until the spring of 1906 the whole family, consisting of himself, his wife, five daughters, and seven sons, the oldest being 21 years and the youngest 2, had always been healthy. In April 1906 the eldest girl, aged 21, who had been in service, came home suffering from a suppurating finger. Symptoms of phthisis manifested themselves, and she died of tuberculous meningitis on 26th May. In the following November another daughter, aged 14, was found to be suffering from well-marked phthisis in both lungs. Death took place on 8th January 1907. During the time she was ill the father began to suffer from a



Sectional Map showing Distribution of Pulmonary Tuberculosis throughout a City Population.
Each Dot Represents a Case.

cough, and the mother complained of pain in the abdomen and left ankle. Two daughters, aged respectively 20 and 10, also complained of cough, and the baby, aged 2, which was anæmic and emaciated, also had a cough. Examination showed that the mother was suffering from tuberculous disease of the ankle, and there also seemed reason to suspect the existence of similar disease in the abdomen, while the two daughters and the baby showed distinct signs of pulmonary phthisis. The baby died on 10th January, after an illness of about three months. The mother was removed to the Western Infirmary, Glasgow. The father, who up to this point was the only one of the male side of the house to be attacked, did not improve. In March, however, it was found that a boy, aged 16, was suffering from phthisis. Meanwhile the father got worse and died soon afterwards."

Absence of Infection in Sanatoria.—That there is no proved case of direct or indirect infection of any members of the medical or nursing staff of any sanatorium in this country during the past ten years has been used as an argument against the danger of infection from human sources. On this point it has no bearing whatever, as in sanatoria it is fortunately possible to render every patient innocuous so far as the massive infection of others is concerned. By education, guidance, and supervision the patient can be so trained that there is no risk of his infecting others, either at home or abroad. On the other hand the unknown and uncontrolled cases are a constant source of danger to the community, and are chiefly responsible for the spread of the disease among adults.

Tubercle Bacilli of Bovine Sources.—As in the human race, so too among the bovines, tuberculosis is responsible for the largest number of deaths, and as mankind is greatly dependent for nutrition upon the flesh and milk of cattle, it is necessary to consider the relative danger of infection from this source.

The Bovine Tubercle Bacillus is Lethal to Man.—In the first place it has been proved that the bovine bacillus may be the causal organism in human tuberculosis. In the very year in which Koch asserted that the human family were not susceptible to bacilli of bovine sources, Ravenel in America was investigating the relationship between bovine and human tubercle, and in June 1901 succeeded in obtaining from the mesenteric glands of a child a bacillus whose culture showed "every characteristic of the bovine tubercle bacillus, and must be regarded as having come directly from cattle."

Many observers have investigated the comparative virulence for animals of bacilli from human sources, and the greatest variation has

been found, so that it is not possible to establish a standard of virulence for bacilli of human source. Moreover, in human pulmonary tuberculosis bacilli have frequently been found which were transition forms between the bovine and the human. That such variations should occur is not surprising when we recall the wide distribution of the tubercle bacillus in the animal kingdom, for just as the higher organisms vary in form according to their geographical distribution, so the nature of the bacillus will vary according to the host it inhabits. Yet a difference in variety or type does not constitute a difference in species; there would seem to be one species of tubercle bacillus, but several types, according to the animal from which it is derived.

The Findings of Royal Commissions.—The Imperial German Health Office, in the examination of thirty-nine cases of primary tuberculosis of the intestine and mesenteric glands in children, found that in thirteen of these the disease was due to bacilli of the bovine type. In this country the Royal Commission of 1901 have demonstrated in clear terms that the bovine bacillus is virulent to the human family. On this point the Commissioners summarise as follows:—"Of the sixty cases of human tuberculosis investigated by us, fourteen of the viruses belonged to Group 1—that is to say, contained the bovine bacillus. If, instead of taking all these sixty cases, we confine ourselves to cases of tuberculosis in which the bacilli were apparently introduced into the body by way of the alimentary canal, the proportion of Group 1 becomes very much larger. Of the total sixty cases investigated by us, twenty-eight possessed clinical histories indicating that in them the bacillus was introduced through the alimentary canal. Of these thirteen belong to Group 1. Of the nine cases in which cervical glands were studied by us, three, and of the nineteen cases in which the lesions of abdominal tuberculosis were studied by us, ten, belong to Group 1."

Bovine Bacilli in Human Pulmonary Tuberculosis.—There is no doubt but that a considerable proportion of ingestion tuberculosis in the form of "*tabes mesenterica*" and tuberculous meningitis in the child is due to infection from bovine sources, and it is possible that in some cases the disease may lie latent for years and break out later on in the form of pulmonary tuberculosis in the adult. De Jong, Sturrman, Von Behring, and others have found bovine bacilli in pulmonary tuberculosis. The Royal Commission on Tuberculosis (Human and Bovine) found the bovine bacillus in two out of forty-two cases of pulmonary tuberculosis examined. In their final report the Commissioners conclude: "Only rarely has a pulmonary lesion in adult man yielded the bovine bacillus."

Infection from Bovine Sources Infrequent in Pulmonary Tuberculosis.—Certain considerations would indicate that infection from bovine sources cannot be regarded either as the causal agency or as the principal means of distribution of pulmonary tuberculosis in the majority of adults. Clinical experience and post-mortem records, which latter tend to show that over 60 per cent. of all subjects have been infected at one time or another with pulmonary tuberculosis, clearly indicate that before the disease can advance by overcoming the natural resistance of the body it is necessary to have either a diminished vitality or a massive infection by the specific agent. Now the chief source of bovine bacilli is the milk of tuberculous cattle, but in the milk supply of any given area the tuberculous milk is enormously mixed and diluted with the milk from healthy cows, so that in general there is no risk of massive infection to the consumer. In childhood, however, milk is the staple food, and there is here the chance of an infection longer continued and greater in amount than that to which the adult is exposed. It is of interest that in the most convincing cases of bovine infection in the child this has been traced to the constant use of the milk supply of one tuberculous animal. Furthermore milk, of which one in ten samples are usually infected, enters in one form or another into the dietary of the entire community—and yet only one in seventy-nine of the total population is suffering from pulmonary tuberculosis.

Relative Danger of Infection from Bovine and Human Sources.—Even in the case of tuberculosis in childhood the chance of massive infection is infinitely greater from human sources than from milk, and the frequency of pulmonary tuberculosis in countries such as Greenland, Egypt, and Japan, where cow's milk enters but little into the dietary of the people, would also tend to diminish the importance of infection from bovine sources. At the same time such statements of national habit require the strictest investigation before they are accepted in their entirety. Thus the writer was informed that pulmonary tuberculosis was very prevalent in the Spanish village of Zalamea-la-Real, Andalusia, and that cows' milk was never consumed by anyone at any time. An inquiry in the place showed that while tuberculosis was extremely common, the second statement was not entirely true, as during two months in the spring milking cows, notoriously tuberculous, came into the village, where their milk was consumed as a delicacy by invalids and young children.

In view of all the facts we may correctly assume that in every case of human pulmonary tuberculosis there is the potentiality for the massive

infection of others, but it is impossible to postulate this for bovine infection so far as the milk supply is concerned.

Bacilli from Avian Sources.—It is probable that avian tuberculosis plays no part in the infection of man, but the question of the morphology of the avian tubercle bacillus is of extreme interest as throwing a light on the mutability of the tubercle bacillus.

All varieties of birds are liable to be affected, and in them it would appear that infection is solely through the alimentary canal, either from the ingestion of polluted matter or from the eating of infected rats and mice. It was once supposed that pulmonary tuberculosis was of rare occurrence in birds, but it has been proved that 60 per cent. of tuberculous birds suffer from the disease in the lungs.

That transition between the avian and human type is possible has been proved by Pansini, who isolated an avian strain from a tuberculous patient, and by Phisalix, who found that a culture derived from a tuberculous emu developed on different plates both the characteristics of avian and of human bacilli, which were extremely virulent to the guinea-pig. Eberloin has shown that the bacilli of tuberculosis in the parrot are identical microscopically, culturally, and in their pathological effects with those from human sources. As parrots can be infected with tubercle from man, these birds are susceptible to human tuberculosis. On the other hand, the most recent work of Shattock and Dudgeon proves that the human tubercle bacillus is only pathogenic to the pigeon in a very limited degree, and that the avian tubercle bacillus is non-pathogenic to the white rat.

III. The Means whereby Man is Infected

The diversity of opinion regarding the sources of infection is most marked in regard to the means whereby man is infected, but in the following presentation of the leading evidence for and against the rival theories, which at first sight might appear to be incompatible, it will be found that there is a good deal between them, even an essential unity in the ultimate means of infection, and in this lies the approximate truth.

Man becomes infected with tuberculosis by inoculation through a mucous membrane. I shall here consider—

1. Congenital Inoculation.
2. Inoculation by a Wound.
3. Inoculation by the Respiratory System.
4. Inoculation by the Alimentary System.

1. *Congenital Inoculation.*—This could occur in the initial infection of the ovum by tuberculous sperm, or by maternal infection of the fœtus. Experimental evidence has shown that these are possible but rare, and the question will not be considered further.

2. *Inoculation by a Wound.*—In this method of infection bacilli would enter the body by abrasions of the skin or of the uro-genital mucous membrane. Infection by these means is not common. There is no proof of the disease having been carried by calf lymph, although localised lymphatic tuberculosis has been caused by wound infection, and the case is recorded of a tuberculous rabbi who induced tuberculosis in a circumcision wound.

3. *Inoculation by the Respiratory System.*—In inoculation by the respiratory system we have to consider aerogenous infection by inhalation of the bacillus suspended in the inspired air which traverses the nostrils, nares, pharynx, larynx, trachea, and bronchi to the lung. The tubercle bacillus is known to be suspended in the air in two vehicles—in the dust of dried sputum and in the minute droplets of secretion expelled during the act of coughing by a tuberculous patient.

Evidence Barred.—In considering the possibility of infection by the respiratory route, I propose to exclude certain arguments which have hitherto been adduced in its favour. These are as follows:—(1) The dictum of Koch in 1901 of the duality of human and bovine tuberculosis, for even if the assertion were proved that bovine tuberculosis is a separate affection, it is no direct proof that the disease in man is caused by inhalation. (2) The dissemination by tuberculous patients of tubercle bacilli suspended in the air is no direct proof of inhalation, as such bacilli might as easily be ingested. (3) All inhalation experiments, including those of Koch, Cornet, Flugge, Heyman, Tappeiner, and many others, in which the possibility of deglutition was not obviated.

Such exclusion may seem unusual if not pedantic, but to anyone who has followed the ramifications of the controversy regarding inhalation as against ingestion, a controversy in which even national bias has a part, it is obvious that only by the consideration of strictly relevant evidence, for or against, is it possible to form an approximately correct estimate of the case.

Direct and Indirect Infection by Inhalation.—With regard to infection by inhalation there are two possibilities. (1) The infection may be direct; the bacillus in the inspired air is carried to the terminal bronchioles and alveoli of the lung. (2) The infection may be indirect; the air-borne bacillus is arrested and absorbed in the upper portion of the

respiratory tract, from which it is carried to the lung by the lymphatic or circulatory system.

Evidence for Direct Infection by Inhalation.—By means of a careful technique, whereby the possibility of ingestion was excluded, Findel demonstrated in 1907, in a large series of experiments on dogs and guinea-pigs, that pulmonary tuberculosis could be readily induced by inhalation of the tubercle bacillus. The spraying of tubercle bacilli directly into the trachea has also succeeded in producing experimental tuberculosis at the hands of many observers.

It has been shown by a large number of experimenters that if animals breathe in an atmosphere in which particles of soot, dust, ultra-marine blue, or other colouring materials are suspended, these can be later detected in the bronchi, and if the experiment continue over some weeks the foreign matter is present in the substance of the lung. Other experiments in favour of infection by direct aspiration are those in which, when an emulsion of *Bacterium Prodigiosum* was dropped into the mouths of rabbits, it was possible to demonstrate the presence of this micro-organism in the alveoli of the lungs thirty minutes later.

The anatomic studies by Birch-Hirschfeld, Schmorl, and others, of the earliest macroscopic lesions in human pulmonary tuberculosis is evidence in favour of direct inhalation. Thus the first observer found that in twenty-eight out of thirty-two cases of latent pulmonary tuberculosis, discovered in a series of 196 persons who had met with sudden death, the primary lesion was in one of the smaller bronchioles at the apex of the lung.

Evidence against Direct Infection by Inhalation.—In the first place the anatomical conformation of the upper portion of the respiratory system is against the probability of suspended matter in the inspired air directly reaching the lung. The nares, pharynx, larynx, trachea, and bronchi form a long narrow tube with many angles, in which the passing air takes on a vortex movement, so that every portion impinges at some point against the moist walls of this tube, whereby the inspired air is warmed before it reaches the interior of the body, and any suspended particles are arrested. Further, the trachea and bronchi are lined with ciliated cells, whose movement is from within out, so that all arrested particles would be driven from, and not towards, the lung. Moreover, the inspired air does not reach the alveoli of the lung direct, as the respiratory exchange of gases takes place in the bronchi and larger bronchioles.

A number of observers have failed to produce pulmonary tuberculosis by experimental inhalation of the bacillus. Thus Vallee was unable to find any lesions in the lungs of two calves six months after the direct intra-tracheal injection of large numbers of bacilli. Again, with reference to the inhalation of foreign particles, Calmette and others report negative results, and claim that if the œsophagus be occluded and ingestion prevented, it is impossible to discover suspended matters in the lungs.

The rarity of primary laryngeal tuberculosis is against infection by direct inhalation, for where the vocal cords are exposed to direct infection, as in the later stages of pulmonary tuberculosis, these structures are very susceptible to local infection.

Evidence for Indirect Infection by Inhalation.—There is considerable evidence to show that bacteria are readily absorbed from the upper portions of the respiratory tract, and may thus reach the lung by the lymphatic or circulatory system.

The experiments of Strauss, Liarus, and St. Clair Thompson indicate that many bacteria, including the tubercle bacillus, are to be found in the nostrils of healthy people, but that in the great majority the inner nasal cavities are absolutely aseptic. This indicates the absorptive power of the nasal mucous membrane.

In the naso-pharynx there is likewise lymphoid tissue, and it has been shown by several observers that the tubercle bacillus is microscopically present in from 5·1 to 15 per cent. of all cases of adenoids, while the percentage was much higher when the inoculation test was used.

Again, the great absorptive power of the tonsil is well known, and it has been found that primary tuberculosis of the tonsil occurs in 5 to 5·2 per cent. of all cases of enlarged tonsils. In this connection there is an interesting observation by Goodall on the tonsils which he removed from seven children suffering from tuberculous glands in the neck. These tonsils microscopically showed tubercles and giant cells, and when inoculated into guinea-pigs gave rise to tuberculosis.

A good deal of clinical evidence might be adduced in favour of indirect infection. In the majority of cases there is a long period of latency (one to ten years) from the time the patient was first exposed to massive infection until the outbreak of the pulmonary disease. This is only compatible with slow lymphatic progression and spread. The presence of Philip's glands—dozens of pinhead glands in the supra-clavicular triangle—in every and in the earliest cases of

pulmonary tuberculosis indicates lymphatic infection, while the frequency of primary pleurisy long before the appearance of alveolar disease is also indicative of infection by this route.

Evidence against Indirect Infection by Inhalation.—The only evidence under this head has been the failure to establish by post-mortem injections of colouring fluids any communication between the cervical and pulmonary lymph chains, although the great mechanical difficulties of injecting lymphatics mitigate against the value of such observations.

4. *Inoculation by the Alimentary System.*—Infection by means of the alimentary system is dependent upon the absorption of the ingested tubercle bacillus from some portion of the alimentary canal. The bacillus may be ingested in food either contaminated at its source or in its preparation by a tuberculous patient. Tuberculous meat and milk contain the tubercle bacillus, but infection from this source is less massive than that caused by the bacilli scattered upon food in the act of coughing by a careless patient. Food may also be contaminated by flies, or the bacilli may be ingested by means of soiled hands, and in the act of kissing.

Vehicles of Infection.—According to the ingestion theory, while there is little danger, for reasons already stated, from the inhalation of dried and pulverised tuberculous dust, the moist sputum of tuberculous patients is a dangerous source of infection from one person to another. Sputum that is distributed on roads, streets, and pavements collects on the shoes, trousers, and skirts of passers-by, and is thus carried into dwelling-houses, where it is transferred to the floors and furniture, while it is not difficult to see that infectious material on the wearing apparel may easily infect food. The greater part of sputum thus carried into houses remains on the floor, as that portion of the clothing most frequently soiled comes in contact with floors and carpets. By this means the smallest children are exposed to risk of infection, as these for the most part play and crawl on the floor, place their hands in their mouths, and will suck or eat articles that have been lying on the ground. From this point of view it is certain that indiscriminate spitting is a dangerous and uncleanly practice.

Direct or Indirect Infection.—Infection by means of the alimentary tract may be direct by ingestion of the bacillus into the digestive portion of the canal, whence it is carried to the lung by means of the circulatory or lymphatic systems. Again it may be indirect, the bacillus being absorbed from the upper portion of the alimentary tract, and

reaching the lung by passage through the cervical lymph chain. In point of fact both routes are indirect, the distinction being rather between infection from the upper or lower portions of the alimentary canal.

Evidence for Infection by Direct Ingestion.—Experiments have been undertaken to show that if the trachea be occluded, and an animal swallow food containing particles of soot, ultramarine, etc., these particles are later found in the lung, but the chief evidence consists of numerous ingestion experiments with the tubercle bacillus itself.

Animal Experiments.—In experiments which extend as far back as the early seventies of last century, Klebs claims to have demonstrated that tuberculous infection most frequently occurs through the alimentary canal, and Chauveau has recently called attention to his experiments in 1868, in which he proved that pulmonary tuberculosis could be brought about by the ingestion of tuberculous material without the production of any injury to the digestive tract.

The experiments of Nicolas and Descos in 1902, confirmed by Ravenel in 1903, have proved that tubercle bacilli introduced into the digestive tract of animals can pass through the uninjured wall of the alimentary canal and find their way into the circulation. The most convincing proof, however, on this subject is that of Calmette and his school at Lille. They deny that dust particles can enter the actual substance of the lung, and hold that tuberculosis never begins in the air passages except by the artificial introduction of bacilli beyond the bifurcation of the trachea, and that in general it commences in the capillaries of the lung, whose small calibre arrests bacilli which have entered the blood stream through the alimentary canal. These observers have shown that in calves, goats, and adult bovines, when tubercle bacilli are introduced into the alimentary canal by means of the stomach tube (to prevent the contamination of the air passages), there invariably follows from one such ingestion tuberculosis of the lung, and that animals will thus contract tuberculosis by absorption from the intestine without visible injury to its walls. In young animals the bacilli are arrested in the mesenteric glands, in which they remain for a longer or shorter period without causing lesions. In adult animals the defensive action of these glands is less active, and the bacilli enter the main lymph stream, being eventually carried to the lung by the pulmonary artery. There they induce tuberculosis at the end of thirty to forty days, the lesions being mostly situated beneath the pleura at the upper and anterior borders of the lung.

In their passage through the lymph channels the bacilli cause lesions in the bronchial and retropharyngeal glands. Confirming these experiments, the Bureau of Animal Industry at Washington have recently shown that the injection of tubercle bacilli into portions of the bodies of cattle, as remote from the lung as the tip of the tail, will cause fatal pulmonary tuberculosis without there being any intermediate lesions to indicate the path whereby the infecting bacteria reached the lung.

Intestinal Tuberculosis in Childhood.—The incidence of primary intestinal tuberculosis in children is evidence for the direct ingestion of the tubercle bacillus. Bonome states that the percentage of primary intestinal tuberculosis in children as compared with tuberculosis in general is 23·84, in adults 16·03, and in the aged 6·25 per cent. Fibijer and Jensen found that among 289 children who had succumbed to various diseases, forty-four or over 15 per cent. were affected with primary intestinal tuberculosis.

Evidence against Infection by Direct Ingestion.—The earliest experiments against pulmonary infection by ingestion of tubercle bacilli were those of Koch and Schutz, in which they failed to induce tuberculosis by this method. This whole series of experiments, however, received a most severe and damaging criticism at the hands of the late D.J.Hamilton. The more recent results of Findel in 1907 are more telling against ingestion infection, as this observer has shown that a dose of tubercle bacilli, one thousand times greater than that which will induce fatal pulmonary tuberculosis if inhaled, is innocuous when ingested. It is also certain that the enormous numbers of bacilli used in successful ingestion experiments are unlikely to have any counterpart in the conditions of human exposure to infection.

Evidence for Indirect Inoculation by the Alimentary Canal.—In all feeding experiments it is possible that infection reaches the lung by absorption of the bacillus in the upper portion of the alimentary canal, nor is it quite possible to obviate this even in those experiments where bacilli were introduced by means of the stomach tube. It is also stated that, if an animal receive a daily injection of ultramarine into the stomach by means of a fistula, it is impossible even at the end of six weeks to demonstrate the colouring material in the lung. On the other hand, the same evidence in favour of indirect infection by the respiratory system is also applicable to the absorption of the bacilli from the upper regions of the alimentary canal.

The Unity in the Means of Infection.—There are many arguments against the acceptance of either direct inhalation or direct ingestion as

the means of infection. By whichever of these channels, however, the tubercle bacillus enters the system, it must pass the great lymphoid arch, bounded by the faucial and lingual tonsils below and by the adenoid tissues of the naso-pharynx above. Here the bacillus is in contact with structures of high absorptive power, through which it may enter the slow lymphatic stream that flows to the thorax. It is of interest that this view has been enunciated in the teaching of R. W. Philip for many years past, based on and in harmony with the clinical phenomena of tuberculosis.

The Basis of the Edinburgh System.—The ætiology of tuberculosis has been dealt with here at some length, as a full understanding of the sources of infection and the means of spread is essential to any co-ordinated plan for the control and prevention of this disease. Partial and ill-considered schemes, which take no cognisance of the vast sources of fresh infection daily at work in our midst, however laudable their humanitarian or philanthropic basis may be, are incapable of attaining as great or as lasting an amelioration from the ravages of tuberculosis as a system which strikes to the root of the evil.

HALLIDAY G. SUTHERLAND.

CHAPTER III

THE EDINBURGH SYSTEM—PRINCIPLES AND METHODS

Origin—The Dispensary ; its Functions and Objects—The Sanatorium—Notification of Pulmonary Tuberculosis—Hospital for Advanced Cases—The Farm Colony.

Origin.—It is nearly thirty years ago since Koch first demonstrated the presence of the tubercle bacillus in the sputum of tuberculous patients, and thus proved the infectious nature of this disease. Several years elapsed before his momentous discovery was generally accepted as a fact beyond the realms of theory, and before it was realised what a powerful preventive weapon in the war with tuberculosis had thus been placed in the hands of medical men.

The knowledge that the disease was caused by a specific organism was the first forward step in the campaign for its extermination. But things moved slowly, and any offorts which were made in the years immediately following 1881 were mainly in the direction of individual or clinical treatment, chiefly by way of sanatoria.

It was not until 1887, when Dr. R. W. Philip introduced the scheme which is now associated with his name, that the first broad statesman-like plan for the co-ordination of efforts, applicable to all the different phases of the tuberculosis problem, was proposed. This plan from its very inception displayed in a remarkable degree the broadest view of the question, and was the outcome of years of thought and work devoted to the subject. With the knowledge that tuberculosis was responsible for 25 per cent. of the total deaths in this country per annum, and realising that the mortality only faintly reflected the enormous frequency of the disease in all classes of society, Dr. Philip was the first to make public the opinion that no amount of treatment directed solely towards the individual patient could ever do more than touch the fringe of the problem. To voice this was one thing, but it was a much greater and more difficult service to point the remedy. That this was done the success of the Edinburgh system attests.

The Edinburgh System.—The fundamental principle of the scheme

is that not content with treating the individual patient who presents himself, the disease should be sought out in its haunts; in other words, to use a military axiom, the war should be carried into the enemy's country. After all, only a fraction of the number of persons affected apply for treatment, and it is by following up these cases to their own houses that Dr. Philip's system grasps the problem at its very root.

The Dispensary.—The first step taken with this object was the establishment of the Royal Victoria Dispensary for Consumption by the efforts of a few friends in 1887, in memory of Queen Victoria's Jubilee. The dispensary was the foundation and *point d'appui* of the whole scheme, and still remains the centre of its activities. Though incidentally these activities are devoted in the first place to giving advice and treatment to the persons attending it, it aims at doing a very much greater and more permanent service to the community, for the work done there in seeing patients is only a means to the end which its founder had in view when the dispensary was instituted. How then does the dispensary render this service to the general public? Every patient presenting himself there is, after examination, advised as to treatment, and more important still, is instructed in such points as the disposal of sputum, necessity for windows being kept constantly open, breathing exercises, sleeping arrangements, and segregation in so far as it can be carried out under his own domestic conditions. The day following this examination one of the dispensary nurses visits the home of each patient, investigates the household arrangements, advises as to their modification where necessary, and ascertains on this and subsequent visits whether the doctor's instructions are being carried out. The great point with both doctor and nurse is to get the patient thoroughly to understand that the onus of carrying out the treatment lies with himself, and to make him interested in his own cure. Only in this way can we attain the best results. Everything in this matter, of course, depends upon the personnel of the dispensary staff, and under firm, sympathetic guidance most patients are quick to respond to our efforts.

The nurse embodies the results of her inquiries and observations in a special report, which is read and signed by one of the medical staff. She also arranges for what is one of the most important aids in the detection of cases of tuberculosis. This has been most appropriately called by Dr. Philip the "march past." At a day and hour ascertained by the nurse to be most suitable, *i.e.* when all or most of the family will

be at home, one of the doctors calls and examines the contacts, and, if necessary, refers them to the dispensary for more complete examination and treatment. This plan furnishes the dispensary with numerous patients, and is one of the most valuable weapons in our armamentarium. There are few households where one or two of the contacts are not suffering from tuberculosis in some form or other, and it is not an infrequent event to discover whole families the victims of the disease. The value of these methods to the community is at once evident, not only in the original case reported to the public health authorities, but other cases discovered from following up the first patient are in their turn notified. The treatment and advice given on the lines indicated tend to lessen the danger of further infection. The house is disinfected from time to time by the sanitary officials, and the whole household is kept under regular but unobtrusive supervision, both by the Medical Officer of Health and by the dispensary staff. This amicable working between the Public Health Office and the dispensary has existed in Edinburgh for years, and adds greatly to the efficacy and value of the work done. The part which the Royal Victoria Dispensary has played in ascertaining the incidence of pulmonary tuberculosis and reporting upon it is shown by the fact that during the years that notification of the disease has been in force fully 50 per cent. of the reported cases have been notified from the dispensary.

Another important function of the dispensary is that of a tuberculosis dépôt or clearing-house, where the different stages of the disease are sorted out and dealt with. Early cases are admitted to the Royal Victoria Hospital, dying cases are sent off to the City Hospital, where wards are set apart for their reception, others are advised about work, emigration, and various other economic questions. The variety of inquiries made is endless. Few weeks pass without patients or their friends consulting the doctors about marriage, advisability of going abroad and where to go, necessity for change of occupation, going to convalescent homes, aid societies, etc., etc. All of these points are inquired into, and help and advice given upon them and many other subjects. Such inquiries are welcomed and are valuable in showing a recognition on the part of patients of the necessity for intelligent and experienced guidance in the ordering of their lives, and in accommodating their arrangements to the altered state of their health. After all, the majority of the patients are treated at the dispensary and attend there at frequent intervals, receiving medicines when necessary; they are also supplied with pocket sputum flasks and antiseptics.

Patients who are too ill to attend the dispensary are attended at home by the medical and nursing staff. In connection with such patients there is an important organisation, viz. a Samaritan Committee, consisting of ladies who volunteer to visit those who are in destitute circumstances. This committee meets once a fortnight under the direction of one of the doctors, when all such cases are discussed, and where necessary, help is given in the form of food and clothing, sending patients to convalescent homes, etc. The ladies are also active propagandists of the open-air régime. The most cordial relations have always existed between the dispensary and other charitable organisations and societies, many of which are now grouped under the Charity Organisation Society. On the one side patients are often referred to the dispensary by these societies, or advice is sought regarding their suitability for relief, while on the other hand destitute and deserving patients are sent to the Charity Organisation Society for inquiry and help. The same friendly lines are followed between the dispensary and the Parochial and School Board authorities, and this co-ordination of energies has all along been an outstanding factor in the Edinburgh system. The mutual gain is necessarily very great. One is often asked whether patients do not resent the inquiries that are made into their circumstances and manner of living. We have never found such to be the case; the visits of both doctor and nurse are heartily welcomed, and the information is sought for with tact and good feeling. The work of the dispensary is now generally recognised, and it has from the first obtained the hearty co-operation of a large number of the medical men of the city. Many of these send patients for examination, and no patient who is under another doctor's care is accepted as a dispensary patient without that doctor being communicated with and his sanction obtained.

The Sanatorium.—The Royal Victoria Hospital was started a year or two after the dispensary, and constituted the second link in the chain of the Edinburgh system. Begun in a small way, in a country house standing in large grounds and quite near the city, it has gradually been extended by the erection of modern pavilions, till now its inmates number nearly a hundred. The buildings themselves, as regards position, plan, and construction, are in quite the latest and most modern style of sanatorium architecture, and have been designed upon Dr. Philip's own ideas and experience of what is best for the open-air treatment. Artistic in appearance, practical in design, and economical in construction, the Victoria pavilions have furnished a model for many other sanatoria. To this hospital are drafted suitable early cases

from the dispensary, as well as cases recommended from practically all parts of Scotland. While the majority of the patients are admitted free, a limited number of contributing patients is taken in, the latter or their friends being able to contribute towards their maintenance in hospital. The treatment is conducted on the most advanced open-air lines, and while the patient is being treated the educational aspect of open-air treatment is abundantly emphasised. Each patient is expected to be a propagandist when he returns to private life, and to spread the doctrine of open air among his friends after his discharge. This work is of the greatest importance both as a preventive and curative agent. Its scope is very considerably augmented by the admission of a number of visitant patients, who spend their entire day at the hospital, returning home at night. These patients are admitted for treatment before there are vacancies for them as internal patients, or in many instances as a purely educative measure regarding the methods of open-air living, so as to be able to practise these in their own homes. This has been a most valuable adjunct to the regular work of the hospital. The average duration of a patient's stay in hospital is from three to four months, and the statistics of the hospital work show that in a very large proportion of cases the time spent there proves of the greatest benefit, and the patient is discharged in a fit state of health either to return to his ordinary occupation or to take up another more suitable calling. As the patients return at intervals to the hospital to report progress, a valuable record is maintained of the permanency or otherwise of the good results derived from their sojourn in hospital. The dispensary undertakes the surveillance of many of the discharged patients residing in Edinburgh, and so continuity of treatment and guidance is secured.

One should mention a feature of the treatment at the Royal Victoria Hospital which is of great importance, viz. after a varying period (longer or shorter, according to the condition of the patient) all patients are put on to some form of graduated work. This ranges from very light tasks, such as raking dead leaves, light painting, &c., to carrying heavy loads or digging. The occupation serves a double purpose—it fills in the time, which would otherwise prove irksome to the patient, and it fits him gradually for returning to his ordinary work. Since the inception of this graduated labour, now many years ago, it has been attended with the happiest results.

Notification.—Taking things in their chronological order, the next important event in the history of the scheme was the adoption of

notification of pulmonary tuberculosis. As long ago as 1890, in a public lecture delivered under the auspices of the Edinburgh Health Society, Dr. Philip strongly urged notification. He held then, as now, that it was one of the most important and absolutely necessary means to be employed in the war against tuberculosis. Though this expression of opinion led to considerable discussion, nothing was done in the matter until 1905, when a scheme of voluntary notification was introduced by the public health authorities. This was only a partial success, but was of great value in educating public opinion, and in showing the opponents of the measure that their fears as to its interference with the liberty of the patient were groundless. In 1907 compulsory notification was adopted, and has worked smoothly ever since. Notification was the first assumption of responsibility with regard to this disease on the part of the municipal authorities, but it was shortly to be followed by another step of the greatest importance and preventive value—the setting apart of special wards at the City Hospital for the reception of dying cases.

Hospital for Advanced Cases.—This segregative measure requires no explanation to show how important a bearing it has in the endeavour to wipe out tuberculosis. The removal of patients in an advanced stage from households in which they are in constant contact with other members of the family must appeal to all as an absolutely necessary step if we are to progress at all in reducing the frequency of the disease. Accommodation is provided at Colinton Mains Hospital for sixty patients (thirty male and thirty female), and as many of them live only a short time after admission, this means that on an average each bed is occupied by several patients in a year. It requires but little effort of imagination to understand the enormous amount of good which the removal of so many patients, suffering from pulmonary tuberculosis in its most communicable stage, from contact with uninfected persons must accomplish. Every case removed to the City Hospital is a danger to the community, and the removal and isolation of such cases is a public service.

Farm Colony.—The last link in the chain, and that which makes the Edinburgh system practically complete in its bearings towards tuberculosis in all its stages, was forged by the purchase of an estate at Polton, where a farm colony is in process of development. It was only in the beginning of last year that this latest addition was made to the activities of the Royal Victoria Hospital. Here patients are employed (both male and female) who have already been inmates of

the hospital, but who still require a lengthened period of supervision before returning to ordinary life. To each of these work is assigned in accordance with his condition and abilities, and some thirty or forty patients are now employed. The work of the colony consists in rearing poultry and pigs and raising garden produce, and for some years at least the bulk of the produce will be used at the Victoria Hospital. It is confidently expected that very shortly the colony will be self-supporting.

This brief description of the component parts of the Edinburgh system shows how very wide a field its activities cover, and also how great a service is being done to the citizens of Edinburgh by the working of the different institutions embraced under the scheme. Quite apart from the treatment of patients an educational centre for the dissemination of advice upon the problems of tuberculosis is at the disposal of the citizens, and all the information (now of great value) which has been accumulated during the past twenty-three years, is open to the Medical Officer of Health. Nor are the benefits confined to the city of Edinburgh, as other centres both in this country and abroad have observed the advantages to be derived from the working of such a scheme as Dr. Philip's. The large number of visitors who come to Edinburgh from all parts to see the system at work, its adoption in many different parts of the world, amply testify to the widespread recognition of Dr. Philip's scheme as the most practical and valuable plan for the ultimate extermination of tuberculosis. To read of the scheme now, when all its co-ordinate parts are at work, one gets but little idea of the genius, organising ability, untiring energy, and perhaps above all the patience and unfailing tact of its originator; one who has not followed its growth can hardly realise the difficulties which arose and had to be overcome to bring the original conception to its full development.

Those who, like myself, have had the privilege of working under Dr. Philip for many years know of the high ideals of which this work is the outcome, and that it must be an enduring monument to the following up of these ideals to their full development in the face of much apathy and many obstacles.

W. Leslie Lyall.

CHAPTER IV

THE TUBERCULOSIS DISPENSARY (PART I)

Its Origin, Functions, Ideals, and History

I.—Origin of the Dispensary Movement

(*a*) With the exception of the Royal Victoria Dispensary, Edinburgh, founded in 1887, the Tuberculosis Dispensary is entirely a twentieth century production.
(*b*) Several hundred dispensaries now in existence (1911) in Great Britain, France, Germany, the United States of America, and other countries.
(*c*) Inferences to be drawn from this rapid development of the movement.
(*d*) The ruling principle underlying the foundations of this movement wherever developed is the importance of dealing with the home surroundings.

II.—Functions and Ideals of the Tuberculosis Dispensary

(*a*) Dr. Philip's views are given throughout.
(*b*) Importance of taking a broad view of the problem.
(*c*) No one method sufficient—must have a complete and co-ordinated anti-tuberculosis organisation.
(*d*) The dispensary should be the headquarters of such an organisation.
(*e*) The dispensary should also act as a "clearing house."
(*f*) The dispensary should also carry out an aggressive search for unsuspected and early cases.
(*g*) The dispensary should also provide home treatment for the mass of tuberculous patients.
(*h*) The essential factors in a successful anti-tuberculosis organisation.
(*i*) Co-operation between dispensary and philanthropic and charitable agencies.
(*j*) Co-operation with the Public Health service.
(*k*) The complete organisation as in existence in Edinburgh represented diagrammatically.

III.—History of the Dispensary Movement

1. *In Scotland*—

(*a*) Foundation of the Victoria Dispensary in Edinburgh in 1887.
(*b*) Gradual development.
(*c*) Victoria Dispensary programme.
(*d*) The focussing of the anti-tuberculosis measures in Edinburgh into one effective organisation brought about by the dispensary.
(*e*) Adoption of the "Edinburgh system" by the L.G.B. as a national scheme for Scotland.

2. *In France*—
   - (*a*) Foundation of the Préventorium Emile Roux at Lille in 1901.
   - (*b*) Rapid growth of movement.
   - (*c*) Departure from the Edinburgh ideals :—
     1. No treatment given.
     2. Considerable material assistance distributed.
     3. Lack of organisation.
     4. Failure to examine "contacts."
     5. Homes supervised only by trained working men.

3. *In Germany*—
   - (*a*) Foundation of the first Charité Clinic in Berlin, 1904.
   - (*b*) Rapid growth of movement.
   - (*c*) Edinburgh ideals more completely carried out than in France :—
     1. Organisation exists.
     2. Homes supervised by nurses.
     3. "Contacts" are examined.
   - (*d*) Departure from the Edinburgh ideals :—
     1. No treatment given.
     2. Considerable material assistance distributed.
   - (*e*) Difference of conditions in Germany due to the Compulsory Insurance System.
   - (*f*) Fundamental principles unaffected.

4. *In America*—
   - (*a*) Foundation of first Clinic in New York in 1904.
   - (*b*) Rapid growth of movement.
   - (*c*) Conformation to Edinburgh ideals :—
     1. Treatment is given.
     2. Material assistance arranged for by co-operation with charitable agencies.
     3. "Contacts" are examined.
     4. Homes are supervised by nurses.
     5. Co-operation with sanatoriums and homes for the dying exists.
   - (*d*) The movement in other parts of the United States.
   - (*e*) The movement in Canada.

5. *In England*—
   - (*a*) Caution required that Edinburgh system be adopted in its entirety.
   - (*b*) Foundation of the Paddington Dispensary.
   - (*c*) Strict conformance with Edinburgh ideals and methods :—
     1. Treatment is given.
     2. Material assistance arranged for by co-operation with charitable agencies.
     3. "Contacts" examined.
     4. Homes are supervised by doctors and nurses.
     5. Co-operation with sanatoriums and homes for the dying exists.
   - (*d*) Amalgamation of Paddington and North Kensington.
   - (*e*) Other dispensaries recently opened, or about to be opened, in London and in the provinces.
   - (*f*) The Central Committee for the establishment and support of tuberculosis dispensaries in London.

I. The Origin of the Dispensary Movement

The Tuberculosis Dispensary has come to be very widely recognised as an important factor in the campaign against tuberculosis.

It has attained this prominent position with meteoric rapidity during the first decade of the twentieth century.

The year 1900 saw only one such dispensary in existence in the whole world—the Royal Victoria Dispensary for Consumption, Edinburgh—whilst now, in 1911, several hundred dispensaries are in operation in Great Britain, France, Germany, Belgium, Holland, Denmark, Sweden, Austria, the United States of America, and Canada.

This rapid and widespread adoption of a new measure would lead us to draw certain inferences as to its value.

Firstly, we may infer that the various nations concerned realised the fact that their previous anti-tuberculosis measures were, in themselves, incomplete and inadequate—lacking in certain vital functions.

Secondly, we may infer that it was recognised that no anti-tuberculosis measures could succeed in eradicating the disease which did not provide means for—(*a*) searching out the early cases and putting them under treatment before the curable stage was passed, (*b*) supervising the home conditions of the tuberculous poor, and both by this means and by the education of patients and their friends preventing as far as possible the spread of the disease.

Thirdly, we may infer that each of these countries recognised that the Tuberculosis Dispensary was the only institution which could effectively carry out these principles.

There are of course great differences between the dispensaries in the various countries—differences of vital importance—but the above would appear to be the main principles which have given rise to this movement.

In other words, the key to the solution of the whole problem is now known to be the home. The home is by far the greatest source of infection, whilst the character of the home affects largely the course and duration of the disease and the value and result of any form of treatment.

Finally the home can only be thoroughly dealt with by Tuberculosis Dispensaries, and therefore though Sanatoria, General and Surgical Hospitals, Isolation Hospitals for Advanced Cases, each and all have important functions to fulfil, their work will be hindered and their

results to a certain extent nullified if Tuberculosis Dispensaries be not established to complete their organisation.

II. The Functions and Ideals of the Tuberculosis Dispensary

The Victoria Dispensary, Edinburgh, was, as I have shown, by many years the first in the field, and Dr. Philip, its founder, is therefore the pioneer in this great movement. Hence in setting forth the functions and ideals of the dispensary system it would be well to present first and foremost Dr. Philip's own views on the subject. He has given these to the world in several published papers where they may be read, but as I have had ample opportunity of hearing these views expressed at first hand, I think it would serve a useful purpose if I were to recapitulate them.

A Broad Outlook Essential.—In the first place Dr. Philip insists on the importance of taking a broad view of the whole problem. He points out that the cure of individual patients, though important in itself, should not constitute our one and only object. Tuberculosis is such a widespread disease and so intimately bound up with the evils of civilisation, *e.g.* overcrowding, poverty, drink, etc., that it cannot be considered in a statesmanlike manner without taking into our consideration also the social problem. Any scheme to be successful must therefore be most carefully thought out. Further, no one method of dealing with the disease can in itself be sufficient to cope with every aspect of the problem. Thus the segregation and isolation of cases has been advocated by some persons as our chief means of eradicating the disease, but considering the wide ramifications of tuberculosis it is clear that this procedure can only be applied to a small percentage of the total number of cases. Others have pinned their faith on sanatorium treatment—but here again we are faced with the fact that only a certain number of those affected are suitable for sanatorium treatment — whilst a third group of people would appear to imagine that a more extended use of tuberculin in the treatment of ambulatory cases would eventually succeed in exterminating tuberculosis from our midst.

A Complete Organisation Necessary.—What Dr. Philip has always said is that *all* the different methods of dealing with the disease should be welded together into one co-ordinated anti-tuberculosis organisation, each factor of which should co-operate with the others in bringing about our one great desideratum, the final eradication of the disease.

The Dispensary to be the Headquarters of this Organisation.—He then

goes on to show that such an organisation, like an army, must have its headquarters and its intelligence department. Now since the chief breeding-ground of the disease lies in the homes of the people, our main line of attack must be directed against those unwholesome home conditions which, if left alone, would continue to foster the spread of the disease, however admirable and thorough our methods of treatment might be. And since the brunt of the anti-tuberculosis campaign, in so far as it affects the homes of the people, falls naturally on the dispensary rather than on the other factors in the organisation, it follows that the headquarters and the intelligence department are best merged in the dispensary.

The Dispensary to Act as a "Clearing-House."—Since the dispensary will be situated in the heart of the district we are dealing with, it is natural that the dispensary should be the "clearing-house" for the mass of tuberculous material in that district. It is to the dispensary that the poor will first come for advice, and the dispensary will thus be able to feed the other institutions—the sanatoria, isolation hospitals, surgical hospitals, etc. For the same reason the dispensary will have the means at hand of gathering information and statistics as to the incidence of tuberculosis not only in the district or town as a whole, but in relation to various streets and dwellings. In this way it becomes an information bureau or intelligence department.

The Dispensary to Carry out an Aggressive Search for Unsuspected and Early Cases.—But the dispensary can do more. Dr. Philip has frequently called attention to the fact that patients often do not seek advice until the disease has passed the curable stage, and in fact that the disease may exist for some time before the patient shows any symptoms or begins to suspect its presence; hence he considers it essential to have some organised system for examining the relatives of those already affected, in order, if possible, to discover other cases in the incipient stages. He allocates these duties naturally to the dispensary, which will thus not only be the means of tracking the disease to its lair, but also of searching out cases who would not otherwise come to light in any case for some years, and possibly not at all.

The Dispensary to Provide Home Treatment for the Mass of Patients.—Further, while making full use of sanatoria, isolation hospitals, etc., there will still remain the greater bulk of tuberculous patients who require to be treated without removing them from their homes. The treatment of these should be undertaken by the dispensary in addition to its other duties, since the dispensary is the only institution which

can treat them efficiently—that is to say in relation to their home conditions.

The Dispensary not to be an Isolated Institution.—But though he considers the dispensary to be such an extremely important institution, it must be clearly understood that he does *not* mean the dispensary to be the sole means of eradicating the disease. He has repeatedly stated that the dispensary must not be an isolated institution, but that it must form part of an organised scheme which must include all the other known means of dealing with the problem.

Summary of the Functions of a Tuberculosis Dispensary.—We have therefore five definite functions for which the establishment of tuberculosis dispensaries is necessary; these are:—

1. The supervision of the home surroundings.
2. The search for incipient cases by the examination of "contacts."
3. The sorting out of the different classes of patients for appropriate treatment.
4. The treatment, with due regard to the home conditions, of the majority of the tuberculous patients.
5. The collection of information and statistics bearing on the incidence of the disease.

The Dispensary's Part in a Complete Scheme.—The following factors are, in Dr. Philip's opinion, essential to a successful campaign against tuberculosis in any given district:—

1. Compulsory notification of the disease.
2. A dispensary in the heart of the district.
3. An isolation hospital for dangerously infective cases.
4. A sanatorium for the cure of early cases.
5. A working colony to which some patients may be sent for a year or two on discharge from sanatoriums before they return to town life.

The realisation of this scheme has been dwelt on in another chapter, so I only refer to it in passing, to show the part which the dispensary holds in such a plan of campaign.

Co-operation with Charitable Agencies.—Further, since tuberculosis is so intimately associated with poverty and its attendant evils, the social and economic conditions of each patient should be thoroughly inquired into, and, where necessary, financial or material assistance should be given. For this purpose he holds that the dispensary should co-operate with all manner of philanthropic and charitable agencies, chief among them being the Churches, the Charity Organisation Society, and the Invalid Children's Aid Association.

Royal Victoria Dispensary. "March Past" of Household to detect Early Cases.

Co-operation with Public Health Authorities.—Full and free co-operation with the State through the Medical Officer of Health, who is the official head of measures for controlling preventable diseases in the district, is also strongly advocated by Dr. Philip. The manner of co-operation as carried out in Edinburgh is explained in the next chapter. It should be noted, however, that in Edinburgh the dispensary not only forms the nucleus of the whole scheme, but that it was actually the starting-point of the campaign, the foundation-stone on which the rest was built.

Diagrammatic Representation of the Relationship of the Dispensary to the other Factors in a Complete Organisation.—The co-operation between the dispensary and the other factors in the campaign as in existence in Edinburgh is shown in the annexed diagram, in which the double lines denote intimate co-operation between any two agencies.

III. The History of the Dispensary Movement

(1) *The Dispensary Movement in Scotland*

As before mentioned, the Victoria Dispensary, Edinburgh, was founded by Dr. Philip in 1887. It owed its establishment entirely to voluntary enterprise and was started on a small scale, but has undergone a gradual process of growth and evolution during its twenty-four years of existence.

The following programme, which illustrates some of the activities of this dispensary, serves to show also what objects its founder had in view so long ago as 1887—five years after the announcement of Koch's discovery of the tubercle bacillus—while preventive measures elsewhere were either non-existent or still in their earliest infancy.

Programme of the Royal Victoria Dispensary, Edinburgh.—1. The reception and examination of patients at the dispensary, the keeping of a record of every case, with an account of the patient's illness, history, surroundings, and present condition, the record being added to on each subsequent visit.

2. The bacteriological examination of expectoration and other discharges.

3. The instruction of patients how to treat themselves and how to prevent or minimise the risk of infection to others.

4. The dispensing of necessary medicines, sputum bottles, disin-

fectants, and where the patients' condition seems to warrant it, food-stuffs and the like.

5. The visitation of patients at their homes by (1) a qualified medical man, (2) a specially trained nurse, for the double purpose (*a*) of treatment and (*b*) of investigation into the state of the dwelling and general conditions of life and the risk of infection to others.

6. The selection of more likely patients for hospital treatment—either of early cases for sanatoria, or of late cases for incurable homes—and the supervision, when necessary, of patients after discharge from hospital.

7. The guidance generally of tuberculous patients and their friends, and for inquiries from all interested persons on every question concerning tuberculosis.

The Inauguration of an Organised Anti-Tuberculosis Campaign in Edinburgh as a Result of the Establishment of the Victoria Dispensary.—The establishment of this dispensary led the way for the commencement of an organised campaign against tuberculosis in Edinburgh. The dispensary was not, in the words of the founder, "as in some other countries an afterthought, the younger sister, as it has been termed, of the sanatorium, but actually the starting-point of the tuberculosis campaign in the city of Edinburgh, from which the other agencies have emerged." The dispensary served to point out the facts concerning the extent to which the disease affected the poorer population, to raise public interest in the matter, and to endorse the sympathy of the richer inhabitants, the medical profession and the public authorities, in measures calculated to eradicate the disease and alleviate the sufferings of affected families. It has also served to centralise and focus into one organisation all individual effort in this direction, so that instead of the chaos of multitudinous anti-tuberculosis agencies all working in more or less different directions, which exists in some centres, the efforts of Edinburgh have all been focussed in one well-directed organisation.

The growth of the whole movement in Edinburgh, including the establishment of the Victoria Hospital as a sanatorium, the setting apart of beds in the City Fever Hospital for purposes of isolation of advanced cases, the introduction of compulsory notification, and finally the opening of the working colony, has been fully described in another chapter. I need therefore only refer to it here to show how the dispensary formed the foundation of the whole system.

Official Appreciation of the Edinburgh System.—This system, having a dispensary as its fundamental basis, has been advocated by the Local

Government Board for Scotland as a national scheme for that country in a circular, dated 10th March 1906, in which it recommended to all municipal authorities the establishment of dispensaries (not necessarily municipal) on similar lines in their districts. A further circular on the same subject was issued on 15th July 1908, and one or two towns have lately acted on this advice and established dispensaries more or less on the Edinburgh model.

(2) *The Dispensary Movement in France*

The first tuberculosis dispensary opened in France was the Préventorium (or Dispensary) Emile Roux, which was founded by Professor Calmette at Lille in 1901.

Professor Calmette prefers to call the dispensary a *préventorium*, as being, he considers, more descriptive of its chief functions.

At the time of the International Congress on Tuberculosis in Paris in 1905 (four years after the foundation of the Préventorium Emile Roux at Lille) there were over fifty dispensaries already established, and the official guide to the Congress says: "A Paris, comme en province, se sont ouverts et s'ouvrent encore, de jour en jour plus nombreux, des dispensaires et des sanatoriums; se sont organisés et se préparent les services hospitaliers et des asiles."

No Treatment Given but Considerable Material Assistance.—Professor Calmette considered that the dispensary should not give treatment, but, on the other hand, should give a considerable amount of material assistance. This has not been strictly carried out, owing to the difficulty of attracting patients if no treatment be given; but though a certain number of the French dispensaries do now give treatment, it must be confessed that the proper functions of a tuberculosis dispensary as understood in this country and in America are hardly realised in France at all, and that not only are the majority of French dispensaries very little else than relieving agencies, doling out material assistance with a free hand, but that there would appear to be a total lack of any definite organisation at all equivalent to the Edinburgh scheme. "La formule de ces dispensaires spéciaux n'est pas univoque. Pour les uns, ils représentent uniquement un organe de préservation, pour les autres, ils sont à la fois un instrument de préservation, d'assistance, et de cure."

Lack of Organisation.—Hence the dispensaries differ considerably from each other in their programme, some carrying out to a slight

extent the Edinburgh methods, others being practically nothing more than relieving agencies exercising a certain amount of supervision of the home conditions of the patients whom they are for the time being assisting.

Contacts not Examined.—As far as I am aware there is no attempt made even at the better ones to discover incipient cases by the examination of "contacts," nor does the doctor himself visit the homes of the patients whom he examines.

Supervision of the Home Conditions.—At the Emile Roux Dispensary visits are paid periodically to the homes by a staff of trained working men, who make full inquiries as to the family income and resources, and give advice as to the best way by which to minimise the risk of infection in each case.

(3) *The Dispensary Movement in Germany*

The progress of the anti-tuberculosis campaign in Germany is fully described in another chapter. I need therefore only mention a few points in connection with the tuberculosis dispensaries which in that country form such an important factor in the anti-tuberculosis organisation. If the Edinburgh ideals have not been carried out to their entirety in Germany, they have at least been far more thoroughly carried out than in the case of France.

Organisation Exists.—In Germany the various dispensaries do form a definite part of the anti-tuberculosis organisation and are themselves linked together in aims and methods.

Contacts are Examined.—Moreover in Germany an attempt is made by the dispensaries to examine the "contact" cases, and the homes are visited by trained nurses with the object of preventing as far as possible the spread of infection.

The first dispensary in Berlin was opened in 1904, in a suite of unoccupied rooms at the Charité Hospital, through the agencies of Professor Kayserling and Ministerial Director Althoff.

Since that date the growth of this movement in Germany has been strikingly rapid. Berlin was soon divided up into several districts, each of which was served by one dispensary, and dispensaries have now sprung up in all parts of the Empire.

No Treatment Given but Considerable Material Assistance.—The German dispensaries are like those in France in one respect, namely,

that they do not give any treatment, and that they give a considerable amount of material assistance.

As I have mentioned before, the giving of material assistance is an almost essential alternative to the giving of medical treatment, if any attraction is to be offered for persons to come for examination, and if any subsequent hold is to be maintained of those patients found on examination to be tuberculous.

The Effect of Compulsory Invalidity Insurance.—As to the reason for the German dispensaries not giving treatment, I need not enter into this subject here, but it must be remembered that the conditions in Germany are entirely different to those existing in this country, being profoundly influenced by the existence of an excellent scheme of compulsory insurance against sickness and invalidity. The operations of this scheme have not only provided the means for the medical treatment of all but the vagrant and the casual labourer, but have indirectly resulted in the establishment of an extremely large number of sanatoria and similar institutions for the working-class population.

Fundamental Principles the Same as in this Country.—The important thing to remember is that though conditions are so different in Germany to what they are in Great Britain, and though the dispensaries in the two countries differ on these practical points of administration, the fundamental principles remain the same. That is to say, the German dispensaries were established to afford (1) a ready means of giving expert advice to the poorer population; (2) to afford both by this means and by the examination of "contacts" a method for searching out and placing under surveillance or treatment patients in the earliest stages of the disease; and (3) to afford an efficient means of controlling as far as possible, both by education and by home visiting, the spread of infection.

(4) *The Dispensary Movement in America*

The growth of this movement in the United States has been no less striking. The first dispensary, or *clinic*, as it is called, was opened in New York in 1904.

The successful development of the anti-tuberculosis crusade in New York has been mainly due to the energies of Dr. Hermann Biggs, the General Medical Officer of that city, and it was a graceful act on his part at the Tuberculosis Conference, held in Edinburgh in June 1910, in connection with the Annual Meeting of the National Association for

the Prevention of Consumption and other forms of Tuberculosis, to state repeatedly in his speeches that not only had Edinburgh, in his opinion, the most complete and perfect anti-tuberculosis organisation in the world, but that the Edinburgh system had formed the model on the lines of which the whole campaign in New York had been conducted.

Dr. Biggs has himself described the campaign in New York in another chapter; I need not therefore do more than refer to the fact that the anti-tuberculosis organisation of that city includes thirty tuberculosis dispensaries or clinics, these being linked together in "The Association of Tuberculosis Clinics of the City of New York."

Edinburgh Ideals Carried Out. — Co-operation with the Charity Organisation Society in order to deal with the social and economic side of the problem as well as the strictly medical side, and to provide extra nourishment or other material assistance to those patients who are in urgent need of it, has been a feature of the New York programme, as it has been in Edinburgh and London.

The patients in New York are not only examined but they are treated at the dispensaries, as in Edinburgh. The "contacts" are also examined, and the houses are visited.

Co-operation with hospitals and sanatoria also exists, and patients are drafted on to these institutions by the dispensaries, if suitable.

Other American Cities.—Other American cities besides New York now possess tuberculosis dispensaries. Chicago ordered ten dispensaries at once. Boston not only has an organisation modelled directly on the Edinburgh system, but it publishes a diagram showing the co-operation existing between its dispensary and the other agencies very similar to that shown on the cover of this book.

At the time of the Washington Congress in 1908 Dr. Philip was presented with a map of Pennsylvania, showing sixty-seven dispensaries in that one State alone, modelled on the lines of the Victoria Dispensary, Edinburgh.

The Dispensary Movement in Canada.—Canada has now taken up the lead, and both Ottawa and Montreal possess dispensaries of the Edinburgh pattern. The latter, the Royal Edward Institute, Montreal, was opened by His late Majesty, King Edward VII., who thus once more, shortly before his death, manifested his deep interest in the anti-tuberculosis campaign.

(5) *The Dispensary Movement in England*

In this country, curiously enough, the movement has only very recently been taken up. The inherent conservatism and prudence of the English people have probably had something to do with this delay. It is very evident now, however, that the merits of the dispensary system are beginning to be carefully inquired into, and we are probably on the eve of a widespread adoption of the tuberculosis dispensary as one of the chief means of controlling the disease.

It will be very important to keep before the public the fact that the dispensary can no more *by itself* cope with the whole problem than could the sanatorium, or any other measure working by itself. If this fact be disregarded the dispensary will, like the sanatorium, be extolled to the skies for a while as the heaven-sent means of fighting tuberculosis, only to be later on reviled by its supporters as being unable to do all that had been expected of it.

If, however, the importance of having a complete scheme, as suggested and carried out by Dr. Philip in Edinburgh, be borne in mind, there can be no doubt that the widespread establishment of dispensaries in this country will have the most far-reaching and beneficial consequences.[1]

[1] A word needs to be said here with regard to the so-called "*tuberculin* dispensaries," as opposed to the proper tuberculosis or anti-tuberculosis dispensary. A small "tuberculin dispensary," or institution for the tuberculin treatment of tuberculosis, has been in existence for some time in London. In the opinion of its founder all other forms of treatment, including sanatorium treatment, are valueless. He claims to have had a very large percentage of successes, except in those cases in which a mixed infection is present, purely by the administration of large doses of tuberculin on lines laid down by himself. His method of administration has so far by no means met with the universal approval of the medical profession, but even supposing it were accepted, and supposing one could guarantee a small percentage of absolute cures, after all the curative treatment of existing cases forms but a small part of the programme of a dispensary proper. We cannot ignore the advanced cases because they happen to be necessarily cases of mixed infection, nor can we lightly put aside what is the chief function of a dispensary, *i.e.* to get into the homes, the chief breeding-ground of the disease, and so to prevent further infection. A "tuberculin dispensary" has been started at Portsmouth, and it is stated that the homes are being visited by a nurse or lady inspector working under the Public Health Department, and that "contacts" will be tested with hypodermic injections of tuberculin, those giving a positive reaction receiving a full course of tuberculin treatment. The visitation of the homes and the examination of the contacts, however carried out, is at least a step in the right direction, and shows that the importance of these two functions is already realised to a certain extent. The tuberculin treatment can and is being carried out at the ordinary tuberculosis dispensaries *in selected cases* as a small part of their comprehensive pro-

Opening of the First Dispensary in London.—"The Paddington Dispensary for the Prevention of Consumption" was opened in January 1909 by charitable enterprise.

It took as its model the Royal Victoria Dispensary, Edinburgh, and has endeavoured to copy the methods of that institution as closely as possible. The only difference, and that a very slight one in practice, though possibly more important in principle, lies in the question of the giving of material assistance. A small amount of such assistance is given by the Victoria Dispensary itself, in addition to the assistance which it obtains for its patients through the Charity Organisation Society and other bodies. In Paddington the dispensary committee passed a resolution at the very outset to the effect that the entire question of material relief should be left in the hands of the Charity Organisation Society. In this way all overlapping of charity has been avoided. The result of this co-operation between the Paddington Dispensary and the Charity Organisation Society has been perfectly harmonious and in every way successful.

The application of Dr. Philip's system to the needs of London was watched perhaps with some trepidation at first, but it may be truly said that from the first the advent of the Paddington Dispensary met with the hearty approval and support of the Public Health Department, hospitals, provident dispensaries, private practitioners, health societies, charitable agencies, and all health visitors and others engaged in social work in the neighbourhood.

Growth of the Movement in London.—This dispensary aroused considerable attention and interest in the metropolis, and several of the other boroughs soon began to make inquiries as to what the Edinburgh system really meant, and as to the practicability of applying it to their own districts.

The inhabitants of North Kensington were among the first to express a desire to follow the experiment of Paddington, and at the first annual meeting of the Paddington Dispensary it was announced that the two districts had decided to amalgamate.

The poorer parts of the two districts are contiguous, and the Paddington Dispensary building was centrally situated for both. It was therefore considered cheaper to increase the staff rather than to have two

gramme. This shows once more that the whole must be greater than the part, and the smaller organisation with its more limited outlook will be quietly absorbed into that larger scheme which seeks to weld into one efficient organisation all the forces and factors at our disposal with which to fight the disease.

buildings. Accordingly this dispensary is now known as the "Paddington and Kensington Dispensary for the Prevention of Consumption," and the work has grown so rapidly that two whole-time assistant medical officers have been appointed. St. Marylebone opened a dispensary in November 1910.

The Central Fund for the Promotion of the Dispensary System for the Prevention of Consumption in London.—These three west-end boroughs are, however, among the richer neighbourhoods in London, and the problem had to be faced how to enable the poorer districts, for instance of the east and south-east of London, to have the same advantages. Several boroughs had shown considerable interest in the movement, but had declared themselves unable to raise sufficient funds from purely voluntary sources. As a result there was a considerable amount of feeling in various quarters in favour of the whole scheme being municipalised and paid for out of the rates. However, the founders of the movement in London—notably Miss M'Gaw—decided to meet this difficulty by forming a central committee whose business should be the collection of a large fund of money from voluntary sources entirely, and with this money to give financial support to those poorer districts anxious to start dispensaries, but prevented from doing so by lack of funds.

This effort on the part of the founders of the movement proved extremely successful. A large and very influential committee was speedily formed, and subscriptions and donations poured in so fast that very soon a large sum of money was available with which to carry out its objects.

It must be clearly understood that this central committee does not concern itself to any great extent with propagandum work.

Grants from the central fund may be made both towards the capital expenditure and the annual cost of maintenance, and of course the proportion of the total cost which is paid by the central fund varies according to the comparative wealth or poverty of the district in question. Thus in a poor locality the central committee may offer to defray anything up to 75 per cent of the whole amount necessary, the rest to be collected locally.

Conditions under which Grants may be Given from the Central Fund.—Naturally the central committee have laid down a few general rules as to the conditions on which grants may be made, but otherwise it leaves the control and management of the dispensaries thus assisted entirely in the hands of the local committees of management.

The following are the conditions on which they insist:—

1. That the dispensary is managed by a voluntary committee and supported by voluntary contributions.

2. That it confines its operations to a definite area to be agreed upon in consultation with the executive committee of the central fund.

3. That it co-operates as far as possible with the medical officer of health and with all hospitals, dispensaries (free and provident) doctors, charities, churches and chapels in the district.

4. That cases requiring material relief are referred to the Charity Organisation Society or other suitable agencies.

5. That the accounts are kept according to the rules of the King Edward's Hospital Fund.

6. That the dispensary, whether it be a new and independent institution or a department of an already existing hospital or dispensary, is conducted on the following lines:—

(*a*) It shall employ one or more medical officers who shall not only see patients at the dispensary but visit them in their homes.

(*b*) It shall employ a specially trained nurse who shall, under the supervision of the doctor, care for the patients at the dispensary and at their homes.

(*c*) It shall only treat cases of tuberculosis.

(*d*) There shall be no letters of recommendation, and all treatment shall be free. Persons found able to pay for treatment shall be referred to private practitioners.

(*e*) Any person who is already under medical care shall be treated only after the consent of his medical attendant has been obtained.

Present Position of the Movement in London.—The poorer boroughs in London have not been long in taking advantage of the establishment of this central fund. Two east-end boroughs—Stepney and Bermondsey—have already established similar dispensaries under the ægis of the central fund, whilst Battersea, Poplar, Wandsworth, and Woolwich have definitely decided to follow suit, and may quite possibly have started by the time this appears in print.

Inquiries have been received by the central fund from many other boroughs; in fact, it is not too much to say that the establishment of tuberculosis dispensaries has been mooted in practically all of the metropolitan boroughs. There seems, therefore, every likelihood that London will soon possess a complete system of tuberculosis

dispensaries, as does New York, Chicago, and many other great cities.

The Movement in the Provinces.—The dispensary system is making slow but sure progress in the provinces also.

Dispensaries have been started at Oxford and at Cardiff, the latter being under municipal management.

The Southampton Medical Society passed a unanimous resolution in favour of a tuberculosis dispensary being started in that town, and there seems every prospect of the scheme being carried through as a memorial to King Edward VII.

Several other towns are discussing the advisability of starting on similar lines, so that no doubt before very long great strides will have been made.

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CHAPTER V

THE TUBERCULOSIS DISPENSARY (PART II.)

Its Organisation, Staff, Equipment, Cost, Methods of Work and Results

Points under discussion illustrated chiefly by reference to the dispensaries in Edinburgh and London.

I. Organisation

(*a*) Advantages of dispensaries being under voluntary control and yet closely linked to the Public Health Service.
(*b*) How this system has been secured in Edinburgh and London.
(*c*) An argument in favour of complete municipalisation of the dispensaries—the poverty of certain districts—and how this has been met in London, viz. by the formation of a central voluntary committee to collect funds and assist the poorer districts.
(*d*) Unsuitability of the provident system for tuberculosis dispensaries.
(*e*) Representative character of the Provisional Committee of the Paddington Dispensary to secure co-operation with :

1. Hospitals.
2. Charity Organisation Society.
3. Public Health Department.
4. Health Society and other bodies.

(*f*) How material assistance is given in :—

1. London.
2. Edinburgh.
3. New York.
4. France.

(*g*) Utilisation of voluntary workers to assist the dispensaries.
(*h*) The Samaritan Committee of the Victoria Dispensary, Edinburgh.
(*i*) The formation of a Visiting Committee in Paddington and the absorption of the existing Tuberculosis Committee of the Paddington Health Society.
(*j*) Organisation of the Visiting Committee in Paddington.

II. Staff

(*a*) Paid Staff :—

1. One or more doctors (full time or part time).
2. One or more nurses.
3. Porter (who also acts as caretaker).

(*b*) Voluntary Staff :—

1. Honorary Secretaries.
2. Members of the Visiting Committee.
3. Honorary Physicians (?)

(*c*) Functions of the medical officers.
(*d*) „ nurses.
(*e*) „ porter.
(*f*) „ voluntary workers.

III. Equipment

(*a*) Premises should be simple and inexpensive, consisting of :—

1. One or more waiting-rooms.
2. One or more consulting-rooms.
3. One or more dressing-rooms.
4. Porter's office.
5. Dispensary.
6. Laboratory.
7. Caretaker's rooms.

(*b*) Furnishing and other requisites.

IV. Cost

(*a*) Factors determining cost of dispensary :—

1. Population of district.
2. Density of population.
3. Death-rate from pulmonary tuberculosis.
4. Amount of voluntary assistance obtainable.
5. Payment or non-payment of medical staff.

(*b*) Cost of dispensary for a district which can be worked by—

1 paid medical officer and
1 nurse, with voluntary assistance.

(*c*) The dispensing of medicines.

V. Methods of Work

(*a*) Description of procedure adopted with each new patient at Paddington.
(*b*) Co-operation with general practitioners and hospitals.
(*c*) Home visits by (1) doctors and (2) nurses.
(*d*) The use of open-air shelters.
(*e*) The appointment of voluntary visitors.

VI. Results

(*a*) Depend largely on the degree of co-operation with other agencies and the efficiency of the latter.
(*b*) Danger of the work becoming perfunctory.
(*c*) A general improvement in the hygienic conditions of the neighbourhood should be noticeable, due to the dispensary's educational activities.

(*d*) It should become more and more rare to find advanced cases seeking advice for the first time.

(*e*) If notification be in force :—

1. Proportion of cases notified by the dispensary to the total notified should increase.
2. Proportion of notifications during life to the number of deaths should increase.
3. Duration of disease, or time elapsing between notification and death, should grow longer.

(*f*) Results of the working of the dispensary system in Edinburgh.

I PROPOSE, in dealing with the subjects included in this chapter, to confine myself more particularly to a description of two dispensaries of which I have gained some practical knowledge—the Royal Victoria Dispensary, Edinburgh, and one of its counterparts in London, the Paddington and Kensington Dispensary for the Prevention of Consumption. The latter dispensary is modelled directly on the lines of the Edinburgh one.

In the last chapter, when describing the ideals and functions of a tuberculosis dispensary, one point was that a certain degree of similarity exists between tuberculosis dispensaries in all countries. Though certain important differences exist even in their essentials, the chief differences lie in the manner in which their ideals and functions are put into practical operation.

Such differences are to be found in :—

1. The organisation of the dispensaries.

2. The extent to which they co-operate with other agencies to form a complete scheme, as in the Edinburgh system.

3. The amount of supervision of the home conditions, and by whom this is carried out.

4. The examination of "contacts."

5. The giving of medical treatment by the dispensaries.

6. The giving of material assistance.

I believe that the methods which have been found applicable and satisfactory in Edinburgh and London, and which in the former city have been subjected to a test extending over twenty-four years, will be found to be the most suitable for application to other towns and cities.

I. The Organisation of a Tuberculosis Dispensary

Advantages of Dispensaries being under Voluntary Control and yet Closely Linked to the Public Health Service.—One of the essential features of the tuberculosis dispensary is that it should not be an isolated institution—a means in itself of dealing with the problem—but that it should co-operate with all the other anti-tuberculosis agencies and form the connecting link between them.

Now in this country almost all the anti-tuberculosis agencies are of a voluntary nature. They include not only the sanatoria and homes for the dying, and also the great general and chest hospitals, but health societies, tuberculosis committees, and other associations for the study and improvement of the social conditions of our poor. The State or municipal agencies include only the Public Health Department and the Poor-Law Service, which with its infirmaries and out-door medical assistance is concerned chiefly or entirely with the poor after they have reached the stage of pauperism. It is therefore obvious that the dispensaries must be prepared to co-operate not only with State Departments but with all manner of voluntary institutions, and for this purpose it appears desirable that the dispensaries likewise should be under voluntary control.

The plan adopted with great success in both Edinburgh and London is to have the dispensary financed and controlled by a voluntary committee and yet closely associated with the Medical Officer of Health.

In Edinburgh this close co-operation with the Medical Officer of Health has recently been still further strengthened by a subsidy from the Town Council to the Victoria Dispensary. The Dispensary remains under voluntary control and management, as it has done ever since its establishment, but forms a recognised instrument in the hands of the Medical Officer of Health for the control and prevention of tuberculosis in his district. Such an arrangement, whether the dispensaries be subsidised or not, provided they remain under voluntary control, gives them freedom of action and a capacity for natural development which is not always to be found in institutions which are restricted by red tape.

Freedom from official trammel is even more important for young and growing institutions than for those as firmly established as the Victoria Dispensary, Edinburgh, but at the same time the importance of close

First Visit of Dispensary Nurse to an Infected Home.

co-operation with the Public Health Department has been fully realised in London. Thus in Paddington, when a voluntary committee was formed to start a dispensary, the Medical Officer of Health for the borough was elected its first chairman.

When, after its first year's work, the inhabitants of Kensington desired to amalgamate with Paddington, the Medical Officer of Health for Kensington was likewise made a member of the committee, and in the same way in every other borough where a dispensary has been established or proposed the Medical Officer of Health of that borough has been a member of the committee of management.

Manner of Co-operation with the Public Health Department in Edinburgh and London.—A word may be said here as to the manner in which co-operation takes place in Edinburgh and London between the dispensaries and the Public Health Department. On the one hand the dispensary becomes the chief agency in the district through which the Medical Officer of Health receives notifications of cases of tuberculosis. Further, all the information and statistics gathered by the dispensary regarding the incidence of the disease in relation to certain houses, streets, or even whole areas in his district are available for the use and guidance of the Medical Officer of Health. On the other hand the dispensary is able to get rooms, clothes, and bedding disinfected after the death or removal of patients, through the Medical Officer of Health. Also, since Poor-Law cases of pulmonary tuberculosis have become compulsorily notifiable, the Medical Officer of Health, through his sanitary inspectors, is able to send a large number of suspected "contacts" to the dispensary to be examined. In Edinburgh a further advantage accrues to the dispensary through its co-operation with the Public Health Department, in that, since wards in the City Fever Hospital have been set apart for cases of advanced disease, the dispensary is able to get most of its dangerously infectious cases, living in overcrowded homes, isolated by the Medical Officer of Health without having to depend on the Poor-Law infirmaries for this purpose.

The Question of Funds.—An argument in favour of the dispensaries being completely under municipal rather than under voluntary management which is often raised, is that in the poorer districts, *e.g.* some of the boroughs in the east and south-east of London, there would be considerable difficulty in raising sufficient funds from voluntary sources to carry on the work. As has been already said, this difficulty is now met by the formation of a central committee to provide

funds to help, or if necessary subsidise, the dispensaries in our poorer localities.

Unsuitability of the Provident System for Tuberculosis Dispensaries.—Another suggestion that is sometimes made is that tuberculosis dispensaries should be run on the lines of the provident dispensaries, but a moment's consideration of this will prove it to be impossible, for tuberculosis probably affects the improvident far more than the provident, and if the dispensaries are to search out and grapple with the disease at its root they must be open to the poorest and most destitute class of person. On the other hand both employers of labour and trades unions should thoroughly appreciate the value of such an institution in their district, and should liberally contribute to its funds.

Formation of Committee of Management.—Supposing, then, that dispensaries be established on voluntary lines as in Edinburgh and London, every effort should be made to secure harmonious relationship with other institutions working in the district. Thus, in order to secure the fullest co-operation with local institutions in Paddington, the provisional committee which was formed to start the dispensary was a very representative one. Besides the Medical Officer of Health for Paddington, who was its chairman, it also included the Chairman of the London Provident Dispensaries' Council, the Treasurer of St. Mary's Hospital, the Secretary of the Paddington Health Society, the Vicar of Paddington, and an Organising Secretary of the Charity Organisation Society. The co-operation with St. Mary's Hospital has been very close, the majority of the tuberculous patients attending there having been transferred to the dispensary, while *vice versâ* patients found by the dispensary to be suffering from diseases other than pulmonary tuberculosis have been mostly referred to St. Mary's Hospital. The most intimate co-operation has also existed between the dispensary and the Charity Organisation Society. The provisional committee of the dispensary passed a resolution in favour of giving no material relief to patients except through the Charity Organisation Society. This also applies to the other Anti-Tuberculosis Dispensaries in London.

The Giving of Material Assistance.—One of the first problems which has to be dealt with when starting a new dispensary, and one which will largely affect its organisation, is whether material relief should be given through the dispensary or by co-operation with some charitable agency. As just stated, none at all is given by the Paddington and

Kensington Dispensary or by any of the other dispensaries in London except through the Charity Organisation Society. In Edinburgh co-operation exists with the Charity Organisation Society, but a small amount of material assistance, in the shape of foodstuff and clothing, is given to necessitous patients by the Samaritan Committee, which consists of voluntary workers who undertake the visiting of some of the more needy cases. Much the same principle with regard to the giving of material relief appears to exist in New York, where co-operation with the Charity Organisation is very intimate.

In France, on the other hand, the giving of material assistance forms one of the most important functions in the programme of the dispensaries.[1] In fact, since the majority of French dispensaries give no medical treatment, the distribution of material assistance forms their sole means of attracting patients.

[1] The following figures, taken from the annual report for 1904 of the Emile Roux Dispensary at Lille, will show the extent to which this system may be carried. It is interesting to note what a large proportion of the total expenditure of this dispensary is taken up with the giving of charitable assistance in the form of food, etc.

Dépenses 1904.

	Fr.	Fr.
Frais généraux—		
A. Appointements—		
Service médical ; 4 médecins dont 1 directeur	3,144	
Service d'enquête et d'arrainissement des logements	2,100	
Service intérieur ; propreté, distribution des secours, administration	2,300	
		7,544
B. Imprimés	314.45	
Chauffage et éclairage	505.60	
Assurances, entretien du bâtiment et divers	1,127.40	
Matériel (Achat et entretien)	316.15	
Entretien d'un cheval	839.40	
		3,103
Assistance—		
Désinfection et blanchissage	1,711	
Crachoirs, antiseptiques, médicaments	591.25	
		2,302.25
Lait	6,030	
Viande	3,930	
Repas	350	
Œufs	6,299.90	
Secours de loyer	1,452	
Charbon	1,044	
Literie et vêtements	110.80	
Envoi d'enfants au Sanatorium de St. Pol-sur-Mer	388.15	
		19,604.85
		32,554.10

The Organisation of Volunteer Work in Connection with a Dispensary —We come now to a most important point in the organisation of tuberculosis dispensaries on voluntary lines, and that is the utilisation of voluntary workers as health visitors, etc., to assist the paid staff in carrying out the work of the dispensary.

In Edinburgh a number of such voluntary workers form what is known as the Samaritan Committee of the Victoria Dispensary. These ladies visit some of the more necessitous cases under the direction of the doctor. Such cases are selected by the doctor, and the workers report fully to him as to the patients' pecuniary condition and progress.

In Paddington the Tuberculosis Committee of the Health Society, which consisted almost entirely of ladies, undertook the visiting of cases notified to them by the Medical Officer of Health, general practitioners, and Poor-Law medical officers. The committee endeavoured to procure sanatorium treatment for patients and to look after patients on discharge. The Dispensary when opened formed a Visiting Committee very much on the lines of the Samaritan Committee in Edinburgh, and in course of time the Dispensary Visiting Committee and the Tuberculosis Committee of the Health Society were amalgamated to form a Joint Visiting Committee. Out of this large committee a small Advisory or Case Committee was formed to discuss more particularly the problems raised in dealing with certain difficult cases in which it was found hard to say whether the patient should be assisted by one or other voluntary agency or by the Poor-Law Guardians.

One of the ladies on the Visiting Committee acts as honorary secretary both to this and to the Advisory Committee. To her the medical officers of the dispensary mention the names of patients whom they wish visited for any particular purpose. She then appoints a visitor whose duty it is to periodically visit the home, endeavour to gain the confidence and friendship of the family, give what encouragement and advice she can, and report progress from time to time to the secretary. Should the visitor consider that the patient is in need of assistance in any form the case may be referred direct to the Charity Organisation Society, or should the case be one presenting some difficulty it is reported to the Advisory Committee, who bring expert opinion to bear on the matter and decide as to whether the case should be referred to the Charity Organisation Society, the Poor-Law, any other public or private agency, or left alone. One who has not had

experience in this work cannot realise the difficulties which arise in dealing with the social and economic condition of tuberculous families. To such a person the wholesale distribution of milk and eggs, or the giving of sanatorium letters would appear to solve the problem without any difficulty.

But it may be truly said, especially in cases of tuberculosis, that such indiscriminate charity frequently does more harm than good. On the other hand many cases have to be assisted who, morally and otherwise, would appear to be most unsuitable recipients of charity, for the sake of the rest of their family, especially in order to save their children from the fate of also becoming tuberculous.

II. The Staff of a Tuberculosis Dispensary

The staff is composed partly of voluntary and partly of paid workers.

The Paid Staff should consist of:—

(*a*) One or more medical officers (either part or full time).

(*b*) One or more nurses.

(*c*) A porter.

(*a*) *The Medical Officers* examine and treat the patients at the dispensary at certain specified hours.

They carry out the bacteriological examination of sputum and other discharges.

They visit the patients in their own homes to give advice as to preventative measures and to examine the other members of the household.

They treat the bedridden cases in the patients' own homes.

They notify cases to the Medical Officer of Health, and if necessary get the Public Health Department to carry out disinfection of premises.

They recommend patients for treatment at sanatoria, special schools, or hospitals for advanced cases, according to the patient's condition and circumstances.

They gather information and statistics from the large amount of material available.

They also undertake the training of the voluntary visitors and lecture to them on various subjects connected with the work.

(*b*) *The Nurses*, working under the medical officer's direction, visit

the homes of the patients the day following their first attendance at the dispensary.

Inquiries are made as to the social and economic condition of the household.

They observe the patient's environment and the sanitary or hygienic condition of his dwelling, especially noting lack of ventilation, overcrowding, or dirt.

Advice is given to the patient and his family as to how best to carry out the doctor's treatment and how to avoid or minimise the risk of infection.

The following schedule of inquiries is filled in on their return to the dispensary.

SCHEDULE OF INQUIRY REGARDING DISPENSARY PATIENTS.

No. in Ledger..... *Date of Report*.....

Name Age
Address Married or Single?
Occupation Has patient changed occupation?
Able to work full time? Or part time?
If unable, confined to bed?
How long ill?
Situation of house (area, ground floor, 1st, etc.)?
Character of neighbourhood?

Number and ages of inmates?
Number and description of rooms?
General aspect of house (clean, damp, dusty, smelly)?
Number of windows? Can they open?
Are they kept open (*a*) by day?
(*b*) by night?
Have they always been kept open?
Does patient sleep alone (*a*) in bed?
(*b*) in room?
How is washing of clothes done?
How long in present house?
If has removed within two years, previous addresses
Have there been illnesses or deaths in house?
(*a*) in own time?
(*b*) in previous occupancy?

Exposed to infection (*a*) at home?
(*b*) at work?
(*c*) among friends?
Present health of other members of household?

Photo. by Marshall Wane & Co., Edinburgh.

THE PATIENT'S HOME UNDER THE CARE OF THE DISPENSARY NURSE.

What precaution taken to disinfect?
T. B. in sputum?
T. B. in dust of room?
General dietary? Teetotal?
General condition (well-to-do, badly off)?
Proximate income of household?
Assisted by societies, church, friends, rates?

Signed.....*Reporter.*

.....*Medical Officer.*

They revisit their patients from time to time, especially endeavouring to supervise those who are living under insanitary or overcrowded conditions, and those who are inclined to be slack or careless in their carrying out of treatment, or of measures calculated to prevent the spread of infection.

In Paddington and Kensington the nurses do no actual nursing, all the advanced cases treated at home being nursed by the nurses of the Jubilee Nursing Association. In Edinburgh, however, the dispensary nurses do a certain amount of actual nursing, and in some cases even prepare meals for patients who have no one to do this for them.

(*c*) *The Porter* is a working man well acquainted with the district and the home conditions of the class of people from which the dispensary draws its patients. He acts as a caretaker to the dispensary premises and has to keep these clean. When the dispensary is open he receives the patients on arrival and takes charge of the waiting-rooms, etc. He also takes down certain particulars regarding the patients, and weighs them at each visit to the dispensary. If he is business-like, has a good memory for names and faces, is pleasant to work with, and makes himself friendly to the patients, he may be a most useful officer on the dispensary staff.

The Voluntary Staff comprises all the visitors and other volunteer workers already mentioned, including the honorary secretaries of the various committees. It may also in some cases include one or more honorary physicians. There are arguments both for and against having honorary physicians as well as, or instead of, paid medical officers.

In Paddington and at all the other London dispensaries the whole of the examination and treatment of patients is carried out entirely by salaried officers, who also visit the homes and examine the "contacts," but in Edinburgh two honorary physicians give their services to the Victoria Dispensary in addition to the paid staff.

The Duties of Health Visitors and other Volunteer Workers.—The duties of health visitors in connection with a tuberculosis dispensary are varied, and, when efficiently carried out, extremely valuable. All those who take up this work should have a knowledge of elementary hygiene and the general methods of prevention. They should thus be always able to give friendly advice to patients as to choice of dwellings, ventilation, arrangement of sleeping accommodation, disposal of sputum, etc. But in addition to this each visitor should make a special study of one or other of the following subjects:—The care and nourishment of infants and children, the selection and preparation of food, the choice of and apprenticeship to suitable trades for youths, and that most difficult problem, the finding of suitable employment for tuberculous adults.

The lady who acts as honorary secretary to the visiting committee will thus have at her command a highly efficient staff of visitors, and in any given case can, at the suggestion of the medical officer, appoint a visitor with a general knowledge of preventive measures and a special knowledge of one or other of the above subjects. If well done this will enormously help the work of the paid staff, and is less likely to become perfunctory.

One or two of these voluntary workers may prefer to offer their services in some other way to acting as visitors. For these also there is a field of great usefulness.

A large amount of secretarial and statistical work needs to be done. If a complete system of indexing be employed, as it should be, this alone will give employment for one or two mornings a week to a voluntary worker. There is also a great deal of correspondence and copying of letters to be done if the dispensary is to co-operate fully with other institutions.

Then there is statistical work which is a heavy drain on the time of the paid staff. The more statistics that are gathered from the vast material at the disposal of the dispensary the more does the latter fulfil its functions of being an educational centre in the larger sense. Most of this work can be done quite well by voluntary workers under the direction of the medical officer.

In Paddington and Kensington the voluntary workers in connection with the dispensary receive a regular course of lectures by the medical officer and various other persons on the medical, social, and economic aspects of the tuberculosis problem.

They thus resemble more the ladies who visit under the direction of the lady almoners of our hospitals, and are better equipped for their

work than the health visitor one occasionally meets whose desire to do good is far in excess of her knowledge of the way to do it.

III. The Equipment of a Tuberculosis Dispensary

Very little needs to be said under this heading, as the equipment of a dispensary does not differ materially from that of an ordinary out-patient department. It should be as simple and inexpensive as possible. As a rule a small dwelling-house may be adapted for the purpose, provided one or two rooms are large enough to act as waiting-rooms.

The accommodation should consist of:—

One or more waiting-rooms.

One or more dressing-rooms.

One or more consulting-rooms.

An office (in which the case-papers, etc., are kept).

A dispensary.

A laboratory.

Caretaker's rooms.

Two dressing-rooms are preferable, but where, as in Paddington, this cannot be secured, one room can be made to do by having separate days for men and for women and children. The rooms throughout the house should be airy and bright and devoid of unnecessary furniture and decorations. The walls should be distempered or painted, but not papered, so that from time to time they may be cleaned and disinfected. For the same reason the floors should be either polished wood or covered with linoleum.

Receptacles containing carbolic acid or other disinfectant should be placed in every room used by the patients and in the corridors, into which the patients may spit when necessary.

Placed near the entrance should be a weighing-machine and height standard. In the consulting-rooms there should be a dark cupboard, with a lamp for the examination of throats, etc.

The laboratory need contain very little except the essential apparatus for the bacteriological examination of sputum and urine. There should be a microscope, a centrifuge, and a steriliser.

IV. The Cost of a Tuberculosis Dispensary

The cost of a dispensary depends entirely on the size and character of the district which it is proposed to serve. No dispensary can be taken as a standard by which to estimate the cost for other dispensaries unless the following factors be taken into account:—

1. The total population of the district or town.

2. The density of the population, *i.e.* the number of persons per square mile.

3. The death-rate from tuberculosis.

Thus the staff of a dispensary which might be sufficient to tackle the disease in a well-favoured district of a given population with a low mortality from tuberculosis might be wholly inadequate to deal with the problem in a district of half the size but the same population and a higher death-rate.

Another factor which needs to be taken into consideration is the amount of voluntary work and assistance which can be obtained.

A large part of the expenditure of a dispensary goes to pay the salaries of the medical officers, nurses, and porter. If the services of efficient voluntary visitors can be secured a smaller staff of nurses will be required. As regards the doctors a certain amount of assistance may be afforded by unpaid workers, but it is rather an important point that the medical officers should be men who are making a special study of tuberculosis, and that one of them at least should give his whole time to the work.

It is also desirable that the entire treatment of any patient should be carried out from the primary examination to the home visiting, examination of contacts, and subsequent supervision by the same person. Honorary physicians can seldom devote sufficient time to such work, and it is therefore more satisfactory to have the whole work done by salaried medical officers.

If now we suppose that the district is of such a size and character that it can be thoroughly handled by a dispensary staff consisting of one doctor, one nurse, and a dozen voluntary visitors, the estimated annual expenditure, exclusive of capital charges, would be roughly £700.

This amount would be made up *approximately* as follows:—

Rent and Taxes	£100
Medical Officer's Salary	250
Nurse's Salary	100
Drugs and Dispensing	100
Porter's Wages at 20s. a week	52
Heating and Lighting	40
Cleaning and Repairs	30
Stationery and Printing	15
Postage and Petty Cash	13
	£700

The above figures are based on the actual cost of working the Paddington Dispensary during its *first* year, but are otherwise only approximate. The salaries, for instance, which are mentioned are merely suggested as minimum commencing salaries, and would be subject to variation, as also would the cost and upkeep of the building.

As regards the dispensing, this may be arranged for either by giving the contract to a local chemist, who will make up most of the stock medicines at his shop and send an assistant to dispense them at the institution, or by employing a special dispenser who will purchase the drugs and do the entire dispensing on the premises. The former method is suitable when only a small number of patients are dealt with, but as the work grows the latter will probably be found to be the best.

V. The Methods of Work of a Tuberculosis Dispensary

A good deal concerning the methods has been already described.

Let us follow a new patient through the dispensary.

On his arrival he is seen by the porter, who finds out whether he is resident in the district or not. If not resident, he is told he cannot be treated, and is recommended to go to some hospital, unless of course there be a tuberculosis dispensary in the district from which he comes. If, however, he is in the district he now has a case-sheet made out for him by the porter, who enters on it his name, address, occupation, his height and weight.

He is then handed over to the nurse in charge in the dressing-room, who fills in his case-sheet still further, entering on it a history of his present illness and any previous illnesses, with a note as to any history of tuberculosis amongst his relatives. She also inquires as to whether he has been recommended to attend the dispensary or has come of his own accord, and whether he has been recently under the care of any doctor. Finally she takes his temperature and pulse and enters them on the case-sheet. The patient then waits his turn to be examined. As soon as the patient before him has gone into the consulting-room he is told to get ready by stripping to the waist and putting on a flannel jacket.

When the doctor is ready for him the patient is shown into the consulting-room by the nurse, who hands over his case-sheet and any letters or cards of recommendation which the patient may have brought.

The doctor then reads through the case-sheet, enlarging on any points which he thinks of special importance, and then examines the patient's chest and notes the physical signs graphically on the diagrams on the case-sheet.

He then examines the patient's larynx and notes any abnormality. In the case of children he examines the mouth and pharynx carefully for bad teeth, tonsils, and adenoids, and palpates the abdomen for enlarged mesenteric glands.

It is generally found advantageous to give the patient a medical opinion as to the nature of his disease, and one has never found any evil consequences to the patient to arise from this procedure. It enlists the patient's confidence, and above all it generally secures his co-operation in carrying out the treatment.

Procedure with Regard to Patients already under Treatment.—Should the patient have been recently under another doctor he is not treated, but is given a formal letter to take to his medical man stating that he has been examined at the dispensary and found to be tuberculous, and asking the doctor's permission to treat the case.[1] The following is the form of letter which is used at the London Dispensaries:—

DEAR SIR,

A patient.....

presented.....self to-day with evidence of.....

.....

Ascertaining that.....he had been under your care, I should be glad to know if you have any objection to h.....attending at this Institution.

Yours faithfully,

Medical Officer.

[1] It should be noted that this letter is only used when a patient who has already been examined is found to have been recently under another doctor. As far as possible steps are taken to prevent such patients ever being examined without their doctor's consent, and both the nurse and the porter are instructed to make strict inquiries and to reject all such patients until they bring written permission.

If the patient be not under another doctor the medical officer writes a prescription for medicine and instructs the patient how the treatment should be carried out—the arrangement of the room, the open windows, the kind of food required, the amount and nature of work or exercise. He gives a card of instructions to read at home at leisure, also a specimen flask in which to bring a sample of sputum for examination, with instructions as to how this should be collected. The patient is then told to call and see the doctor at stated intervals, say once a week or once a fortnight. At each subsequent visit the doctor makes a short note on the case-sheet as to the patient's progress, and from time to time re-examines him to note any change in the physical signs.

Procedure with Regard to Non-Tuberculous Patients.—If the patient be not suffering from tuberculosis, but from some other disease, *e.g.* bronchitis or heart disease, he is not treated at the dispensary, but is given a card or letter to attend a suitable hospital, and on presenting this is allowed to attend the out-patients' departments. In Paddington all such cases, if adults, are sent to St. Mary's Hospital, and if children to the Paddington Green Children's Hospital.

The letter states:—

"You are recommended to attend.....Hospital .....Department at.....o'clock on ....., and hand this to the sister in charge."

It is signed by the medical officer, and gives also the patient's number and the date.

Enclosed in the envelope is a post-card addressed to the medical officer of the dispensary, saying that the patient has been examined by such and such a doctor, and will or will not be treated as the case may be. This card is returned to the dispensary by the lady almoner, or secretary of the hospital, and thus the medical officer has the satisfaction of knowing whether or not the patient followed his advice.

It should be mentioned that not only are these letters used for sending non-tuberculous patients to the general hospitals, but that a large number of tuberculous patients attending the dispensary are from time to time sent to one or other of these hospitals—especially the Children's Hospital—to have tonsils or adenoids operated on, teeth extracted, or other complications attended to.

These hospitals also use similar letters for the opposite purpose, namely, for sending tuberculous patients to the dispensary. A large number of patients are sent regularly to the dispensary in this way by St. Mary's Hospital. Thus every effort is made to establish a full, free and friendly co-operation between the dispensary and the general hospitals of the district.

Supervision of the Home and Examination of "Contacts."—On the day following his first attendance at the dispensary the patient is visited in his home by the nurse, who inspects all the rooms and the arrangement of the sleeping accommodation, and what precautions have been taken to prevent the spread of infection. She gives advice and elicits a certain amount of information with which she fills in her schedule on her return to the dispensary. In the course of a few days the medical officer also visits the home. His object is to see if his instructions are being carried out, and offers to examine the other members of the family. In this way many unsuspected cases are discovered. Occasionally the source of infection is found to be another member of the family who is suffering from the disease in a more or less advanced stage. Steps are then taken to prevent any further risk of infection. If necessary the advanced case is recommended to enter a hospital or infirmary, where he may cease to be a danger to his friends.

Should the house have a flat roof or a back yard the doctor considers the advisability of lending to the patient an open-air shelter in which to sleep.

These shelters have been found extremely useful. They are simple and cheap in construction. Their functions are as follows:—

1. The continuation of sanatorium treatment at home after discharge from one of these institutions.
2. The treatment of early cases who are unable to obtain, or who for some reason are unsuitable for, sanatorium treatment.
3. Treatment of more advanced cases who could not be recommended for sanatorium treatment.
4. In treating advanced cases who would otherwise be sleeping in such over-crowded conditions as to be a danger to their relatives.

Should the family be in such circumstances that the patient is

unable to obtain sufficient nourishment the case is referred either to the Charity Organisation Society or to the Guardians; should there be several small children in the family a visitor is appointed with a special knowledge of their care and nourishment; should the family appear to be not making the most of their resources a visitor advises as to domestic economy; or should the impoverished condition of the family be due to lack of employment of the bread-winner a visitor is chosen who has made a study of this side of the problem.

VI. The Results of a Tuberculosis Dispensary

As the dispensary is an integral part of a complete scheme, the measure of success achieved by it depends largely on the efficiency of the other factors in the campaign and on the closeness of the co-operation existing between them.

The work of the dispensary, perhaps more than that of any other factor in the campaign, is liable to become perfunctory unless the staff be well chosen. Printed reports are very little guide as to the character of the work which has been done.

Thus the number of visits paid by the doctor and nurse during the year may sound very large, but these visits may have been absolutely valueless. One good visit from the right sort of person is worth six indifferent calls by one whose heart is not in the work, and who holds the appointment merely as a means of earning money.

The result of the successful working of a dispensary should be a gradual but noticeable improvement in the hygienic conditions of the poor living in that district. The dispensary will not only have an educational effect on its actual patients, but through them it will indirectly act as a great educational asset to the entire district.

Another result which would point to the work having been done satisfactorily would be that it should become more and more rare to find patients suffering from advanced stages of the disease seeking advice for the first time. I understand that at the Victoria Dispensary, Edinburgh, this has become exceedingly rare, and it is certainly already becoming quite noticeable in Paddington.

If notification be in force in the district the following facts should be revealed:—

Firstly, that the proportion of cases notified by the dispensary to the total number notified is increasingly large—showing that the dispensary was becoming more and more the centre of the anti-tuberculosis campaign.

Secondly, that the annual proportion of cases notified during life to the number of deaths also increases—showing that the dispensary, through its system of searching out the disease, is getting hold of an increasingly large percentage of the tuberculous material in the district.

Thirdly, and most important, that the duration of the disease, taken as the average time elapsing between the notification and the death of the patient, becomes longer and longer—showing that the dispensary is discovering an increasingly large percentage of cases in the incipient stages.

During the first year that compulsory notification was in force in Edinburgh over 50 per cent. of the total number of cases notified were notified by the Victoria Dispensary.

It is rather difficult to prove the result of the dispensary's activities by a marked fall in the death-rate from tuberculosis, as such a fall, if it occurs, may be partly attributed to so many other factors, but the success achieved by the working of a complete organisation in Edinburgh is certainly suggested by the mortality curve. Without claiming absolute relationship of cause and effect, there is little doubt that the extended activities of the system were associated with the steady fall which occurred in the number of deaths from pulmonary tuberculosis in Edinburgh during the ten years 1897 to 1906, a fall of 42·1 per cent. as compared with a fall of 17·9 per cent. during the same period in London.

The rate of fall has been greater in Edinburgh during the previous ten years than in any of the other towns of Scotland. These facts appear to prove undoubtedly that the "Edinburgh system" has been an unqualified success, and we may certainly apportion a large part of that success to the Victoria Dispensary, which was not only the starting-point in that city of the whole campaign against tuberculosis, but has ever since kept in the forefront as the most important factor in the complete organisation. France, Germany, America, and other

countries are every day proving the value and efficacy of the Tuberculosis Dispensary, and I believe that even London, though its first dispensary is still quite young, is beginning to realise in it the only satisfactory method of dealing with the problem.

D. J. WILLIAMSON.

CHAPTER VI

THE SANATORIUM

Conception, Construction, and Administration

Conception—Selection of Cases—Difficulties of Prognosis—Early Diagnosis—More Advanced Cases—Applications for Admission—General Plan of Administration—Sanatorium Education—Discipline—Duration of Treatment—Heating of Sanatoria—Special Treatments—Bacteriological Treatment—Construction—Altitude—Locality—Site—Distribution of the Buildings—Choice of Type of Building—Component Parts in Detail—Patients' Sleeping Rooms—Sanitary Arrangements—General Arrangement of a Pavilion Sanatorium—Administrative Block—Details of Construction—Connecting Paths—Hot Water Supply—Disinfection of Sputum—Shelters.

Conception.—The sanatorium, in the Edinburgh system, occupies a place in direct relation to the dispensary, and intermediate between the colony and the hospital for advanced cases. It is the link in the system which is particularly concerned with those patients who require treatment, and whose condition admits of hope of arrest or amelioration. Patients are sorted out in the sanatorium—those who are fit for graduated work under medical supervision are after a period of residence sent to the colony, those who fail to react to treatment are after a period of education sent home or to the hospital, while the bulk of its inmates are cases requiring considerable periods of treatment before being fit to be sent back to work outside or in the colony.

Selection of Cases.—Applicants for admission are first passed through the dispensary, and only those are admitted whose physical condition warrants the expectation that they will benefit by a course of sanatorium treatment. This selection and re-selection of cases is rendered necessary by two factors. In the first place the problem of prognosis is exceptionally difficult, and secondly, advanced cases may pass through the various stages indicated above. Such cases are admitted on probation, and may by prolonged treatment reach the stage at which they are able to return to work at the colony. The selection of patients depends not only on the prognosis arrived at on first examination, but on that come to after a period of treatment.

Difficulties of Prognosis.—It may be well here to indicate shortly what the main difficulties are in giving a prognosis, and what factors mainly influence the patient's progress under treatment. First and foremost comes his latent power of resistance to disease, that recuperative power which is called into operation by appropriate treatment, whether specific or general. This is in every case at the start an unknown factor. One meets with cases which on admission show few physical signs of disease, and the general condition may be fair, but still improvement fails to take place, or is at best only temporary and partial. In the present state of our knowledge we can only refer this to a deficiency of latent recuperative power. Such cases are fortunately few, but they are by no means all associated with bad family histories; in fact a patient with a bad family history may do exceedingly well.

Considering next the clinical facts as they appear on examination, we find that the capacity for improvement depends more on the patient's general physical condition than on the extent of the pulmonary lesion. Many a tuberculous subject is now earning his living who might at the outset of treatment have been considered hopeless if judged solely by the standard of the stethoscopic examination of the lungs. On the other hand a limited lesion with physical enfeeblement, as evidenced specially by a rapid pulse, etc., indicates the probability of a grave prognosis.

A provisional prognosis is therefore arrived at by grouping together the general physical condition, the extent of pulmonary involvement, and the state of functional efficiency of the patient's various organs. In addition we must remember that the first and last of these are greatly influenced by his previous history and surroundings. A labouring man with a family who has worked on to the last, and whose food and work, especially in a city, are perhaps of the worst, will, when removed to the pure air and hygienic conditions of a sanatorium, receive a much more powerful stimulus to recovery than will a patient whose nutrition has been carefully attended to at home.

Thus in the sanatorium treatment of pulmonary tuberculosis there exist factors of uncertainty in prognosis more powerfully operative and more varied than in most other conditions, and the initial difficulty of prognosis, which is already great enough, is increased. It is therefore exceedingly important from the point of view of benefiting all classes of patients that the sanatorium should be used to test the patients' recuperative power, the cases being finally selected by an expert with experience of the capabilities of the system and a thorough knowledge of the factors

which govern prognosis. This qualification is especially important in view of the fact that every public sanatorium has frequently to reject cases sent in as suitable. In spite of increased acquaintance with the possibilities of the treatment of pulmonary tuberculosis it is still unfortunately true that occasionally, when a patient does not appear on the day fixed for his admission, inquiry elicits the information that he is dead. Considering the depressing effect of a death on the rest of the inmates it is better than that he should die within a few hours or days of admission.

When the sanatorium serves an urban district through a dispensary such mistakes are much less likely to occur. They emphasise the necessity of having all applicants personally examined by one of the staff of the sanatorium before admission, in the case of country districts where the distances are not so great as to make such an arrangement impossible.

Early Diagnosis.—It is not within the scope of this chapter to deal with the oft-repeated demand for the earlier diagnosis of pulmonary tuberculosis, but it might be well to mention that it is better, both in the interest of the practitioner and of the patient, that cases should be sent for treatment before they have proved by long-continued decline and extension of disease that they are incapable of being treated at home. One of the most delicate situations with which the sanatorium physician has to deal is to explain to such cases, when they improve under his treatment, why they were not sent earlier, or, alternatively, why their condition was not sooner diagnosed.

More Advanced Cases.— In connection with more advanced cases one of the problems which has to be dealt with in the anti-tuberculosis crusade is what to do with patients whose disease has so far been arrested as to become chronic, but whose condition and physical signs preclude the possibility of any hope that they will ever be able to work, and who are yet not moribund, and thus not, strictly speaking, hospital cases. The object in dealing with such cases is to prevent them being a danger to their neighbours. It is difficult to make working-class patients observe the elementary sanatorium rules regarding spitting and other means of spreading infection, and it is greatly to be feared that many of them disregard precautions and remain sources of danger to their neighbours, even when sanatorium treatment and experience has enabled them to prolong their own lives. In a sanatorium working to its fullest capacity they must move out to make room for others. Where circumstances permit they are often kept in for long periods, to their own

great benefit and to the safe-guarding of those who come in contact with them in outside life.

Applications for Admission.—Applications for admission should be made on a form which will elicit the more important features of the patient's case, such as the daily temperature variation—a single observation is useless—the state of the pulse, the extent of the physical signs (either recorded verbally or on a skeleton chart), and the presence of complications tuberculous or otherwise. Annexed is the form used in the Royal Victoria Hospital for many years. It is the formal application which passes through the dispensary and may take the place of personal examination in the case of patients coming in from a distance, as the hospital admits cases from all parts of the country.

*Per*_____ *Dated*_____

THE ROYAL VICTORIA HOSPITAL FOR CONSUMPTION, EDINBURGH

MEDICAL EXAMINATION

WITH A VIEW TO ADMISSION TO THE HOSPITAL.

(Statement to be completed and signed by Medical Attendant.)

_____ 191

I have examined_____

to-day, and find condition as follows :—

GENERAL APPEARANCE	SYMPTOMS	PHYSICAL SIGNS	TEMPERATURE
			PULSE
LENGTH OF ILLNESS	COMPLICATIONS		URINE (*in respect of albumin*)

N.B.—The Medical Attendant will oblige by making the Statement as explicit as possible, and by forwarding it **direct** *to the Clerk and Treasurer, Royal Victoria Hospital for Consumption, 4a St. Andrew Square, Edinburgh.*

Signature,_____

Qualifications,_____

Address,_____

In the case of sanatoria with waiting lists re-examination at frequent intervals should be insisted on as a condition on which the applicant's name is kept on the list, and especially is it necessary that a fresh record should be made immediately before admission. No doubtful cases should be admitted from a distance, as patients are apt to be sent in who should, in the letter of the law, be sent home at once. When such cases travel a long distance it often would do away with any chance of prolonging existence to send them back home again. Thus sanatoria serving large country districts are often burdened with patients who are kept only for humanitarian reasons. Such cases injure the reputation of the sanatorium and the treatment generally. When certain of the beds in a sanatorium are reserved for the exclusive use of certain towns or districts the rules for admission should in no respect differ from those in force for beds not specially reserved. An objectionable practice is the necessity or privilege of being recommended by a subscriber. All applicants should be treated alike, and admission should be entirely decided by the possibility or probability of saving useful lives.

General Plan of Administration.—From the above sketch the relationship of the sanatorium to the various other departments will be seen more clearly. It is kept in touch with the poorer urban districts by means of the dispensary which separates out the cases into those unsuitable for admission and those suitable. After admission into the sanatorium the latter are divided up according to individual requirements. Those whose condition, although advanced, warrants at least a probationary trial, if they show signs that they are possessed of the necessary recuperative power, are kept in for a full period. The remainder are treated until fit to be sent home or to the colony.

The less serious of them are treated by the regulation of their rest, exercise, and diet. The exercise may be formal, though at the Royal Victoria Hospital graduated work in the garden or grounds has for many years taken a place in the régime. All cases are at first kept at rest. As their condition improves they are gradually passed through the further stages of the treatment. In the treatment of this class the colony is especially valuable, inasmuch as sending such cases home to bad surroundings and hard competitive work is an invitation to recurrence or relapse.

Sanatorium Education.—The general management of a patient's life in a sanatorium may be summarised as educating the patient into leading a healthy hygienic life. He must be educated in a twofold sense.

He must learn to minimise the chance of being a centre of infection to others. He must be taught the manner in which the disease is communicated and the dangers of coughing, spitting, and kissing, and the care necessary to prevent infection through handkerchiefs, linen, and table utensils which he may have occasion to put near his mouth.

So far as he is individually concerned, he has his own life regulated. He learns the proper intervals at which to take food and the proper food to take, both as regards quantity and quality. His rest and activity are arranged as indicated by the requirements of the case. He learns the necessity of open air night and day as an element in counteracting the poisons of the disease and as a stimulant to his general health. Perhaps the most difficult thing to teach him is that there is no necessary relationship between temperature, fresh air, and catarrhal fevers. It may take long to disabuse his mind of the fallacious idea that sitting in a current of fresh air is necessarily followed by a cold.

Discipline.—In regard to the internal discipline of a sanatorium, the medical superintendent should be supreme. In particular he should have the power to dismiss patients for breach of rules without reference to any outside committee.

Duration of Treatment.—It may not be out of place here to give some indication of the length of time required for successful treatment. The size of the sanatorium should be in excess of the requirements. Nothing militates more against success than a long waiting list. The applicant is kept at home, where he has presumably been doing badly, and is not admitted at the time of diagnosis, while, in addition, he is in a state of unrest and uncertainty, which has a particularly sinister influence on the course of his trouble. Mental anxiety especially is badly borne by the consumptive, even when his disease is apparently cured, and is frequently the determining cause of a relapse. There should be no official limit to the period of residence, as it may be the unfortunate lot of a patient to have to go out just as substantial improvement is setting in, and thus the benefit of the whole period of treatment is lost. This is particularly important in sanatoria where there is no compulsory colony system or any other provision for supervising the patient's life after leaving, with the view to readmission should a recurrence threaten.

As time goes on and the pathological relationships of the disease are better understood, it is being recognised that the onset of the disease is

by no means determined by the appearance of symptoms and physical signs in the chest. The date of infection may be months or years previous to the date at which the patient developed symptoms which compelled him to seek medical advice. It follows that if this view be correct a disease which takes months or years of insidious progress to reach a stage at which medical intervention is necessary cannot be cured in a few weeks or even months.

Another point which influences the duration of treatment is the actual extent of the pulmonary lesion. The normal process of cure is by absorption and shrinkage of the tuberculous tissue. It is true that the preliminary catarrh which heralds the advance of tuberculisation does clear up often with great rapidity, but here we have the fallacy that it may be due to secondary catarrhal infection of devitalised tissue containing tubercle nodules. The disappearance of the catarrh does not indicate that the nodules that have caused it or have opened the door for the secondary infections have been removed or are even quiescent, and at the same time, when small or scattered, it may be outside the capabilities of any known method of clinical observation to detect their presence. They must shrink and disappear by the same process that effects the eradication of the larger foci. This rapid disappearance of accompaniments, as compared with the almost intolerably slow disappearance of dulness and change in the breath sounds, serves to differentiate tuberculosis from the more acute pulmonary conditions.

Duration of treatment is further prolonged by the fact that tuberculisation of the lung means tissue destruction, and therefore shrinking of the nodules entails diminution in size of the whole organ. The lung is, however, held in the chest wall, a more or less rigid bony case, which resists the desired contraction except in particular, and in some sites of the disease very limited, directions. A slowly progressive lesion with such impediments to improvement must obviously take an unusual time to disappear. That it can disappear, and that cure is possible, is proved by the many recorded cases of calcified scars observed in the post-mortem room as well as by clinical observation of old cases. Unfortunately we have no certain clinical means of detecting the final disappearance of danger. So long as any tuberculous nodules remain in the lung, so long have we the danger of relapse or recurrence, and the disappearance of symptoms and accompaniments indicate that arrest rather than cure has taken place.

It is this confusion between arrest and cure that is responsible for so many differences of opinion as to the results of treatment. The

patient must be prepared to live a hygienic life, not necessarily a strict sanatorium life, so long as he has any foci of disease in his body, and no one can tell when these finally disappear. It is therefore misleading to talk of cures after a few weeks or months of treatment. Sanatorium treatment, strictly speaking, can only effect arrest; the cure is in the patient's own hands afterwards, either at home or in the colony.

Treatment may alter to a certain degree the physiological and pathological conditions affecting cure, but nothing at present available can influence the physical conditions of mass and rigidity which largely determine the duration of the process. It is obvious, therefore, that sanatorium treatment must in many cases exceed the three to six months commonly allotted to it. Even at its conclusion the patient is not out of possible danger. The duration must vary with the individual case. A minimum may be about six months, followed by certain precautions as to work and life for a further period of eighteen months to two years. This will only apply to early cases, and is then only the bare limit of safety. In advanced cases it is increased in a much greater ratio than the increase in size of the area affected.

Sanatorium Treatment.—Great importance is thus thrown on the after treatment at home or in the colony. The question may then be asked, Why send a patient to a sanatorium if he can treat himself at home, and if what is perhaps the most crucial period must be spent at home? The reason lies in the fact that the average home life is not strictly hygienic in the sanatorium sense. To take full advantage of the open-air life the consumptive must go beyond the limits common to our country. The more thoroughly the open-air life is carried out in all its details, the better the chance of recovery; the more complete the change from former habits and surroundings, the more powerful the tonic stimulus. The consumptive has to learn that the danger of the open-air life lies not in going in for it completely and thoroughly, but in doing it in part, alternating a warm vitiated atmosphere with a cold pure one. Perhaps more important than anything else is the fact that, until he has learned the system, what he is to do and what he is not to do is not left to his own judgment, as it must be in private life, even when the practitioner responsible for the carrying out of the details has himself had practical experience of what is a specialised line of treatment.

While the patient's attention should be concentrated on the necessity of carrying out treatment in all its details, it should be diverted from himself. Clinical observations should be made as unobtrusive as

possible, especially in those not seriously ill. Temperature taking, counting of the pulse, etc., are no doubt very necessary from the physician's point of view, but undue insistence on such points, though very impressive to the patient, has the effect of turning out a not inconsiderable proportion of self-centred invalids to whom the only topic of interest is their temperature and pulse. This type, while most commonly met with in paying institutions, is by no means unknown in the working-class sanatorium, and depends for its existence on the peculiar psychical conditions caused by the disease.

On the other hand the details of treatment and their importance cannot be too strongly insisted on, and the reason for each explained, if the patient is to carry on the treatment afterwards for the requisite period to ensure cures. The need for the colony is proof that education and supervision are necessary if the patient is to carry the treatment to a successful issue when thrown on his own resources. In addition to the more thorough way in which the patient learns to carry out the treatment, he is safely guarded from certain dangers. His food and exercise are regulated to safeguard him against excess, and he is isolated from the various secondary infections with which he is in almost daily contact in his own home. The connection of colds with the contraction of pulmonary tuberculosis is no survival of an exploded notion. The start of breaking down or of spreading tuberculisation is often a catarrhal infection. The tuberculous lung with its raw surface and diminished resistance is particularly prone to invasion by secondary organisms. All colds are infectious, though there may be contributory causes, as extreme or rapid change of temperature. Visitors to a sanatorium should be under control to prevent the introduction of influenza and allied infections. The patient always living at the outside air temperature is safeguarded against those changes of temperature which render his mucous membrane liable to infection. The fate of patients who leave before arrest is accomplished and consolidated is frequently to develop an infective catarrh or cold on going home which induces a local congestion and lowered resistance, facilitating the return of the disease. Especially is this the case when the home conditions are not hygienic even in the popular sense.

Heating of Sanatoria.—In the Edinburgh system the heating of sanatoria is especially arranged to avoid the possibility of the patients being exposed to any of the contributory causes which tend to the development of secondary infection. In the gradual development of the Royal Victoria Hospital it was early recognised that while it is good for the

patient to be kept warm by being properly clothed so as to conserve the body heat and energy, it is distinctly prejudicial to make him breathe warm air. Heated air loses that characteristic quality which is called freshness. The temperature gradients of nature are gradual, while a person passing from a heated room to the outside air encounters an exceedingly steep temperature gradient, perhaps a score of degrees in a few seconds. In the former case the gradual gradient enables his mucosa to adapt itself to the gradually altering conditions, while in the latter he is breathing with congested mucosa a microbe-laden atmosphere. The circulating blood is able to deal with the invading organisms, but immediately he passes into the cold air his mucosa becomes pallid, and the organisms gain entrance before his circulation has recovered its balance. The result is what is termed "a cold." Radiators and all convection heating apparatus are to be condemned. Open fires are preferable, being more cheerful, and heating the air less than solid objects primarily by radiation. If free through circulation of air be insisted on in apartments occupied by patients, the attempt to heat it is futile, while if it be confined and heated it is harmful.

The efficiency of the treatment depends on the thoroughness with which it is carried out and the perfection of the hygienic conditions. With this reservation the type of sanatorium from the point of view of results is immaterial, and elaborate buildings do not conduce in the least degree to excellence of results.

Special Treatments.—None of the specialised forms of treatment have so far realised the claims made for them, or the expectations raised on their first introduction. Treatment by high frequency currents, X-rays, and elaborate inhalations owe their effect largely to mental impression, and tend to divert the patient's attention from the more important factors of sanatorium treatment. The point to insist on is the essential simplicity of the system, that it is merely the thorough living of a hygienic life, which must be carried out after leaving if the danger of recurrence is to be avoided.

Bacteriological Treatment.—The only specific treatment which has justified itself is the bacteriological by vaccines and sera. Though in pulmonary disease the complication of secondary infection and the multiplicity of the organisms concerned have prevented the same degree of success that has been attained in treating cases of pure or surgical tuberculosis, still the partial success attained warrants the hope that further research and increased knowledge and experience will cause this department of the treatment to develop, until by direct specific

treatment the pathological stage of the disease may be more quickly and surely overcome, and thus the duration of rigid active treatment may be materially shortened.

All sanatoria should be fitted with appliances of a laboratory for the proper carrying out of this treatment, which is a highly specialised one, and in inexperienced hands, therefore, considering the potency of the agents employed, not unattended with risk. Constant and minute observations have to be made to ensure the best results, and in this direction the usefulness of sanatoria presided over by specialists should be taken advantage of in the treatment not only of pulmonary lesions but of other forms of the disease, as the healthy life exerts a powerful retarding influence on the progress of all tuberculous affections.

Construction.—The sanatorium or building in which the patient is accommodated must fulfil certain simple conditions. It must provide a maximum of fresh air and sunlight, its structure and surroundings must be as hygienically perfect as possible, and it must be so designed as to admit of easy and inexpensive administration.

Sanatoria vary in size and type of construction, from the altered villa capable of containing a few patients to large institutions specially built and designed for the purpose.

Altitude.—In these islands they have been erected at almost every altitude from sea-level to 1000 feet up. They exist as curative institutions in all varieties of climate. Abroad they are found in subtropical countries like Madeira and Queensland, as well as in climates like that of Canada with its extreme winter cold. Altitude and climate have been asserted to exert a very marked influence on the course of tuberculosis, and yet we meet with sanatoria at all altitudes and in almost all climates with a practically uniform measure of success attending the application of the open-air life. It does not follow that because a patient does well in the dry bracing atmosphere of the Alps at some thousands of feet of elevation, he therefore will do the better for being treated at the highest altitude available in Great Britain, where perhaps he will find himself exposed to damp hill mists and other inconveniences which he might have escaped lower down. The aim of the treatment is, or ought to be, to fit the patient for taking his place in the ranks of the workers, and not to produce a crop of exotics requiring to winter abroad or to live under artificial conditions of climate or altitude. Thus a person the subject of tuberculous disease should be treated under conditions as little artificial in these

respects as possible, and as nearly alike as is practicable to the conditions under which he will afterwards have to live and work. This view is now generally recognised, and all along has been the guiding principle in the Edinburgh system. The Royal Victoria Hospital, founded by Dr. Philip in 1889, is on the borders of the city of Edinburgh, whence a large proportion of its patients is drawn, and yet the results, both immediate and remote, will bear comparison with those of any similar institution whose site has been chosen solely with regard to hygienic and climatic conditions.

Locality.—A public sanatorium should be situated in a healthy locality, but must be easy of access from the district which it is intended to serve. It is better in the interests of economy and of administration to sacrifice a hundred feet of altitude than to add a mile to the distance to which patients, coals, and stores have to be conveyed from the nearest railway station. The question of rainfall and climate need not be discussed, because in any given administrative district, such as a country, which may have occasion to erect a sanatorium, the differences are relatively slight, although climate is one of the factors which requires consideration. It may be said briefly that there should be a small rainfall, this, generally speaking, entailing a fair amount of sunshine, and the locality selected should not be unduly exposed to fogs from the sea or river valleys, to mists from the hills, or to dust from roads. Questions of soil, drainage and water supply need not be dwelt upon, because they are governed by the laws of public health which are applicable to any similar institution with the same number of inmates. The only point which needs special emphasis is that some system of sewage disposal should be employed which will ensure the destruction of the tubercle bacilli, with which the excreta are contaminated through the swallowing of sputum, even in cases with no gastro-intestinal disease.

Site.—When the locality has been chosen on the above general lines the actual choice of a site should be influenced by certain important considerations. It should not be in the middle of arable land because of the unavoidable smells which accompany agricultural operations at certain times of the year. There must be available shelter from the sun and wind, and free circulation of air round the sanatorium, so situated as to get the maximum amount of sunshine. In other words the site must be a compromise. Because a sanatorium is an open-air institution it need not be perched on a hillside, neither is it necessary that it should be buried in woods.

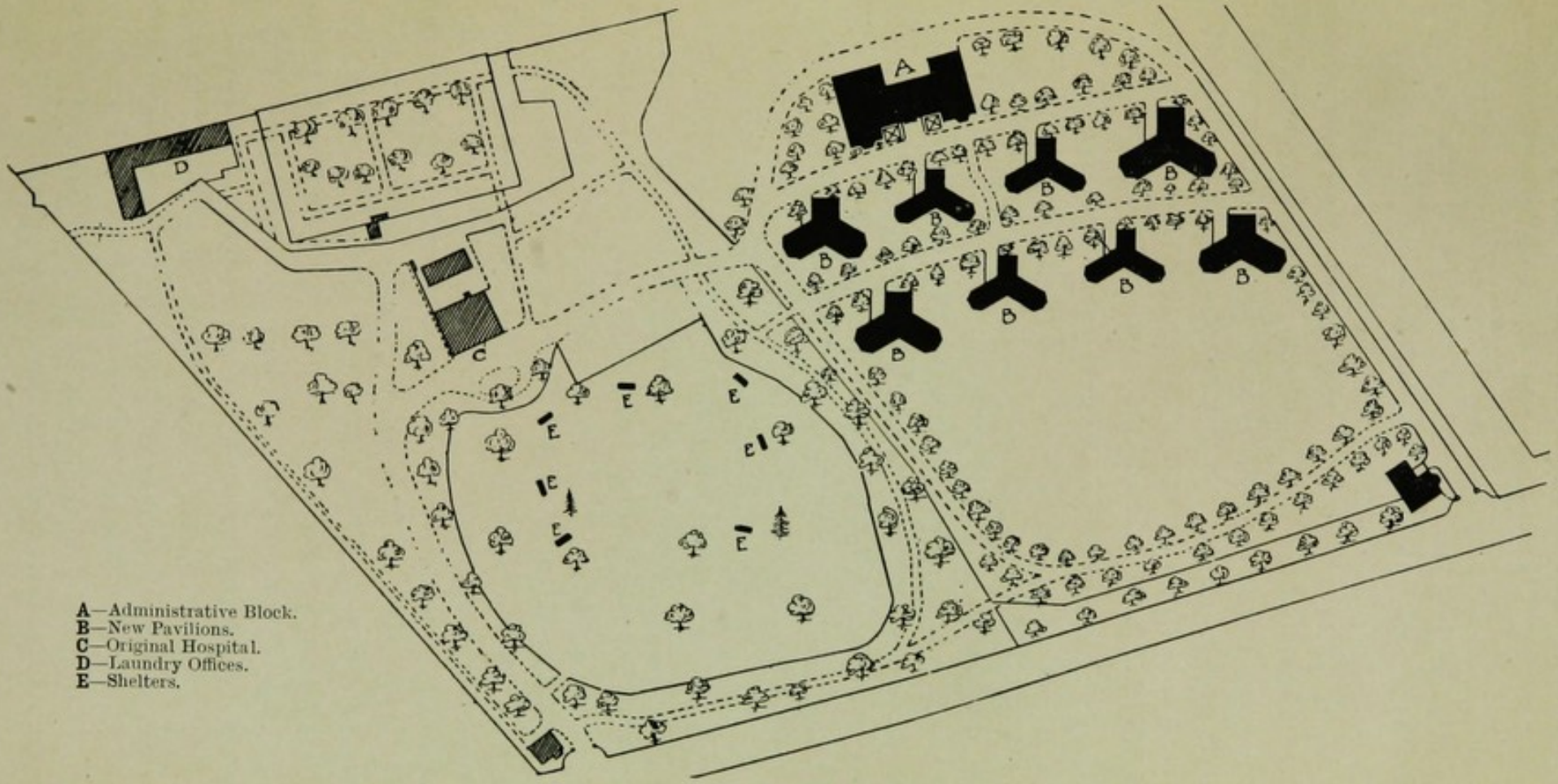
Similarly because in winter, and in this climate frequently also in summer, it is beneficial to the patient that he should get all the sunshine available, he should not be roasted for lack of shelter from the sun in hot weather. The building must be sheltered not from hypothetical north winds, which are comparatively rare, but from the prevailing winds of the district, with the distinct reservation that the direction of the wind in any given spot is determined quite as much in hilly districts by the configuration of the landscape as by the direction of the overhead air currents. The site must furnish sufficient level ground for the buildings and possible extensions. At least one approach should be level, because the convalescent patient, when first prescribed walking exercise, in many of the more advanced cases must have a level walk of reasonable length on which to exercise, so that he need not be confined to the site of the building until he is sufficiently advanced to be able to ascend a gradient; for the same reason the woods or other shelter from the wind and sun should be close at hand. For the actual purposes of treatment a hill or a wood a mile away sheltering the sanatorium is useless.

The aspect of a sanatorium site should be in the main to the south, so as to catch as much sunshine as possible.

Distribution of the Buildings. — Having chosen a site, the next question which arises is the distribution of the various buildings and approaches. Much subsequent trouble in administration will be avoided by attention to a few details. The entrance to sanatorium grounds should be from the north, and no traffic ought to pass to the south of the building through that part of the grounds reserved for the patients. The main entrance to the building is then at the back or north side. This arrangement of the approach and entrance ensures proper control of visitors, all of whom, as previously stated, should be under direct medical supervision. The administrative block is in direct relation to the entrance and approach. All engines, laundries, septic tanks, and other sources of dust, smoke, and fumes are best removed from the sanatorium buildings proper, and preferably hidden by woods, yet conveniently situated to the approach for carting. Whenever possible they should be to the leeward of the prevailing wind.

Types of Sanatorium Buildings. — Sanatorium buildings may be divided into three main types, though combinations of any of the three are to be found.

I. The small single building, with a central administrative block and wings accommodating the patients.



PLAN OF THE ROYAL VICTORIA HOSPITAL.

II. The hydropathic type, in which the arrangement is generally somewhat similar, but the wings are of more than one storey.

III. The pavilion type, in which the administrative portion is a single isolated block, and accommodation for the patients is in separate buildings or pavilions.

The component parts of a sanatorium are :—

A. The administrative portion, comprising kitchen, patients' dining-hall, nurses' and servants' quarters, matrons' and doctors' quarters, dispensary, laboratory for routine clinical observations of an elementary kind, and a room for the routine examination of patients. These are frequently accommodated in separate buildings or in widely separated parts of the same building, but for purposes of discipline among the staff they are better in a single block.

B. The patients' sleeping quarters, either wards or separate rooms, with their sanitary equipment.

C. The engineering department, including lighting and laundry plant, mortuary, coal stores, etc. As stated above, they should be as far away from the sanatorium as is consistent with proper administrative control and ease of communication, and never attached to the administrative block.

The laboratory may adjoin the engineering, or be situated in the administrative block. In either case it should afford sufficient accommodation for research work, and be fitted with the necessary apparatus for carrying out modern bacteriological tests.

Choice of Type of Building.—The three types of building differ rather in the relative position and arrangement of the component parts than in the structure of each individually. Each type possesses certain advantages over the others, and various considerations will determine the type most suitable for any given sanatorium.

The first point to consider in the choice of type is the size of the institution at the start, the possibility of extension at a future date, and the probable ultimate dimensions, having regard to the population and to the incidence of tuberculosis in the district which it is designed to serve.

The initial size will be contingent on the local needs and the funds available for its erection, its ultimate size on the possibility of co-operation on the part of municipalities or other public authorities towards its upkeep. It will be obvious that for a sanatorium which will have to be enlarged a certain type may have inherent advantages.

The style of building will also be influenced by the area of level site available. This consideration affects the structure of sanatoria probably more than of any other, as they are so frequently erected among hills or on sloping ground, the objection to which has already been indicated.

The question of the relative ease of administration of the various types will have to be considered, especially in regard to the supervision and control of patients and staff. As regards the staff this has been noticed in enumerating the constituent parts of the administrative block. The patients' quarters, especially shelters, should be within sight of the doctors' or matrons' ordinary working rooms, or the working quarters of any of the staff responsible for the maintenance of discipline. The cost of erection will affect the architectural features of the building perhaps more than the actual type. The practice of spending large sums of money on sanatorium construction and leaving them unendowed cannot be too strongly condemned. The building should be effective for the purpose, but simple. The aim in its erection should be comfort not luxury, and the expenditure of capital on elaboration of architecture, to the detriment of the subsequent maintenance of a public institution, paid for out of public funds, is to be strongly deprecated.

A sanatorium is a costly institution to maintain, inasmuch as the cost of feeding and nursing is relatively high, while the total number of cases which can be treated is low. When the average length of residence is calculated in months and not in days and weeks, as in the case of a general hospital, it is obvious that the outlay per patient is relatively large, although the cost per bed may not appear so high.

The layman's conception of the usefulness and cost of a curative institution is based on the familiar statistics of a general hospital. To the lay mind sanatoria appear costly out of all proportion to the total number of individuals benefited. When in addition it is remembered that the percentage number of cures cannot be determined till the cases have stood the test of years of outside life, and then appear much attenuated, that the number of recurrences of the disease, either through the fault of the patient himself, or the unavoidable unhealthiness of his home conditions, bulk more largely in public attention than the number of those who resume their work quietly, the fact of their having been in a sanatorium being soon forgotten, it is easy to understand the difficulty experienced in maintaining a sanatorium off the rates or by public subscription; hence the importance of saving money

Administrative Block of the Royal Victoria Hospital.

on erection for purpose of endowment. There are sanatoria in this country and abroad built on what is known as the hut principle, the buildings of which are primeval in their simplicity and relatively cheap, while the results got may be as good as those attained in institutions erected at a large capital cost per bed. Expenditure on buildings, therefore, does not conduce to improvement in the results of treatment.

Contingent on the supply of funds and on the demand for admission will be the number of patients who can be treated in a year. The sanatorium should therefore have a certain elasticity as regards size. It should be possible to add to the sanatorium without interfering with the primary administrative design, and on the other hand it should be capable of being diminished in size with a corresponding diminution in cost should it be desirable to limit the number of cases.

For ease and cheapness of administration it is important that those portions of the building devoted to this special purpose should be as central as possible, so that the distance to all parts of the institution is reduced to a minimum.

Provided that a sanatorium be designed on the above general principles, it is obvious that each type possesses certain advantages. A single building centralises administration more than the pavilion type, as distances are obviously shortened whenever the number of patients exceeds thirty or thereby, especially if they be accommodated in separate rooms. The building becomes cumbersomely long unless it revert to the hydropathic type and be built with more than one storey.

In considering the advantages of the latter type as regards ease of administration, stairs present more inconvenience and cause more fatigue to nurses and other members of the staff than considerably greater distances on the level. Raising a sanatorium building to more than one storey necessitates an elevator, with an increased outlay to start with, and subsequent difficulties and expenses of administration. A hydraulic hoist consumes a large quantity of water, while an electric hoist adds considerably to the cost; in addition a hoist well is not a hygienic structure. As almost invariably constructed they do not give access to sunlight; they collect dust, and if hydraulic they collect damp. Even when only very early cases are admitted patients may, during the course of treatment, develop hæmoptysis or acute relapses or infections which incapacitate them for climbing stairs, and

consequently an elevator becomes a necessity. Another advantage claimed for the hydropathic type of building is that it is more easily and cheaply heated by a single hot water installation. The question of heating has already been dealt with, and the general lines on which the heating of sanatoria should be guided have been described. The objections to convection heating have been explained, and the impossibility of heating currents of fresh cold air has also been pointed out. If a system of heating by fires be adopted this argument in favour of a single building disappears.

The pavilion type obviously possesses many advantages. In this type it is possible to realise in the most complete form the principles of aerotherapy. In it the patients are distributed in buildings which can be multiplied almost indefinitely, provided initial provision has been made for administration. The number of patients can then be increased by adding pavilions, or diminished by closing them, without disturbing the general arrangement of the sanatorium or the plan of administration. Diminution of size can be accompanied by a diminution in staff in a way which cannot be realised in a single building, and thus the cost of maintenance is reduced.

Another advantage of this type is the ease with which non-infective cases can be isolated. This can be accomplished in a way impossible in a single building unless special provision be made in the original design. The pavilion type renders easy the separation of patients and staff. It is desirable for purposes of discipline that the whole staff should be lodged in one building; at the same time it is advisable that the entire staff should be isolated from the patients, both to avoid chance of infection and for reasons of discipline. Tuberculosis is now regarded as an infective disease, and as public opinion is educated out of the hereditary theory into the infective, it will come to be recognised that the staff must be safeguarded against risks of infection. This will be best attained by housing the staff separately, as in a hospital for infectious diseases. This system has the further advantage of discouraging familiarity between the patients and staff. It may be argued that under the hygienic conditions of a sanatorium, infection cannot take root as in ordinary life. Against this view it must be urged that all precautions should be taken against risk, and that infection may lie latent for years and may break out when the infected individual is living under totally different conditions of life and work. The danger of contracting the disease does not cease

Pavilions at the Royal Victoria Hospital, Edinburgh.

within a short period of exposure to infection, but remains probably for years for anything we know to the contrary. A sanatorium is an institution open to the air and consequently open to the invasion of flies and insects. One has only to have lived there to appreciate the risks of insect-carried infection. Insects may gather infection from the lips or covers of sputum mugs and then fly off, it may be to the food dishes or domestic utensils used for the staff. The single building type of sanatorium was originally devised in the days when insect-borne infection did not occupy the important place which it now does in epidemiology. The pavilion type, with its more complete isolation, offers the greatest measure of safety.

Component Parts in Detail

Patients' Sleeping-Rooms.—Whatever type of building be adopted the patients' accommodation, whether wards or single rooms, must have a southern exposure. The factor which determines their arrangement is the necessity of securing the admission of light and air on all sides rather than any system of internal ventilation. Any room occupied by patients should be ventilated by a through current passing direct from open air to open air. The rooms, therefore, must open off a corridor so provided with windows that it is practically open air, the communication being by large fanlights for use when the doors are closed. This precludes the possibility of any system of grouping the rooms, and makes the wings only one room and a corridor in thickness from back to front. It is thus easily understood how the length of the corridor of a single-storey sanatorium limits the easily workable size and possibility of expansion. The administrative advantages derived from having the whole sanatorium in a single building are thus more apparent than real. The front windows of the rooms should be as near as possible to the centre of the front wall, so as to leave the corners in shade, and should have fanlights for use in stormy weather when the windows have to be shut. Many types of windows have been devised, but the most useful is the opening casement window with gun-metal frames. This avoids the sagging which inevitably occurs when the windows have wooden frames and are open continuously for long periods.

Sanitary Arrangements.—Baths, W.Cs., slop-sinks, etc., are arranged in a block connected with the back of the corridor by a cross draughted

passage. They should not be placed in any angle of the building where eddies are apt to blow through into the corridor. The ideal position is at the ends of the wings, where obviously they exert the least interference with the lighting and through ventilation of the corridor, and where the chance of gases and exhalations being carried into the building is least. The difficulty in locating them at the extreme end of the building is that if the corridor be any great length patients in the centre of the building may be inconveniently far from conveniences. This is again one of the objections to long corridors.

General Arrangement of a Pavilion Sanatorium.—In such a sanatorium each pavilion is of small size. Every patient is near lavatory conveniences which can be given their ideal sanitary position without, to any appreciable extent, increasing the distance. By a radial arrangement of the pavilions in a semi-circle around the central administrative block distances are kept at a minimum. Each pavilion is connected with the central block by telephone, while attached to each is a ward kitchen, and thus for purposes of administration and nursing each is a separate complete unit. On this general arrangement has evolved the Royal Victoria Hospital, though the shape of the ground available, the fact that roads, etc., were in existence before the hospital was erected, together with the utilisation of pre-existing buildings as nurses' home, laundry, etc., has slightly modified the typical arrangement, though at the same time proving the general adaptability to pre-existing conditions. The pavilions consist each of two small wards tilted at an angle with the lavatory block behind. This tilting of the wards further improves the position of the back wing from a sanitary point of view, while the fact that being open to the light and air at both sides and at the projecting end removes the objection to the tilted arrangement which is apparent with single rooms. In a sanatorium with separate rooms opening off a corridor, tilting of the wings forward or curving of the front limits the amount of sunlight falling on the front of the building, as the projecting wings throw a shadow on the central portion both morning and evening; in addition in wet weather the wing facing the south-west is exposed to the full force of the wind and rain, and necessitates the closing of the windows when the wind is from that direction. In the case of wards the tilted arrangement is not open to this objection, as the windows can be closed on whichever side the wind is blowing; and the sunshine can enter from all sides except the end by which they are attached to the administrative portion. The automatic heater for heating water for

Interior of Pavilion: Relation of Beds to Windows.

baths, etc., and coal stores, are lodged below the back wing. The steam is supplied by a central boiler which is situated to the north of the buildings and hidden by trees.

Administrative Block.—The general arrangement of this is easily understood. Sleeping quarters should be in the upper storeys. On the ground floor the doctor's and matron's quarters should be close together and near the telephone. The matron should be near the kitchen and dining-hall. Separate complete dining accommodation should be provided for the nurses and servants. The only part specially designed for the use of patients is the dining-hall, which should be large enough to meet possibilities of extension and should be open on three sides, the fourth connecting with the kitchen through a service room. A cloak-room for patients' overshoes, etc., should be provided. The service room should have an opening directly to the front of the building for distributing food to bed patients in the pavilions.

Details of Construction.—Some of the details even in domestic architecture have become so familiar of recent years that they need only be alluded to. Thus all corners, skirting-board, and cornices are rounded to prevent the lodgment of dust. Floors are polished pitch pine except in passages where there is much traffic, where they should be of terrazo or of cement, as it is impossible to keep them polished, because the patient in a sanatorium does not go about in ward slippers but in thick boots. The painting of wards and rooms is one of the difficult questions to settle. The aseptic highly-polished surface of enamel paints in sunny weather causes a glare so intense as to be painful to patients confined to bed. The hygienic advantages of a glossy surface are less necessary in a sanatorium than in a hospital, owing to the free access of nature's disinfectants, sunshine and air; the walls may therefore be coated with a good distemper giving a matte surface, which diminishes the glare but requires, owing to exposure to the weather, more frequent renewal than glazed oil paint.

Connecting Paths. — These should be of concrete with raised centres for dryness, and should run to the various pavilions as straight as is consistent with the artistic laying out of the ground.

Hot Water Supply.—This may be by steam from a central boiler, as indicated above, but there should be in each ward kitchen a boiler sufficient to supply water for foot-warmers, etc. This ensures a supply of hot water at any time of day or night, and admits of the main boiler being banked up except at bathing hours. In each lavatory there

should be a sink with a hot tap with a nozzle suitable for filling bottles. The sink should not be of porcelain as it is liable to be broken by the falling of a hot bottle. A similar tap should be provided in each ward kitchen for night use.

Disposal of Sputum.—Sputum when collected may be put into paper bags containing sawdust and burnt in the boiler furnace, or a single boiler with a wide cock at the bottom may be fitted in the engineering block, preferably heated by a fire, so as to be independent of steam when the boiled contents run into the drains.

Shelters.—Shelters should be constructed of dressed wood so as to be easily kept clean. They should be so constructed as to have as few ledges as possible. Rustic work and undressed wood is undesirable because it harbours insects and dust. The shelters used in the Royal Victoria Hospital are of this simple construction, measuring 12 to 14 feet long, 4 feet broad, glazed at the ends and open in front, with roofs sloping down towards the back, so that there is no closed space at the top to catch stagnant air. They are best arranged in two sets with their backs directed to the prevailing winds. If trees are available for shade, as should be the case, they are necessary only in stormy or wet weather. Shelters should all be overlooked by the working quarters of the staff, as when out of sight it is impossible to ensure that the rules regarding rest, smoking, etc., are carried out by patients. In exposed situations and where shelter accommodation is limited revolving shelters are of advantage.

In the above only the more important points of management and construction have been touched on, chiefly those in which sanatoria differ, or should differ, from other therapeutic institutions. The place of the sanatorium in an organised system of treatment and prevention has been indicated, and it may be well to emphasise the fact that the sanatorium or its treatment is only part of a system, but that unless the other links of the chain be provided also the treatment is incomplete, and the results must suffer by the cases being badly selected to begin with and relapsing before the cure is consolidated at a later stage. The regulated open-air treatment of the sanatorium gives results both as regards the alleviation of symptoms and the improvement in the patients' well-being at all stages of the disease which it is very difficult to get in the home treatment of the working classes. Even in better class practice the same is true, unless the invalid's quarters be reconstructed on sanatorium lines and the treatment constantly supervised by a specially trained nurse, as it is impossible for the busy

Open Shelters as Arranged for Night Use.

practitioner to supervise the details in a sufficiently thorough manner to secure the best results. The tonic stimulus of the treatment, which is often sufficient alone to check the advance of the disease, must always prove a valuable adjunct to the specific treatment by tuberculins and vaccines.

J. J. GALBRAITH.

is pursued and not the cause; and that irritation of pulse and quickness of circulation, which are the effects of weakness, are treated as if they proceeded from inflammation, until the patient is reduced to a skeleton, and all the powers of the constitution are destroyed: thus co-operating with, and increasing, a disorder of which the destructive tendency and the ravaging powers are but too well known; but admitting that this old practice succeeds, and that the life is preserved, it is still but a system of palliation, for the extreme precaution necessary against the fear of taking cold makes the patient a complete hot-house plant, and implies a state of constant bondage. The climate cannot be brought to suit the constitution, therefore the constitution must be hardened to bear the climate, which can only be done by . . . restoring the frame to its original healthy tone and vigour. . . .

"It is Dr. Stewart's urgent wish that the patients should be for many hours daily in the open air—cautioning, however, avoiding fatigue—either on horseback or on foot, or in an open carriage, which last he relies upon as being least likely to tire the patient. The diet should consist of plain meat, broth, pudding, fish, or any course of simple but nutritious food, according as the patient feels inclined. . . .

"Dr. Stewart is anxious to explain that his system partakes not in the most remote degree of the Brownonian or cramming system; he is altogether hostile to it, or to any undue means of giving strength by false stimuli; he only prescribes that moderate quantity of refreshing food which nature and reason point as wholesome, and those early and regular hours which are most efficacious to digestion."

In the early years of the eighteenth century other writers had now and then urged the adoption of open-air treatment, but it was not until 1840 that George Bodington laid down the principles of aerotherapy, and founded in England the first sanatorium in the world, amid a storm of ridicule from the powers that were. How near his views approximated to the modern clinical conception of tuberculosis is indicated in the following passages from his book:—

"Sir James Clarke rather sarcastically alludes to what he terms the *beef steak and porter system*, which he decidedly condemns, apparently guided by the 'phlogiston' theory. I could never recommend porter and beef steaks to any person suffering from tubercular consumption—not from any preconceived notion of 'phlogiston,' but on account of its very grossness and unfitness for a consumptive patient. On the other hand neither could I recommend to such an one, from a prejudice in

favour of the aforesaid theory of 'phlogiston,' a meagre diet of vegetables, beer and water, aided by tartarized antimony, etc. I should recommend to one thus consuming away under the influence of this *wasting disease*, a nutritious diet of milk, fresh animal and farinaceous food, aided by the stimulus of a proper quantum of wine having regard to the general state and condition of the patient. If this is to be called the *beef steak and porter system* then I am guilty of patronising it, but to my mind it rather has the character of a preservative system, whilst the wasting plan is as much entitled to be called the destructive one."

And again—

"The only gas fit for the lungs is the pure atmosphere freely administered, without fear; its privation is the most constant and frequent cause of the progress of the disease. To live in and breathe freely the open air, without being deterred by the wind or weather, is one important and essential remedy in averting its progress, one about which there appears to have generally prevailed a groundless alarm lest the consumptive patient should take cold. Thus, one of the essential measures necessary for the cure of this fatal disease is neglected from the fear of suffering or increasing another disease of trifling importance. No two diseases can be more distinct from one another than consumption and catarrh. It is the latter only which might be caught by exposure to atmospheric causes; with the former they have nothing to do. Farmers, shepherds, ploughmen, etc., are rarely liable to consumption living constantly in the open air, whilst the inhabitants of the towns and persons living much in close rooms within doors are its victims. The habits of these latter ought, in the treatment of the disease, to be made to resemble as much as possible those of the former class as respects air and exercise, in order to effect a cure. How little does the plan of shutting up patients in close rooms accord with this simple and obvious principle.

"The equal temperature so much considered and said to be necessary should be that of the external air instead of that so commonly employed, the warmth of a close room.

"The common hospital in a large town is the most unfit place imaginable for consumptive patients."

It was long before the views of George Bodington were accepted in this country, although he died in 1882, the year in which Koch determined the bacterial origin of the disease. His teaching, however, found a more ready acceptance abroad, and in 1854 the first sanatorium

Stage II. Regulated Walking and Breathing Exercises.

in Silesia was founded by Brehmer, while in 1873 Dr. Edward Trudeau had begun this treatment in the Adirondacks.

The Principles of Aerotherapy. — Aerotherapy has by no means reached the limits of its acceptance, as the majority of the profession have yet to learn that its principles are applicable in the treatment of most forms of disease. Regarding pulmonary tuberculosis as a systemic intoxication due to a specific micro-organism, we control the intoxication and raise the resistance of the patient by a regulated life under conditions of pure air, and by the avoidance of all debilitating influences. At the same time by various medicinal, hydrotherapeutic, and specific measures a more or less direct attack is made on the tubercle bacillus. In this chapter I propose to consider how the patient's resistance may be raised by (1) pure air, (2) dietary, and (3) graduated rest and activity.

Pure Air.—Pure air is the first essential of aerotherapy. It is not so much a question of changing the environment of the patient from the city to that of the mountain, the sea, or the desert, as that the poisoned atmosphere of the ill-ventilated sitting-room and bedroom should be abolished and the patient exposed to the free atmosphere, whether of the city or of the country. In all stages of the disease an almost immediate improvement is to be marked after such a change. The hectic flush, the pallor, the irritant cough, the low arterial tone, myotatic irritability, and night sweats all go before the healing property of pure air. I have never seen, nor do I ever expect to see, a single case of night sweat that resisted complete exposure to the atmosphere. Dryness, calmness, and changes of temperature are minor considerations, and it is possible to carry out the open-air treatment even in the midst of a great city. It is well to accentuate this point, as change of climate has not always meant a change from the unphysiological to the physiological life. If the patient goes to some health resort and there continues a life crowded with social excitement, it were better that he had remained in the city living with open windows. Here fogs will now and then complicate the treatment, but the larger smuts may be excluded by stretching fine gauze over the open window.

Types of Cases.—Fresh air is essential in the treatment of every type of case, whether it be early or advanced, pyrexial or apyrexial, catarrhal or non-catarrhal, complicated or uncomplicated. The amount of exposure to the air should not be limited by any considerations whatsoever, and in point of fact the more advanced

the case the more marked is the *immediate* improvement and relief of symptoms, this being particularly applicable to cases of mixed infection.

Seasonal Variation.—The open-air treatment can be carried out in the British Isles all the year round, and so far from its being contra-indicated or modified in winter, it is common experience that tuberculous patients in this country do better in winter than in summer. The old teaching was to send these patients abroad for the winter, whereas if they are to be sent away at any time it should be during the summer months. The effect of cold on tuberculous patients is particularly liable to produce chilblains, and this is to be guarded against in the winter months by the provision of suitable clothing, warm gloves, and hot bottles, if the patient be sleeping in the open air. If there is to be any attempt at open-air treatment it is perfectly useless to think of heating the atmosphere, and the amount of money that has been wasted in the construction of sanatoria by laying down elaborate systems of heating which are never used, or if used are only effective in the same degree as they are prejudicial to treatment, is a consideration which might well be kept in view for the future.

Sanatoria.—So far I have considered the principles of aerotherapy on general lines, and this with intention, for while sanatoria are institutions for special treatment, it is also possible in the majority of cases to carry out this treatment at home, which likewise applies to the regulation of dietary, rest, and graduated activity. In certain cases sanatoria are invaluable, in so far as they insist on a strict discipline and constant medical supervision, and where this is not to be attained at home, life at a sanatorium represents the patient's chance of arrest and cure. In other cases it is equally valuable to send the patient to a sanatorium for a time so that he may be carefully educated in the open-air treatment, which he is then able to carry out in his own home.

In choosing a sanatorium site and climate are of minor importance to good discipline and proper supervision, and these are more likely to be attained in small than in large institutions. The absence of all pills and potions for night sweats is the best criterion of the efficiency of the open-air treatment. Apart from their curative and educative value in the actual treatment of the disease, sanatoria have played a large part in extending a knowledge of the open-air treatment among the profession and among nurses, and have thus widened the possibilities of treatment at home.

Stage III.—Grade A. Patients Raking and Sweeping Lawn.

I have avoided any reference to the part tuberculin should play in treatment, as this is fully discussed in the following chapters.

Home Treatment.—When a patient is to be treated at home, and if there be no garden and shelter in which he can sleep at night, it is essential to alter the arrangements of his room. Furniture should be as simple as possible, and all carpets and hangings removed. The windows must open top and bottom to the full extent, and the bed should be placed across an open window, so that the patient sleeps with the wind on his face. If a gale be blowing direct on a window it will be necessary to close it, but in this case a board 6 inches deep should be placed beneath the lower sash of the exposed window, and the bed placed across a less exposed window. If this be not possible it is a good plan to have a weather-board 4 feet deep fixed outside the window at an angle of 45°. This will ensure that the window can be kept open 3 feet at the bottom, no matter what gale is blowing. If the patient must sleep indoors at night he should spend as many hours as possible outside, irrespective of weather conditions.

Draughts.—The confusion of thought which exists as to the essential difference between fresh air and draughts is often a difficulty in inducing patients to carry out the open-air treatment at home. The latter has erroneously been defined as "a concentrated dose of fresh air," but a draught has no relation whatever to the freshness or otherwise of the air, and it is possible to have one blowing out of a sewer grating.

What is a draught? One finds the following statement in Notter and Firth[1]: "At 60° F. air, moving at the rate of 2 feet per second, is barely perceptible; at 3 feet it is more so; and above this it becomes a draught. At 70° F. the velocity of the air current can be even greater without being noticed." From this data we may define a draught as *a current of air, differing from the surrounding atmosphere in temperature and velocity to such a degree that a sensation of chill is produced in an individual exposed to it.* It follows that a person sitting between a fire and an open door or window is in a draught. One-half of the body is warmed, the other chilled. Resistance is lowered, and a morbific process engendered, of which the most frequent manifestation is a "cold." Such is common and personal experience. Whether the pathology of nasal catarrh be bacterial infection, or loss of the inhibitory power of the normal secretion, or whether it be related to an inhibition of the high absorptive faculty

[1] *Hygiene*, 6th ed., p. 31.

of the nasal mucosa and of the great lymphoid arch of the nasopharynx, as experimental work in a wide field would seem to indicate, is an interesting yet minor aspect of the issue. My contention is that the freshness or otherwise of the air has no place in the equation. A difference of temperature is the determining factor. Thus on a mountain one may be exposed to air currents moving at high velocity, but few would designate these "winds, austere and pure," as draughts, nor would exposure to such induce any morbid process.

What, then, is fresh air? "The pure atmosphere freely administered, without fear." Thus Bodington. Fresh air is indeed far removed from the very general conception of so-called efficient ventilation, based on the degree of impurity present in the respired air. Fresh air is super-aeration, in which no degree of impurity can exist, as the same air is never twice breathed. Such is the first principle of aerotherapy.

The open-air treatment, properly carried out, is actually a prophylactic against pneumonia, nasal catarrh, or cold in the head. In all the years at the Royal Victoria Hospital, where the patients sleep in shelters with pure air blowing over them, there has not been one single instance of cold in the head.

Shelters.—The first principle of open-air treatment is fresh air, and under ideal climatic conditions this could best be attained by a life in the open, the patient sleeping literally under the stars. In a changeable and uncertain climate various forms of shelter have been devised to protect the patient from rain while still exposed to the open air. The defect in the majority of these is that they are constructed with a view to keep out the rain, whereas the first essential should be to let in the air. Moreover in some of them the amount of air entering can be diminished by the patient, and if windows and doors be shut to keep out rain the shelter is converted into a hut with little or no ventilation. Again, a very frequent defect is that the roof slopes downwards from back to front, constituting a cul-de-sac for the collection of polluted expired air. All revolving shelters, apart from mechanical difficulties, have the defect that their exposure is determined by the direction of the wind.

To obviate these defects the writer has suggested a form of shelter known as the Pure Air Shelter. It is a timber structure, made in sections, easily put together, varnished inside, painted outside, and roofed with rubberoid. It is designed to ensure that the patient never breathes the same air twice, there being through ventilation in all conditions of weather, as even with the windows and doors shut

Stage III.—Grade B. Graduated Work: Patients Clearing Rubbish Boxes.

the shelter is open to the air over an area of 56 square feet. This is attained by the use of everted and inverted planes fixed at an angle of 45° and running round all sides, so that there is a constant exchange of air, while at the same time it is impossible even for driven rain to enter. When the patient is in bed the current of air is directed over his head and crosses the shelter diagonally. The use of these planes appeared to be the simplest structural method of ensuring direct ventilation.

The shelter faces south-east, the front having a large French window, while the back faces north-west with a smaller window. The lighting is devised to ensure the maximum amount of sunlight in all positions of the sun, but avoiding the discomfort of the morning and evening sun striking the patient's eyes direct. Thus the upper panels of the door are in glass, so that the early morning sun is thrown across the shelter but not on the bed.

Dietary.—Loss of appetite and functional gastric disturbance are frequent and early symptoms of pulmonary tuberculosis, and are intensified when the patient is treated on other than open-air lines. On the other hand, restoration of appetite is one of the most immediate results of aerotherapy, and the patient of his own accord consumes a larger quantity of food. As to the exact nature of his dietary, this will largely depend on that to which he has already been accustomed, and the physiology of dietetics is dealt with in Chapter X. A good general rule is that the patient should have a more generous diet than that which he was on prior to his illness. A generous diet is one thing, to stuff the patient is another. This latter is indefensible. He may put on weight like the Strassburg geese, but the tissues become flabby and resistance is lowered. The chief articles of diet should be milk, eggs, butter, porridge, fish, chicken, game, mutton, raw meat, vegetables, mild bacon, ham, well-toasted stale bread, and preserves. To be avoided in general are greasy soups, cold meats, tinned meat, and sausages.

Graduated Rest and Activity.—The place of graduated rest and activity in treatment depends on very definite physiological and pathological phenomena. A patient develops pulmonary tuberculosis by the entrance of the tubercle bacillus into the pulmonary system, where the natural immunity of the patient is unable to overcome the infection. A definite train of symptoms follow — lassitude, languor, weakness, disturbance of the gastric functions, and, later, a poisoning of muscle tissue represented by myotatic irritability and myoidema. All these are indicative of a profound systemic intoxication, due to

the diffused toxins of the tubercle bacillus in the pulmonary tissues. The indications for treatment are therefore that by rest, by therapeutics, and by aerotherapy we should render the disease quiescent. When this has been attained we attempt by various measures, of which graduated activity is one of the most important, to raise the degree of resistance, and to promote the formation of immune bodies, so that the disease will not again become active.

Rest.—All patients coming under treatment should be placed on absolute rest until the clinical condition has been ascertained. The temperature and pulse are the best indications as to the amount of rest required, and absolute rest is indicated when the temperature rises above 99° F., or if the pulse-rate be constantly over 95. In every case there should be absolute rest before and after meals for at least three-quarters of an hour. When a patient is constantly on absolute rest this should be taken to include the use of the bed-pan. As the temperature and pulse settle down to a more equable level, graduated movement may be introduced, the exact amount being detailed to the patient. Getting up for half an hour in the afternoon, he progresses until he is up all day, and then the stage of graduated activity is entered upon, commencing with short fifteen-minute walks on the level, once, twice, or more frequently during the day.

Graduated Activity.—When quiescence has been attained one proceeds gradually to greater degrees of activity, the temperature and pulse being guides to the actual amount. An immediate rise of temperature of 2° F., or an evening temperature of 99°, or a continuing pulse-rate of over 95, indicates that the activity has been too great, and should be stopped or lessened according to the condition of the patient.

The principle of graduated activity was first advocated by George Bodington some seventy years ago in "An Essay on the Treatment and Cure of Pulmonary Consumption on Principles Natural, Rational, and Successful; with Suggestions for an Improved Plan of Treatment of the Disease among the Lower Classes of Society," in which he suggests "walking as much as the strength will allow, gradually increasing the length of the walk until it can be maintained easily for several hours every day," and urges the provision of "country houses in proper situations, well ventilated, and provided 'with all appliances and means to boot,' where patients should be strictly watched and regulated in all respects as regards exercise, air, diet, etc.," while in particular "with respect to the consumptive poor patients, those who cannot afford to pay for a proper treatment of this sort," he advocates that "hospitals should be established in the vicinity

Stage III.—Grade C. Patients doing Light Spade-Work.

of large towns, in fit situations, and properly appointed in all respects for their reception and treatment. In those there should be provision made for . . . gardening and farming occupations for the convalescent. The common hospital in a large town is the most unfit place imaginable for consumptive patients, and the treatment generally employed there very inefficient, arising from the inadequacy of the means at command. . . . Connected with such an hospital provision should be made for the employment of the convalescent and cured patients."

Royal Victoria Dispensary.—Graduated activity was early adopted in the practice of the Royal Victoria Dispensary, and in an address on "Rest and Movement in Tuberculosis"[1] Dr. R. W. Philip said: "Even in respect of the affected lung itself, insistence on rest beyond a certain degree and in special circumstances is most fallacious. Let me cite a fact or two in this connection. In the early days of my work in this department—more than twenty years ago—when the systematised scheme of activity had not been elaborated, when there was no sanatorium for consumption in Great Britain—we instituted classes for physical movement and respiratory exercises in connection with the Victoria Dispensary for Consumption. With the help of successive officers of the Dispensary, I arranged such classes for selected cases from the immense *clientèle* of the institution. The patients used to come —often long distances—at fixed hours and enjoy regular training with regard to posture and healthy respiratory movement. More especially the young were taught the value of a healthy form of chest. Such physiological points were insisted on, as nose breathing and the value of slow and full diaphragmatic movement. In addition to this, measured walks of varying amount and gradient were prescribed, exactly as we prescribe medicines. Thus we had walks radiating from the Dispensary round the Meadows, walks over the Bruntsfield Links, and walks in various directions on the slopes of Arthur's Seat. The patients reported at successive visits, their experience in carrying out such instructions, and notes were made of the effects produced."

Walking and Hill Climbing.—When the patient is able to walk two or three miles on the flat without disturbance of pulse or temperature he should be promoted to hill climbing, the gradient being gradually increased, with which is associated definite muscular, cardiac, and respiratory exercises.

Hill climbing has several advantages over the more mechanical exercise on level ground, as muscles are more stimulated when their action is accompanied by effort, which is present in ascending a gradient

[1] *British Medical Journal*, 24th December 1910.

to the end of the climb, and further, a different group of muscles comes into play on descending.

It is generally accepted that the size of the heart is diminished in pulmonary tuberculosis, and there is no question that its action is weakened both by the toxæmia and by the obstruction in the pulmonary circulation. Hill climbing induces deep respirations, so stimulating the heart and venous circulation, and this more advantageously than is to be attained by more mechanical breathing exercises. In hill climbing the movements of the chest and lungs are reflex in response to the energy expended, and the exercise lasts for a considerable time. As the pulmonary circulation is increased the diseased areas will be permeated by blood rich in opsonins. On this theory small quantities of bacterial debris and toxins will also be absorbed into the general circulation, there stimulating the production of fresh opsonins. It is clear that if the exercise be excessive too large a quantity of bacterial debris and toxins will be absorbed, so that the amount of opsonins present will be lowered. In this, however, the temperature is as reliable a guide as the opsonic index. While it seems probable that auto-inoculation plays a considerable part in the beneficial action of all forms of graduated activity, there is no doubt that the improved muscle tone is directly associated with increased resistance.

Precautions.—Whatever be the form of activity, certain precautions are essential. The patient should never feel tired after exercise, as if so it has been excessive. All forms of exercise should be methodical and progressive, increased week by week, and carried out at definite hours. The patient should breathe through the nose and avoid conversation, as this induces hurried and unequal respirations. After exercise he should have a tepid sponging and change of underclothing.

Regulated Work and Recreation.—When the patient is able to walk five miles a day, including the ascent of gradients, he may be promoted to graduated physical labour, or permitted to engage in such outdoor recreations as riding, mild golf, croquet, fishing, and shooting. In most cases cycling, and in all cases hockey, tennis, and football are contra-indicated, as they throw too great and too sudden a strain on the heart and lungs.

Scheme of Physical Treatment.—The following scheme of physical treatment is used at the Royal Victoria Hospital, Edinburgh:—On admission each patient is placed at complete rest. During this stage, in addition to minute examination of every organ, the patient's general condition is carefully observed. According to the estimate which is made, the length of the resting period is fixed. Thereafter, in the

Stage III.—Grade D. Patients Making Tennis Lawn.

absence of contra-indication, the patient is gradually advanced through the other stages, according to his or her physical condition. The nature and amount of activity are definitely prescribed, just like drug treatment. The dose is increased or diminished as the temperature chart, pulse-rate, and other indications suggest. A coloured badge is given to the patient to denote the stage he has reached. Apart from their psychological influence on the patients, these badges have a physiological significance to the physician, as indicating the actual amount of activity.

I. *Resting Stage* (*White Badge*).—On admission to the hospital all patients are prescribed complete rest, lasting from a few days to several weeks, according to the individual case.

II. *Stage of Regulated Exercises* (*Yellow Badge*).—This includes—1. Walking varying distances, from ¼ to 5 miles—(*a*) on the level; (*b*) on sloping ground. 2. Various respiratory exercises once or twice a day. 3. Other forms of movements to improve carriage of shoulders, head, chest, etc.

III. *Stage of Regulated Work.*—The work is chosen with a view to utility and with due regard to the patient's individual case and to his past trade. This stage is subdivided into four grades (A, B, C, D).

III. *A* (*Pale Blue Badge*).—Picking up papers, leaves, and other light rubbish in the grounds. Knitting. Sewing. Drawing.

III. *B* (*Green Badge*).—Emptying garden waste-boxes, and assisting to carry away rubbish. Carrying light baskets for various gardening purposes. Light painting work (gates, fences, furniture, etc.). Wiping shelters. Setting tables and laying cloth in patients' dining-room. Cleaning silver. Cleaning brasses, towel-rails, and taps.

III. *C* (*Deep Blue Badge*).—Raking. Hoeing. Mowing. Sweeping leaves. Drawing two-wheeled barrow with assistance. Other gardening jobs requiring a similar amount of exertion. Heavier painting work. Sweeping shelters. Scrubbing floors. Cleaning boots. Cleaning knives. Assisting in laundry (folding clothes, etc.). Washing and drying dishes.

III. *D* (*Red Badge*).—Digging. Sawing. Carrying heavy baskets for various gardening purposes. Wheeling and drawing full wheelbarrow, and other heavy gardening work. Drawing bath-chair. Bathing other patients. Mangling. Window cleaning. Polishing floors. Sweeping and cleaning courtyard. Carpentering. Joinering. Attending boiler. Engineering. *N.B.—In III. B, C, and D patients make their own beds and go errands if necessary.*

Some Details in General Treatment.—The patient's hours will vary according to circumstances, but a point should be made of retiring early. If the night be cold he may undress before a fire, at which his night

apparel has been warmed. A hot drink of milk will often induce sleep. If the morning be damp a fire may be lit in the patient's room. All rooms used by the patient day and night must be freely open to the air.

The hygiene of the skin is of first importance, and may be attained by sponging with tepid water to which Eau de Cologne has been added, by the tepid bath, by dashing cold water over the chest back and front, by the cold shower, or by the cold plunge, according to the age and condition of the patient.

If the patient be used to alcohol he may continue it in small quantities at meals and in a suitable form, but in general is better without it. Smoking should be forbidden as long as there be any active local lesion. There should be an avoidance of all excitement and worry, and constant medical supervision.

Routine Management.—The following is a suggestion for routine management:—

7.30 A.M. Fire lit in patient's room if morning is cold.

8 A.M. Cup of tea infused with milk, or raw egg alone.

8.30 A.M. Patient rises; hydrotherapy as advised.

9 A.M. Breakfast. Allowed fruit, porridge made with milk, tea, coffee, or chocolate, infused or well diluted with milk, cream, milk, toasted stale bread, pure marmalade or home-made preserves, fresh eggs, boiled, scrambled, or poached, raw meat, boiled fresh fish, mild bacon and eggs, or cold ham. Avoid sausage, cold meat, and new bread.

9.30 to 10 A.M. Absolute rest.

10 A.M. to 12.15. Out of doors, rest or exercise.

12.30 to 1 P.M. Absolute rest.

1 P.M. Luncheon. Allowed clear or non-greasy thick soup, boiled fish, chicken, game, raw meat, underdone tender steak, vegetables, white milk puddings, shapes, stewed fruit, cream, butter, cheese, milk (fresh, soured, or butter-milk).

1.30 to 2 P.M. Absolute rest.

2 to 4.15 P.M. Out of doors, rest or exercise.

4.15 P.M. Cup of afternoon tea infused with milk, or a glass of rum and milk.

6 to 7 P.M. Absolute rest.

7 P.M. Dinner. Similar to lunch, but lighter.

9 P.M. Retire for night.

So far as possible the principal meals should be equal in amount and nourishment, and with the exception of afternoon tea there should be no eating between meals.

HALLIDAY SUTHERLAND.

Photo by Marshall Wane & Co., Edinburgh.

STAGE III.—GRADE D. PATIENTS PREPARING A ROADWAY.

CHAPTER VIII

THE THEORETICAL AND PRACTICAL BASIS OF TUBERCULIN IN TREATMENT[1]

Introductory—On Toxins—Specific and Auxiliary Toxins—Tuberculous Toxins—Toxins in Tuberculin—Mechanism of Reactions—Seat of Inoculation—Local Action—Nature of the Toxin—Reaction of the Organism—Curative Action.

Introductory.—In spite of much research during the years that have elapsed since Koch's discovery of tuberculin, we know very little of its chemical composition, of its mode of action, or of the degree of immunity which it confers upon man or upon animals. In accepting the opportunity of contributing to a volume dedicated to Dr. R. W. Philip, I propose to consider some of the problems regarding the use of tuberculin in treatment, and so far from being a critical or historical study of a vast subject, this essay is simply an exposition of personal views based on experiments with my tuberculin.

On Toxins.—It is essential that scientific words should be defined, especially where there is a danger of their bearing a general interpretation. Thus the word "toxin" is a bacteriological term, and as such might seem easy to define, but while the general definition of toxins, based on the pathogenic action of these substances, is sufficient for practical purposes, there is the danger that we may establish arbitrary distinctions and artificial classifications. In the case of some toxins their pathogenic action may be easily observed and measured, while the action of others is less easily determined by our present means of investigation.

If we take the tetanous toxin as representing a type with which other bacterial toxins may be readily compared, we find that the tetanus bacillus, if grown in a suitable medium, diffuses an exotoxin. Experimentally we can prove this exotoxin to be specific, because when injected into a susceptible animal it produces the clinical picture of tetanus, such as is produced by no other bacterial toxin. It is therefore not the bacilli but the toxins of tetanus that are lethal, and this through their affinity for nerve tissues. This fact is important, and is due to the

[1] Translation by the Editor.

following conditions:—(*a*) The toxin is diffused in the culture, and is soluble in water; (*b*) the toxin diffused in an artificial medium is identical with that produced by the bacillus in the tissues of a susceptible animal; and (*c*) its action on the central nervous system is characteristic, so that it is easily identified.

In addition to the specific exotoxin, the bouillon in which the tetanus bacillus has been grown contains a hæmolytic toxin. This latter is of less import, as it is found in the culture media of many other bacteria. That is to say, a bacillus, such as the tetanus bacillus, diffuses into a suitable medium various toxins which differ not only in their pathogenic action, but also in the fact that some are not special to any one bacillus. The first, the characteristic or specific toxin, I would call the signature of the bacillus (*la signature d'une espèce microbienne donnée*), while the others may be called auxiliary toxins.

Specific and Auxiliary Toxins.—It is by no means easy to distinguish between these specific and auxiliary toxins, for if the pathogenic power of bacteria be due to the action of their toxins on the tissues of a host, such action is most variable. Thus few toxins are analogous to that of tetanus, in that they can reproduce all the clinical phenomena of the bacillus. Some are not readily soluble in the culture fluid, while others are retained in the protoplasm of the bacteria. In the case of chronic bacterial infections of long duration, in which there is relatively little systemic intoxication, it is difficult to determine to what extent the lesions are due to a specific toxin.

Under such conditions how is it possible to distinguish a specific toxin from an auxiliary toxin? The method is the same as that which we applied to tetanus. However feeble be the action of a specific toxin, such action cannot be produced by any other bacterial poison. At the same time this specific action may only be apparent when the toxin is inoculated into an animal whose system is so sensitised that it will give a pathogenic reaction. That is to say, the specific action of a toxin, which would appear to be latent when the toxin is inoculated into a healthy animal, is at once apparent if inoculated into an animal previously infected with the bacillus from which that toxin is derived.

Tuberculous Toxins.—Let us apply these criteria to the toxins of the tubercle bacillus. The tetanic toxin can produce all the symptoms of tetanus. Does this hold true for the toxins of the tubercle bacillus? Again, by what means can we demonstrate a specific toxin in tuberculosis?

Tubercle formation is the most marked manifestation of the pathogenic power of the tubercle bacillus, but it is not specific. It is due to

the chemical composition of these bacteria rather than to their biological activity, for such lesions can be produced by dead tubercle bacilli, by the bacillus of leprosy, and by certain organic substances. It is not essentially an expression of the pathogenic action of Koch's bacillus, for we know that in the experimental tuberculosis of Yersin the animal dies without any macroscopic tubercles being apparent in its viscera. Further, in Arloing's homogenous cultures the bacilli, whether of human or of bovine sources, have lost the power of caseation, and only produce in the tissues an atypical reaction. It is therefore clear that tubercle formation in man or in animals is not simply the apanage of the tubercle bacillus, but rather represents a defensive process which may be called into play by different agencies, and is not necessarily due to the presence of Koch's bacillus in the tissues. It cannot therefore be cited as proof of the existence of specific toxins of the tubercle bacillus. Those extracts which Auclair has named xylemine, chloroformine, etherine, and benzinine are not specific toxins, since they possess the power of inducing similar tubercles in common with other toxins of non-tuberculous origin.

Moreover, such changes are not entirely due to those fatty and waxy substances which constitute the protecting envelope of the bacillus, as when these have been extracted and the bacillus reduced to its nucleo-protein constituents it has still the power of inducing tubercle formation in the guinea-pig. We must therefore look for something in this bacillus which is more specific than its faculty of inducing tubercle formation. Now the tubercle bacillus can be grown with ease in a suitable medium. If we filter off the glycerinated bouillon in which the bacillus has been grown we find that a healthy animal can tolerate considerable inoculations of this filtrate—which must not be confused with Koch's tuberculin—without showing any symptoms of intoxication beyond a certain degree of temperature disturbance.

It would be utterly unscientific to attribute this temperature reaction solely to the activity of the toxin of the bacillus, for in addition to this hypothetical toxin the bouillon itself contains other substances capable of inducing a febrile reaction in a healthy animal. This applies particularly to the peptones and albumoses which are added to bouillon in order to increase its nutritive value. From this only one conclusion can be drawn—that the tubercle bacillus diffuses one or more toxins into the culture medium, that these toxins are but feebly pathogenic in a healthy animal, and that they do not produce easily recognisable histological lesions. This would seem but natural when we remember the slow evolution in general of tuberculosis in man.

If we repeat the above experiment with a tuberculous animal we find that this latter reacts to even a small inoculation of the bouillon filtrate by a marked febrile disturbance, which occurs after a certain incubation period and is specific. It may be asked why should this temperature reaction in a tuberculous animal be attributed to the presence of a specific toxin, the answer being that it is caused by so small a dose of the bouillon filtrate that the action of peptones and albumoses is negligible. The presence of a diffusible specific toxin in the bouillon can be demonstrated only by injecting this latter into an animal previously sensitised by inoculation with the tubercle bacillus.

Toxins in Tuberculin.—Experience shows that this specific toxin is present in all tuberculins. Its existence can be demonstrated by a most ingenious method (Moussu and Heyman), in which cultures of tubercle bacilli are placed in sealed collodion sacs or in Chamberland's bougies. These sacs or bougies are introduced into the bodies of healthy bovines, so that the bacilli are unable to produce actual tuberculous lesions, and can only act on the organism only by means of their diffusible toxins. The animals continue in good health with normal temperatures. At the end of a month, however, an injection of tuberculin which has no effect on control animals induces a typical febrile reaction. This proves that a tuberculous lesion *per se* is not of necessity a link in the production of the temperature reaction, as in the above instance no lesions existed. It rather indicates that the diffusible toxin has slowly impregnated the organism, and has a special affinity for nerve tissues.

When we inject any variety of tuberculin, that is a certain quantity of tuberculous toxin, this is partly absorbed by the central nervous system, and if this be already sensitised it will react to the extra intoxication by phenomena of which the febrile reaction is the most marked. Tuberculin is a nerve toxin. It has been shown by Lingelsheim and Borrel that this substance is most active when injected into the central nervous system. Guillain and Laroche confirmed this by demonstrating that tuberculin can be markedly fixed by the brain substance of the guinea-pig or of man, in the same way as the tetanous toxin is fixed by these tissues. Dead tubercle bacilli produce the same effect when injected into the brain of the guinea-pig, proving that the toxin remains in part in the bodies of the bacilli, and is not readily diffused into the culture media.

The post-mortem examination of a tuberculous guinea-pig killed by a lethal dose of tuberculin shows an intense congestion around the tuberculous lesions, often accompanied by minute hæmorrhages. Tuber-

culin has therefore a vaso-dilator action, this being of great diagnostic importance, as it is the basis of the best known reactions in early diagnosis—the cutaneous reaction and the ophthalmic reaction. The question as to whether these reactions are due to the same toxins as produce the temperature reaction seems almost insoluble, as we are unable to isolate these toxins in the culture fluid.

Koch's tuberculin is a very complex substance, and neither Koch nor his collaborators were able to isolate the active principle from the peptones and albumoses. We are unable either to affirm or deny the existence of a single or of many tuberculous toxins by definite chemical proof. The problem may be approached indirectly by comparing the pathogenic action of Koch's tuberculin with my tuberculin, the composition of which is different.

My tuberculin is less rich in albuminous substances, as no peptone is added to the bouillon, which in itself contains albumoses, and is thus possessed of a toxic action. After cultivation of the bacilli the bouillon is concentrated without heat, and to the diffused toxins are added those toxins directly extracted from the tubercle bacilli by maceration in 1 per cent. orthophosphoric acid. If my tuberculin induces a feebler vaso-dilator reaction on the tuberculous guinea-pig or patient than that of Koch, one might explain this on the assumption that Koch's tuberculin was richer in tuberculous toxins. Were there only a quantitative and not a qualitative difference between tuberculins, then my tuberculin should have a much feebler action on a tuberculous organism, as judged by the vaso-dilator and temperature reaction. This is not so, as in some patients a temperature reaction is induced by an inoculation of ·0000006 of a c.c. (·6 c.c., D_6).

On a tuberculous patient the temperature reaction from my tuberculin is as marked as, if not more so, than Koch's tuberculin, but, on the other hand the vaso-dilator action of my tuberculin is weaker. It is not possible to explain this anomaly unless one admits the existence of two toxins, the one a specific intoxicant to the nervous system, which we may investigate by the temperature reaction, the other an auxiliary toxin with vaso-dilator properties.

The first toxin should be regarded as the characteristic toxin of tuberculosis, as its reaction on tuberculous patients or animals is more certain and more specific, not only in diagnosis but also in the way in which the dosage can be determined. It is already apparent that the intoxicant power of this toxin is very feeble and scarcely appreciable on a healthy organism, but is immediately in evidence if there has been a

previous inoculation of tubercle bacilli. This would give the temperature reaction an almost infallible significance in diagnosis but for the fact that non-tuberculous affections can also sensitise the organism so that it reacts to tuberculin. At the same time a much smaller dose of tuberculin will give the reaction in the tuberculous than in the non-tuberculous subject.

The vaso-dilator or auxiliary toxin is produced not only by the tubercle bacillus, but also by the *bacillus typhosus*, *Klebs-Lœffler bacillus*, *spirochæte pallida*, and other organisms. The experiments of F. Arloing prove that animals sensitised by the toxins of these organisms react to the ophthalmic reaction with tuberculin.

The vaso-dilator reaction is most marked with tuberculins rich in peptones and albumoses. Calmette's ophthalmic reaction by means of tuberculin precipitated with alcohol causes a lesser vaso-dilator disturbance than Höchst's tuberculin test with unpurified tuberculin, rich in albuminoid substances. This does not apply to the temperature reaction. Koch showed that purified tuberculin gave a much stronger temperature reaction than crude tuberculin. My tuberculin with a small amount of albuminoid substances is a relatively feeble vaso-dilator, but its power of producing a temperature reaction is very marked; it is therefore not suitable for the ophthalmic reaction.

In general, strong solutions of tuberculin are required for the vaso-dilator reaction; thus Von Pirquet's reaction necessitates a tuberculin concentrated from 1 per cent. to 25 per cent., and according to Lowenstein the number of positive reactions increase with the strength of the solution. While a 1 per cent. solution gives a positive reaction in 50 per cent. of cases, this percentage is increased to 85 when a 10 per cent. solution is used. Strong solutions, however, give a positive reaction in non-tuberculous infections.

The ophthalmic reaction occurs with weaker solutions, but it is present in the non-tuberculous and is most certain in well-marked tuberculosis. In suspected cases the temperature reaction following the injection of weak dilutions of tuberculin is more valuable.

Mechanism of Reactions.—While the pathogenic effect of an injection of tuberculin into a tuberculous animal is easily observed, the actual mechanism of this phenomena is difficult to explain.

The theory of Wolff-Eisner is based on two propositions, the one as to the nature of the toxin, the other as to its fate on entering a tuberculous organism. According to this scientist the tuberculous toxin consists of microscopic and ultra-microscopic fragments of tubercle

bacilli in suspension in tuberculin. These particles, while of low toxic power themselves, when injected into a tuberculous organism are converted into an active toxin through the intermediary of a lysin. The pathogenic action of tuberculin is therefore dependent on the presence of a lysin, which results from the response of the tissues to infection by the bacillus, and is consequently an antibody. As this lysin exists in the tuberculous only, these alone react to tuberculin. Further, as a certain time is necessary for the lysin to act on the tuberculous toxin, this explains the incubation period before the reaction appears. Wolff-Eisner holds also that these bacillary particles gain in toxicity as they lose their acid-fast properties. Thus a crude emulsion of tubercle bacilli, in which the particles have acid-fast staining, has a low toxic power. On the other hand an emulsion of bacilli, so finely ground down that one cannot detect acid-fast particles under the microscope, has a high toxic power.

This observation has no bearing on the presence or absence of a lysin, to which the tuberculin reaction is said to be due. It merely shows that the substances contained in the body of the tubercle bacillus are more toxic when so finely ground down that they have lost their acid-fast property. The fact that in this fine state of division they are more soluble in the fluid of the organism into which they are injected would explain their increased toxicity. From these facts one is unable to postulate the existence of a lysin producing in the living body changes on the bacilli which are actually due to the grinding mills of Höchst.

This ingenious theory in its present form is hardly acceptable, as it does not include or explain all the facts. Koch has shown that a healthy man reacts to the subcutaneous injection of from 2 to 5 mgr. of pure tuberculin. It is a question of dosage. The healthy animal inoculated with the bacillus typhosus gives the ophthalmic reaction. It is inconceivable that the typhoid bacillus produces a lysin which is also anti-tuberculous. Tuberculous cattle which have reacted to a test dose of tuberculin are refractory to a fresh test for three or four weeks. During this period it is necessary to increase the dose to obtain a reaction. It is difficult to explain this according to Wolff-Eisner's theory. If the lysin has converted the dose of tuberculin x inoculated at the first test into an active toxin, why does it not act in like manner on the second dose x, and why does it act only when the dose has been increased to 3 or 4 x at the second inoculation?

Seat of Inoculation.—The seat of inoculation has a bearing on the degree of reaction produced by tuberculin, as the effect is more marked

and more rapid when injected into the brain than under the skin. In a tuberculous guinea-pig the lethal subcutaneous dose is ·02 grm. of tuberculin, while an intracerebral inoculation of ·000000001 grm. is fatal (Borrel). This ultratoxic action of the toxin is apparent whether it be in the form of tuberculin, or as a bacillary emulsion in which the particles have retained their acid-fast property. This increased toxicity of the tuberculous toxin when injected into the brain seems inexplicable according to Wolff-Eisner's theory. The toxin would certainly come more rapidly into contact with the lysin than if injected subcutaneously, but this should also apply to intravenous injections. Experience proves that the toxic effect of intracerebral injections are more marked than is that of intravenous injections.

What then is the mechanism of the tuberculin reaction? The tuberculous toxin is not easily diffused either in artificial media or in the tissues of man or animals. The changes which it produces on the organism are often slight, and may show themselves in cellular activity only.

The pathogenic effects of tuberculin are multiple. The most obvious are the temperature reaction and the vaso-dilator reaction, but there is also the positive chemiotaxis which it induces in the leucocytes, the anæmia of the red cells, and its action as a neurotoxin. This last shows itself, if slight, by a rise of temperature and increased pulse-rate, but if more powerful by vomiting, headache, and even by death. With equal doses the healthy nervous system reacts less than one already impregnated with toxin.

Yet between the effect of tuberculin on the nervous system of a healthy as against a tuberculous animal the difference is only one of degree, being governed by the dose and the seat of inoculation. A dose of tuberculin, inactive subcutaneously, will give a marked reaction intracerebrally. This is not surprising. To give a typical reaction tuberculin must attack the nerve cells. When tuberculin is injected under the skin of a healthy animal there is considerable prospect that most of it will be absorbed by other tissues, so that the small quantity fixed by the central nervous system is insufficient to produce an appreciable toxic effect. In the tuberculous animal, whose tissues are already impregnated with tuberculous toxin, less will be absorbed, and a larger portion of the dose is free to act on the already sensitised brain cells, thus producing a typical reaction. When tuberculin is inoculated intracerebrally its full effect is apparent on the brain cells, as none has been otherwise absorbed. The work of Guillain and Laroche, who demonstrated that tuberculin can be fixed *in vitro* by cerebral substance

confirms my view that this chemical union increases the toxic effects of tuberculin.

The fact that tuberculin is not very diffusible and that its fixation by nerve tissues through a chemical action whereby its toxicity is increased are sufficient to explain the temperature reaction without postulating the presence of a lysin. This is also the explanation of the difference in time of the incubation period according to whether the injection is subcutaneous or intracerebral.

Local Action.—In addition to the general reaction, tuberculin has a local action on tuberculous lesions, although, as has already been shown, a general reaction may occur in the absence of any local lesion. The one condition necessary for the reaction is the presence in the tissues of the diffusible toxins of the bacillus, as then by injecting more toxin the system is surcharged and a temperature reaction follows.

When injected subcutaneously tuberculin is not entirely absorbed by the nervous system, but also acts on tuberculous lesions whose pathogenicity is increased, so that there results by positive chemiotaxis a leucocytosis and exudation of plasma to which the vaso-dilator properties of the toxin also contribute. It is important to note that the general and local reactions following a subcutaneous injection of tuberculin are the same as those produced by the disease itself, proving that all these phenomena arise from a common source, the presence in the body of a large quantity of tuberculous toxin.

Nature of the Toxin.—As we are unable to isolate and determine the chemical composition of this toxin, its nature can be known only through the agency of experimental pathology. Tubercle bacilli killed by heat and ground down produce the same phenomena in a tuberculous guinea-pig as does an injection of tuberculin. From this we conclude that the bodies of the bacilli contain a toxin which is identical with that in tuberculin. Wolff-Eisner considers that its toxic effects are due to bacillary debris held in suspension. If the tuberculin of Ruete-Enoch be centrifuged for twenty-four hours, fragments and even entire bacilli can be obtained, but this preparation is filtered through paper only. It is impossible that tuberculins filtered through a Chamberland bougie or dialysed should contain bacillary particles, yet such tuberculins give the toxic reactions. Wolff-Eisner replies that the fragments are ultra-microscopic, which is impossible of proof, and is only put forward to oppose the view that tuberculin contains a toxin diffused from the bacilli. Sahli's conception of the toxin as identical with bacillary proteins is much more rational. According to circumstances this

proteid is partly soluble and passes into the culture medium in a state of colloidal solution, being thus an endotoxin. With this I agree, and consider that the pathogenic effects of Koch's bacillus are due to this endotoxin diffused more or less easily into the culture medium, which may be natural, as in man or animals, or artificial, as in bouillon. This explains the unity in the action of different tuberculins, although these are not identical. The tubercle bacillus has a complex chemical composition, and its protein contains divers albuminoid substances, each of which is an endotoxin. These are more or less stable, and the complex molecules into which they are broken up in the culture medium result in the differences between the various tuberculins.

My tuberculin consists of (1) the bouillon in which the bacilli are grown, and (2) these bacilli macerated with 1 per cent. orthophosphoric acid. Into the bouillon, which is free of ordinary peptones, the bacilli diffuse a small quantity of albumen, which coagulates on heating, and which is not found in the macerated bacilli. The albuminoid substances in the two constituents of my tuberculin are different, as if these are mixed in a concentrated state a precipitate is formed. This is not due to the phosphoric acid. On the other hand the phosphoric acid extracts the albuminoid constituents of the bacillus as acid-albumens and leaves intact the nuclein. It follows that the conditions under which the bacillus is grown, and the soluble substances extracted, have a direct influence possibly in breaking up the albuminoid constituents or rendering them more soluble. By the different methods of preparing tuberculin it is clear that the albuminoid substances of the bacilli undergo alteration and molecular disintegration according to physical and chemical conditions. In Koch's old tuberculin, in which the bacilli are macerated by heat in an alkaline medium, there is bound to be hydrolysis of the proteids in the bacilli and in the culture medium. We know that this tuberculin is much more toxic than if the bouillon is filtered. This increased toxicity is not due to the natural toxins of the bacillus, but follows a molecular disintegration due to the conditions under which it was prepared.

This is confirmed by Wheeler's recent work (*Journal of Biological Chemistry*, 1909). He has shown that hydrolysis of the protein in different bacteria produces products the toxicity of which varies according to the method employed. With pepsin soluble non-toxic substances are obtained, although the original proteid was toxic; with trypsin the product is toxic; with sulphuric acid it is more so; and with alcohol

it is most toxic. The specific nature of tuberculins can only be tested by their toxicity. There is no test that this toxicity is due to the natural toxin and not to secondary artificial products. Thus my tuberculin is less toxic than Koch's on a tuberculous guinea-pig, yet homœopathic doses give the tuberculin reaction in man.

If the tuberculous toxin varies in its physical and chemical properties according to the composition of the nutritive medium and the method of preparation, it follows that the same variations as occur in tuberculins will be found in the toxins existing in an infected individual. In artificial media it is most probable that the endotoxins are liberated on the death of the bacillus. In my peptone-free bouillon it is easy to prove that these substances attain their maximum solution at the point when the growth of the culture is declining.

Reaction of the Organism.—So far we have dealt with the pathogenic properties of these toxins by themselves, as if they acted on a passive organism. Infected organism, however, opposes the invading bacilli more or less energetically, and the result of the war will depend upon what resources the tissues possess to destroy the bacillus and its toxins. How can we measure the defensive powers against tuberculosis? The answer seems simple—by the amount of antibodies. This magic word is supposed to be capable of explaining the whole mechanism of immunity, although there does not exist a more vague and less precise term. In tuberculosis particularly this idea is most disconcerting, and demands the most accurate definition. On what in reality does this idea of antibody rest? On the reaction *in vitro* between the patient's serum and the bacilli or their extracts. It is an indirect method of research, and we are far from understanding the chemico-physical conditions from which it arises. We call these antibodies sensitisers, agglutinins, precipitins, and bacteriolysins. To what do they correspond in the living body, and in what form do they exist in the circulating blood? It is only possible to formulate a hypothesis. It is certain that these reactions *in vitro* are the result of something in the living body, but they are no measure of the immunity of an individual against bacillary infection.

We question very much whether natural or artificial acquired immunity can be measured except by the reaction of the living organism, that is by reactions *in vivo*. These are the only definite criteria of our means of defence against bacterial infection, and it follows that all "antibodies" should conform to two conditions—(1) to protect the organism against a given species of bacterium or its

toxins, and (2) to be called into being only by the action of these bacteria or their toxins. Thus, if after some injections of tuberculin the serum of a healthy animal shows sensitising substances, agglutinins or precipitins, then tuberculin has produced these antibodies, or to be more exact, under the influence of tuberculin the serum has developed physical and chemical properties which it did not previously possess. Yet these reactions *in vitro*, interesting as they are, do not indicate the degree of immunity of an animal either to tuberculosis or to tuberculin.

This last is of the first importance, but the degree of immunity can only be measured by experiments *in vivo*. We may inoculate a healthy animal, treated with tuberculin, with tubercle bacilli to test its resistance to infection, or we may mix the serum of such an animal with a lethal dose of tuberculin to see whether this serum contains an antitoxin, in which case it would prevent the lethal action of the tuberculin on a tuberculous guinea-pig.

Let us now consider the bearing of experiments *in vitro* on tuberculosis. The most interesting is that of Borget, which proves the presence of a sensitising substance in the serum of tuberculous patients whether they be treated with tuberculin or not. This is certainly proof of some defensive action on the part of the tissues, but it is no measure of the degree of immunity. Further, Borget showed that it was possible by artificial means to produce this substance in the serum of the guinea-pig, but that it does not protect the animal against experimental infection. In some cases of tuberculosis in man this substance is present, in others it is absent. Besanson and Serboanes showed that while it is specific it is of little value even in prognosis. Frugoni proved its presence in 71 per cent. and its absence in 29 per cent. of cases of marked tuberculosis. It is not absolutely specific, for the same observer found it present in 8 out of 10 cases of leprosy. Borget's reaction is therefore no measure of the degree of immunity. This also applies to the agglutinin and the precipitin reactions. These tests do not tell us if specific treatment has been successful or not, or whether it should be interrupted or continued in an individual patient.

Reactions *in vivo* are of far greater significance, but the question arises whether they refer to the characteristic pathological action of Koch's bacillus, or to its accessory effects. Thus one expected to find a test for immunity in the power which the serum of a treated case possessed in neutralising the ophthalmic and the cutaneous tuberculin reactions. That would be an easy and invaluable method of measuring

the degree of immunity to tuberculosis. I have shown, however, that the cutaneous and ophthalmic are secondary and not characteristic reactions. Of this the following is further proof. If one mixes the serum of a patient treated with tuberculin with tuberculin itself, one finds that it is no longer able to produce the ophthalmic or cutaneous reactions, but at the same time there is no diminution of the toxic properties of this tuberculin, as judged by its lethal action on the guinea-pig, this last being characteristic of the tuberculous endotoxin. As this endotoxin is not neutralised or attenuated by the serum of patients treated specifically, one has no right to affirm that these patients have acquired an immunity to tuberculosis, in spite of the suppression of the vaso-dilator reaction. It is perhaps rare for immunity to reach this point, but having reached it, the best guides to treatment are those in the hands of the clinician.

Curative Action.—One part remains for consideration. On what does the more or less complete curative action of tuberculin depend? If one supposes that the endotoxin in tuberculin is identical with that diffused from the bacilli in the living body, then its action is incomprehensible. If the one endotoxin in the body inhibits the mechanism of defence, as no one denies, how does the same endotoxin diffused in bouillon accelerate this mechanism. This contradiction disappears if one admits that the two endotoxins are different although of the same family.

By what slight modification in its chemical and physical properties is this natural endotoxin converted into a curative tuberculin. The key to the mystery is in the phagocyte. The work of Metchnikoff and his school has supplied abundant proof of the prepondering role of the leucocyte, and to a lesser extent of the mesoblastic cells, in producing immunity to bacterial infection. In the end it is a matter of intra- or extra-cellular digestion by means of leucocytic ferments.

The bacteria, on the other hand, do not die without a struggle. By their special secretions they paralyse the phagocytic action. If the organism is to live the leucocytes must adapt themselves to the particular conditions caused by different species of pathogenic bacteria, and this adaptation is only possible by a preliminary digestion and assimilation of the bacteria and their toxins. Without this there can be no immunity. The experiments of Petterson and those of Salimberri confirm this hypothesis. These scientists have shown that leucocytes taken from an animal immunised against the vibrios of Metchnikoff can protect a healthy animal against an otherwise lethal dose of the same. The leucocytes of the immunised animal have taken on a new property,

inasmuch as their ferments have become adapted to the digestion and assimilation of a species of bacteria against which they previously exercised only a feeble action.

We know that the tubercle bacillus is only digested with difficulty by the leucocytes of a healthy animal. It is the same with the endotoxin, which passes from the tuberculous focus into the blood and causes a slow intoxication of the cells of the central nervous system. Suppose that the endotoxin present in tuberculins has been so modified in preparation that it is more easily assimilated by the leucocytes than is the natural endotoxin, it is then a vaccine. This easily assimilable endotoxin helps the leucocytes to adapt themselves to the conditions created by the tuberculous infection, and reinforces the destructive action of their ferments against the natural endotoxin. The aptitude of leucocytes to assimilate the endotoxin in the vaccine differs not only in different species but in the same species and in individuals, which explains the variation in the curative effects of the vaccine.

This idea explains the paradoxical fact that tuberculin often reduces to normal the temperature of a febrile tuberculous patient. The natural endotoxin has not been destroyed, and causes through the central nervous system the temperature reaction. If we inoculate the vaccine the leucocytes become adapted so that they digest the natural toxin which was previously circulating in the blood.

The general conclusion of this paper is as follows:—It is not possible to raise the resistance of the organism except by increasing the digestive functions of the leucocytes against the tubercle bacillus and its endotoxins. The tuberculins which are most likely to bring this about are those which contain the bacillary endotoxins in the form in which they are most easily assimilated by the leucocytes.

E. Béraneck.

CHAPTER IX

ONE ASPECT OF TUBERCULIN TREATMENT [1]

Methods of Using Tuberculin—Tuberculin in General Practice—Febrile Cases—Routine Precedure — Dosage in Conjunction with Patient's Occupation—Duration of Treatment—Class of Cases—Clinical Results—Conclusions.

Methods of Using Tuberculin.—Tuberculin has definitely found its place in therapeutics, and whilst its opponents are becoming fewer, the number of its supporters is continually on the increase. There is no longer ground for doubt as to the value of its action in the treatment of tuberculosis, and if there be any discussion on the subject it is rather with reference to the methods of employment than to its efficiency. There are still adherents to the methods of inducing a febrile reaction, but it is safe to predict that within the next few years these will become fewer. On the side of the opponents of all febrile reaction we find two schools. The first of these acts on the principle of regularly progressive doses, believing that the effective action of tuberculin increases in proportion to the quantity which a patient can be made to tolerate. This school traces a constant connection between the vaccination of a tuberculous patient by tuberculin and his degree of immunisation in respect to the infectious virus.

The other school, which usually favours the injection of tuberculin in very minute quantities, considers that this method has not only a mithridatic effect, but is especially a specific stimulant of the defensive powers of the weak organism, its more or less effective action not depending on the greater or lesser quantity of toxin injected. Those who from the first accepted this theory have always held that the strictest individualisation is necessary in tuberculin treatment, and have no hesitation in saying that clinical observation of the patient can alone indicate the proper course to pursue, retaining always the principle of closely watching any reactionary phenomena.

[1] Translation by Colonel R. L. A. Pennington.

Tuberculin in General Practice.—Side by side with the question of the quantity of tuberculin comes that of determining whether this toxin should be administered by the practising physician, or reserved for use in sanatoria, hospitals, and cliniques.

The great majority of writers on the subject object to the general use of this therapeutic agent, and consider that it should not be employed in general practice.

Sahli alone, at the Congress of German physicians at Wiesbaden this year, was opposed to this view. Up to a certain point it is easy to understand the fears which the majority of writers on the subject entertain, but on the other hand it is perhaps regrettable if restrictions in the use of tuberculin tend to limit its utility in the cure of tuberculous subjects in their homes, and even at their work. It would seem that a judicious consideration of individual cases is preferable to the wholesale veto on the use of tuberculin in private practice. It may be asked, against what danger is one guarding in prohibiting the use of tuberculin in general practice and by non-specialists? Any danger can only arise from the inexperience of the practitioner in tuberculin treatment, or from insufficient observation of the patient, who in many cases cannot be as well superintended in his home as in a hospital. Tuberculin is a double-edged tool, and it is unquestionable that its use may benefit or harm a patient according to the *modus operandi*. It is therefore of importance that a physician should be aware of the risk from the improper use of tuberculin. But now that there are a considerable number of good publications on the subject, every practitioner can readily acquaint himself with the method of treatment, which in addition to certain theoretical knowledge requires only prudent and conscientious attention. As for the difficulty of properly observing a patient in his home, it may be said that with rare exceptions a conscientious doctor in close touch with his tuberculous cases in his general practice can always succeed in impressing them with the necessity for exactitude and perseverance, and should certainly be able to carry out a satisfactory tuberculin treatment in the patient's home.

Naturally it is impossible to treat all in their homes. A judicious study of individual cases points to the necessity of hospital treatment for febrile tuberculous patients at least in the early stages, but apart from these there are a large number of tuberculous patients who would benefit by tuberculin without leaving their homes, and often whilst continuing their occupations. It would be regrettable if by reserving this treatment for sanatoria and hospitals, general

practitioners were deprived of the stimulus and opportunity to make themselves acquainted with this branch of therapeutics. Since it is necessary that every physician, and not only specialists, should be able to deal with tuberculosis at the outset, it is evident that all should be in a position to administer tuberculin to their patients at the commencement of the malady. As Sahli remarks in his treatise, tuberculin will be called on to play not only a curative but also a prophylactic part, consequently it must come into the general domain of medicine and not be confined to specialists if it is to be of value as a weapon against tuberculosis.

After having used Koch's tuberculins, T.A. and T.R., for a number of years, I have now, during the last ten years, used Béraneck's tuberculin only. I have always employed tuberculin in my clinique, in hospital and in general practice, so that I am no more a partisan of one system than of the other. The number of my patients treated with tuberculin amounts to 260; of these I treated 15 in hospital, 110 in my clinique, the remainder either in their homes or in my consulting-room.

Febrile Cases.—When a patient is feverish, suffers from considerable lesions, or when his general condition is unsatisfactory, I would always advise early treatment in a clinique or in a hospital; but when the treatment is reasonably advanced there is no reason why the patient should not be treated at home.

Routine Precedure.—I place those patients with bacilli in the sputum, who are capable of benefiting by the treatment, under observation for two or three weeks before commencing actual treatment. Each is given a chart on which is recorded the temperature, taken two to four times daily according to circumstances, the number of expectorations in twenty-four hours in the case of pulmonary patients, and the quantity of sediment in urinary cases; the pulse-rate, when possible, and finally the weight recorded twice every week before each injection. The febrile cases are kept in bed, as are also the sub-febrile cases, at least during the observation period and at the commencement of treatment, so as to admit of estimating the action of tuberculin under definite conditions. Later, for the patients in the early stages, for the febrile cases, and for those with only slight rise of temperature (98·6° F. to 99° F. at the most) I prescribe a special régime which includes a good deal of rest. In the majority of cases work must be suspended both during the observation period, and during the first stage of treatment. By the foregoing methods I decide on whether the tuberculin

treatment should be in the patient's home or otherwise. It has been objected that the observation of patients, easily arranged for in a hospital or sanatorium, is often impossible in a town, but I take as a guide the chart which the patient gives me at each visit. Temperature and pulse are given me; the weight which I take twice a week and the general condition are the best indications as to whether my directions have been followed and if the treatment is progressing satisfactorily or otherwise.

Dosage.—I commence with very small quantities, ranging from $\frac{1}{200000}$ mgr. (·5 c.c., D_7) to $\frac{1}{40000}$ mgr. (·25 c.c., D_7), $\frac{1}{100000}$ mgr. (·1 c.c., D_7), $\frac{6}{1000000}$ mgr. (·6 c.c., D_8), and sometimes $\frac{3}{1000000}$ mgr. (·3 c.c., D_8).[1] I often keep to these quantities for a considerable time, and do not advance them until I am satisfied that they are well borne by the patient, and that they bring about no reactionary phenomena. As soon as I obtain satisfactory results from a given quantity of toxin I keep to that quantity for some time, and increase it only when the action tends to become enfeebled. I always inject the same quantity of tuberculin two or three times so as to avoid any anaphylactic effect, always possible even with the most careful dosage. I may say that in spite of my relatively long experience and care in operating I am often obliged, at the commencement of treatment, either to lessen the original quantities and to use even more attenuated solutions of tuberculin or to modify the technique of the administration of the toxin. There can be no definite rule—each patient must be studied separately, and it is only thus that tuberculin therapy can be practised advantageously—in the case of numerous patients.

In Conjunction with Patient's Occupation.—Once the treatment is well started, and as soon as its therapeutic effect is declared, I allow the patient, if he be free from fever or is only slightly sub-febrile (maximum 98·6° to 99° F.), to resume his occupation, which I graduate according to my observations and the state of his chart. If I notice that a patient suffers from his work I endeavour to make him do somewhat less, and where that is impossible, I slightly reduce the dose of toxin until the equilibrium is re-established. In most cases of this kind I find usually an improvement of the local and general symptoms when the patient resumes his full occupation.

Duration of Treatment.—The treatment must often be of long duration; in some cases it may require years, and considerable patience is

[1] Editor's note on page 124.

therefore required both on the part of the patient and of the physician. As far as this is concerned I have nothing to complain of on the part of the majority of my patients; loss of patience is rare. In the course of such extended treatment (I have now been attending a patient in the third degree for five years, who is now much improved) it is surprising how seldom one finds intercurrent affections such as influenza, catarrh, angina, etc., even though the majority of the cases live a normal life. As to complications directly due to tuberculosis, these are very rare, and with a careful technique and exact observation of patients I have had no occasion to record any serious local or general consequence of my vaccinations.

Class of Cases.—Almost all my cases treated in their own homes and inoculated with tuberculin are tuberculous patients in the first or second stage (tuberculous affections of the urinary system usually require hospital treatment), and belong to all classes of society. Amongst them are numerous workmen, clerks, dressmakers, etc., who after a certain rest at the beginning of the treatment, are obliged to resume work. The therapeutic results obtained from persons in this category are specially interesting, proving how effective the toxin can be in improving the general and local condition.

Clinical Results.—The most constant result of the toxin is its effect on the weight of the patient; a number of patients in full work put on weight rapidly, a phenomenon rarely observed under ordinary conditions of life. Though I am not much in favour of the systematic fattening of every patient suffering from a tuberculous affection, I recognise that this action of tuberculin may be useful to many workers whose weight is often a good deal below normal. The increase of weight registered after some months of treatment is satisfactory, and equal to that obtained by dietetic physical treatment.

The toxic products influence the temperature in the great majority of patients in a favourable manner. Tuberculin exercises a defervescent and regulating effect on the temperature. In most cases the pulse-rate is lessened soon after the commencement of the treatment. One of the first symptoms of local amelioration in open pulmonary tuberculosis is the diminution of expectorations, frequently observed in the first weeks of treatment.

Conclusions.—I would further draw attention to the stimulating effect of toxin in many cases; the patients feel better and less tired.

If we consider that these results are often obtained in patients on full work, living with their families, and under conditions not

specially comfortable, we must admit that tuberculin has a considerable rôle.

It would be advisable, in place of proscribing the use of this agent in general practice, to encourage physicians to familiarise themselves with this method of treatment, which experience shows to be at once valuable and harmless.

EDUARD BAUER.

Editor's Note.—As it would encumber the text to express these small doses in fractions or decimals of a cubic centimetre of pure tuberculin—since the smallest dose mentioned above, *e.g.* three-millionths of a milligramme, would read ·000000003 c.c.—it is allowable, both for comprehension and convenience, to assume that one cubic centimetre of tuberculin is equal to one gramme. Thus doses can be expressed in fractions or decimals of a milligramme. In actual practice the dilution of Béraneck's tuberculin is extremely simple, each solution being a tenth weaker than the one preceding. The strongest solution on the market, T.B.K., D_1, has 1 c.c. of pure tuberculin in 9 c.c. of normal saline. To make T.B.K., D_2, one takes a wide-mouthed bottle with 9 c.c. of *cold* ·85 per cent. NaCL, previously sterilised, and to this is added 1 c.c. of T.B.K., D_1, making Dilution II. (Tablets of sodium chloride containing ·85 grm. are obtainable, one of which added to 100 c.c. of distilled water gives a normal saline solution.) The next dilution, T.B.K., D_3, would be made by taking 1 c.c. of D_2 in 9 c.c. of normal saline, and so on. The doses are given in decimals of a c.c. Thus, beginning with a dose of ·5 c.c. D_7, one would gradually increase to doses of ·6 c.c., ·7 c.c., ·8 c.c., ·9 c.c., and 1 c.c. D_7, thereafter proceeding to doses of ·1 c.c. D_6, ·2 c.c. D_6, and so up the scale. It is essential to remember, as Dr. Bauer writes, that there is no definite rule, and further that the optimum dose is below the maximum dose. An ordinary hypodermic syringe, graduated in tenths of a c.c., is used. It may be sterilised by filling and discharging with 90 per cent. alcohol. The injection is made in the front of the forearm, and the skin wiped with 90 per cent. alcohol. I have never seen an abscess follow these simple precautions. To prevent rust the needles are kept in absolute alcohol. To anyone who uses this tuberculin the number of the dilution with the amount injected conveys an accurate impression of the dose. As, however, various units of dosage of other tuberculins are in use throughout the United Kingdom, the dilutions of Béraneck's tuberculin are expressed in different relations in the following table:—

1 c.c. T.B.K.—(pure) = 1 c.c. Béraneck's Tuberculin = 1 grm. = 1000 mgr.
1 c.c. T.B.K., D_1—(1-10) = ·1 c.c. Béraneck's Tuberculin = ·1 grm. = 100 mgr.
1 c.c. T.B.K., D_2—(1-100) = ·01 c.c. Béraneck's Tuberculin = ·01 grm. = 10 mgr.
1 c.c. T.B.K., D_3—(1-1000) = ·001 c.c. Béraneck's Tuberculin = ·001 grm. = 1 mgr.
1 c.c. T.B.K., D_4—(1-10,000) = ·0001 c.c. Béraneck's Tuberculin = ·0001 grm. = $\frac{1}{10}$ mgr. = 100,000 millionths of a mgr.
1 c.c. T.B.K., D_5—(1-100,000) = ·00001 c.c. Béraneck's Tuberculin = ·00001 grm. = $\frac{1}{100}$ mgr. = 10,000 millionths of a mgr.
1 c.c. T.B.K., D_6—(1-1,000,000) = ·000001 c.c. Béraneck's Tuberculin = ·000001 grm. = $\frac{1}{1000}$ mgr. = 1000 millionths of a mgr.
1 c.c. T.B.K., D_7—(1-10,000,000) = ·0000001 c.c. Béraneck's Tuberculin = ·0000001 grm. = $\frac{1}{10000}$ mgr. = 100 millionths of a mgr.
1 c.c. T.B.K., D_8—(1-100,000,000) = ·00000001 c.c. Béraneck's Tuberculin = ·00000001 grm. = $\frac{1}{100000}$ mgr. = 10 millionths of a mgr.

It is convenient to remember that the numeral after the "D" gives the number of zeros in that dilution.

CHAPTER X

THE PHYSIOLOGY OF DIGESTION IN ITS APPLICATION TO DIETING IN TUBERCULOSIS

I. Introductory—II. The Beneficial Effect of Appetite and Cooking on Digestion—III. The Influence of the Food Stuffs on the Secretion of the Digestive Juice—IV. The Physiology of the Pyloric Region—V. Fate of the Absorbed Protein—VI. Fat and Carbohydrate—VII. General Principles of Dieting—VIII. Types of Tubercular Cases from the Dietetic Point of View—IX. State of the Digestive Secretions in Tuberculosis—X. Practical Hints as to Dieting in Tuberculosis.

I. Introductory

The problem of dieting is one of the most important that the sanatorium physician has to face, and one on which opinion has been much divided.

The introduction of cod-liver oil as a remedy opened a new era in the treatment of tuberculosis, by showing that the nutrition of the patient was after all the determining factor in the progress of the case.

Apart from this the treatment in the early days consisted in keeping the patient at a constant temperature, that is in avoiding rapid changes of temperature with the resulting vascular disturbances in the respiratory tract and consequent organismal infections or "colds," though of course the organismal element was not recognised, and the pathological process was supposed to be directly due to the rapid changes of temperature.

Such a line of treatment, though sound from the particular point of view, defeated its own object by its effect on nutrition. The confinement reacted on the patient by interfering with appetite, digestion, the formation of hæmoglobin, and other less perfectly understood processes of metabolism.

An early form of dietetic treatment was that of Salisbury, whose meat dietary, through its richness in stimulating extractives and the absence of fermentable constituents, in part gave the necessary stimulus

to secretion, and prevented the dyspepsia resulting from confinement. The greatest advance was made, however, when it was realised that the temperature of the inspired air was, in a sense, immaterial, and that the temperature gradients of nature were so gradual that they caused no ill effects to the respiratory tract; when, in fact, the patient was given the benefit of the natural stimulus of the open-air life, and was safe-guarded against steep temperature gradients by being kept constantly in the open air. Then only could the patient's nutrition be maintained at the requisitely high standard to enable him to withstand successfully the ravages of a toxic pathological condition.

It seemed at this stage that the state of nutrition could not be too quickly forced up to the requisite high pitch, and a process of indiscriminate stuffing ensued to combat the characteristic anorexia of the disease. By degrees it came to be recognised that such a treatment was unphysiological, and in those who did not react with sufficient rapidity resulted in a secondary dyspepsia—with disastrous effects.

Of late years forced feeding has been almost entirely abandoned in favour of a more rational method, in which the proteins and other constituents are given in quantities and relative proportions suited to the disease and the individual case. Further, gastro-intestinal secretion being specific for every type of food, we believe that selective dieting can be used with benefit to re-establish normal conditions of secretion and digestion. While selective dieting can be applied to any type of diet, its most powerful and beneficial effects are observed with a protein dietary where the proteins are given raw, either in the form of raw eggs, or raw meat, or raw meat juice. This dietetic treatment of pulmonary tuberculosis—"zomotherapy," as it has been called by Richet—has long been applied with conspicuous success to the treatment of the disease and its digestive phenomena at the Royal Victoria Hospital under Dr. Philip. We therefore make no apology for treating it as fully as space will allow, as it is particularly in the treatment of the dyspeptic conditions so commonly associated with pulmonary tuberculosis that the physician finds himself in difficulties when his resources are limited to the ordinary sanatorium dietary.

In the first place it will be necessary to give a résumé of some of the important recent physiological work that has been done on alimentation and metabolism, and in so far as it affects the subject in hand we shall endeavour to show how these newly-discovered facts may be usefully applied.

II. The Beneficial Effect of Appetite and Cooking on Digestion

The work done by Pawlow and his pupils has emphasised the importance of appetite, and has therein confirmed the experience of everyday life—that food daintily cooked and served is easily digested.

By means of experiments on dogs he was able to sample the secretions from the salivary glands, stomach, and pancreas, while preserving the continuity of the alimentary canal, so that the animals remained in health. He found that appetite and the zest with which the animal consumed its food played a great part in starting the process of digestion especially in the earlier stages. Thus an increased secretion of both saliva and gastric juice resulted on showing meat to a hungry dog, and still more on allowing the animal to feed on the meat, in spite of the fact that, owing to there being a fistulous opening between the œsophagus and the exterior, the swallowed matter did not come into contact with the mucosa of the stomach. Food placed in the stomach of the dog through the fistulous opening during sleep remained undigested for a long time from want of the "appetite juice" necessary to start the digestive process. This preliminary secretion is due to reflex nervous action, the vagus being the efferent nerve for the production of gastric juice, while the afferent exciting impulses pass by the nerves of tactile sensibility distributed to the mouth and by the nerves of special sense. The flow of the digestive juices which accompanies and follows the eating of daintily cooked food is, therefore, the direct result of the pleasant sensations derived from the sight, smell, and taste. But, while the effect of cooking is thus beneficial in stimulating appetite and in making starchy foods more digestible, its effect in other directions is detrimental. The naturally semi-fluid protein substances are coagulated, and thus rendered more difficult of digestion; the relatively hard insoluble particles of cooked protein are retained longer in the stomach and digested more slowly in the small intestine than when the protein is ingested in its native state.

III. The Influence of the Food Stuffs on the Secretion of the Digestive Juices

Once started the secretion of gastric juice continues of itself, because the absorbed products of the digestive action of the appetite juice lead to a further secretion. Among the products which can bring this about are dextrins, albumoses, peptones, and the extractives of meat—possibly

also other substances formed in the cooking of meat (*e.g.* by roasting). All these stimulating substances act directly on the cells of the gastric glands after being absorbed into the general blood-stream, and thus act independently of nerve mechanisms. By feeding the dog with various diets and noting the rate of the secretion of gastric juice, its acidity and peptonising power, Pawlow has been able to construct curves which show the effects of different kinds of food on the digestive secretions. He has found that the nature of the secretion is adapted to the work required of it. It looks as if the absorbed substances call forth a juice suitable for the digestion of the remainder of the meal. The juice secreted in response to a meal of raw meat is large in amount and strongly acid, but does not last long, because the stomach, owing to the rapidity of the digestion, soon empties itself; that secreted for a meal of bread is scantier, but strong in peptonising power and long continued, indicating a greater resistance to digestion on the part of the vegetable proteins. Fatty food depresses the secretion of gastric juice, but calls forth a pancreatic juice richer than usual in fat-splitting ferment. Starchy food excites a flow of saliva rich in ptyalin; it is a weak stimulant to gastric secretion, and consequently does not stay long in the stomach. From the deficiency of acid in the gastric juice excited by it, it may be inferred that the production of pancreatic juice is not markedly stimulated. Coagulated meat protein, when deprived of its extractives, causes very little secretion compared to a corresponding quantity of raw meat; in addition the coagulated protein remains longer in the stomach, and therefore must fatigue it more than raw protein does. In a series of observations by one of us (J. J. G.) on tuberculous patients, with the object of estimating the activity of secretion with cooked and with raw meat, it was found that a test meal of cooked mince was after an hour still present in the stomach, to a large extent in an undigested condition, while the stomach of the same patient one hour after a raw meat test meal was entirely empty. After a period of dieting on raw meat a test meal of cooked meat revealed a distinct rise in the secretory power of the stomach.

Not less remarkable is the effect of raw eggs. When taken on an empty stomach these stimulate no secretion, but pass straight through to the intestines, there to be absorbed. This was noted by Pawlow, and is amply confirmed by clinical experience.

The addition of extractives of meat to any diet has a remarkable power in stimulating the flow of gastric juice. Thus a bread meal

eaten without appetite lies on the stomach, inducing little or no secretion; the addition of extract of meat or raw meat in small quantity produces a secretion which starts digestion, and so leads to further secretion. The process then continues exactly as in the case of a bread meal eaten with appetite. As already stated, coagulated meat freed from extractives is unable to excite secretion; the addition of the extractives restores the power.

It might therefore be argued that there is no object in eating the meat raw so long as all the extractives are conserved, but on the other hand the advantage of raw meat as compared to cooked lies in its easy digestibility. It is already in the soft semi-fluid state which it is one of the objects of gastric digestion to attain before the food passes on to the intestine. The food therefore stays only a short time in the stomach, and this, combined with the high percentage of acid in the juice secreted under the influence of meat, renders the stomach relatively sterile, and allows of a return to normal diet. By appropriate feeding the stomach can therefore be "educated" to secrete a more powerful digestive juice, and so to overcome dyspeptic conditions, particularly when the dyspepsia is functional.

IV. The Physiology of the Pyloric Region

One of the most important parts of the alimentary canal is that of the duodenum, pylorus, and adjacent part of the stomach. The movements in this region, as demonstrated by Cannon and others in cats by means of the X-rays after a meal containing bismuth salts, consist of ring-like constrictions which run right round the lower part of the stomach and progress slowly one after another to the pylorus. If the contents of the stomach are sufficiently fluid the pylorus relaxes and allows some of the fluid to enter the duodenum, but if there are insoluble and solid particles in the chyme the pylorus closes reflexly and refuses passage to such particles, at least for a time.

When the chyme which has thus escaped into the duodenum is acid in reaction the pylorus quickly closes by another reflex action, and remains closed till the reaction of the duodenal contents is rendered neutral. This is evidently a protective mechanism to prevent the entrance of too much acid fluid at one time into the duodenum. It is now necessary to mention another result of the entrance of this acid chyme into the duodenum. The contact of an acid fluid with the mucosa of the duodenum leads to increase in the flow of pancreatic

juice. This has been shown to be not a reflex nervous effect, as one might imagine, but what is called a "hormon" action. The acid of the chyme acting on the duodenal mucosa leads to the formation of a substance called secretin, which becomes absorbed into the blood-stream, circulates all over the body, and acts as a specific stimulant to the pancreatic cells. The result, therefore, of the entrance of the acid chyme into the duodenum is a flow of pancreatic juice which, being alkaline, neutralises the acidity, and so allows more chyme to enter from the stomach, because now the pylorus can again relax. Bile is at the same time poured out into the duodenum, so that the consequence of a highly acid gastric juice is an abundant supply of pancreatic juice and bile. The stimulating effect of a meat diet owing to the high acidity of the gastric secretion extends therefore beyond the stomach.

These facts also explain why coagulated protein remains longer in the stomach than raw. The pylorus refuses ready passage to the insoluble material, and the acid chyme which results from the presence in the stomach of cooked protein-containing extractives prevents that organ from emptying itself quickly.

V. Fate of the Absorbed Protein

It was formerly believed that proteins were digested for the most part only to the stage of albumose and peptone, and that these substances were absorbed as such, being immediately transformed into serum proteins which circulated in the blood and lymph and supplied protein to the different tissues. It is now believed that proteins are split up much further, even to the stage of single amido acids, or combinations of a few amido acids together (peptides). Compared to the size of the native protein molecule, these amido acids are simple bodies consisting of carbon, hydrogen, oxygen, and nitrogen. The carbon atoms may be united in a single straight chain as in alanin, $CH_3 \cdot CH_2 \cdot CHNH_2 \cdot COOH$; or some of the carbon atoms may be united in a closed ring $(C_6H_4OH) \cdot CH_2 \cdot CH_2 \cdot CHNH_2 \cdot COOH$ (tyrosin); or there may be other configurations of structure which do not concern us at present. Such bodies are the rudiments which by their union constitute a protein molecule, and, although there are wide differences of structure among them, they all possess a similar atomic grouping at one end, viz. $CHNH_2 \cdot COOH$, by which they are linked one to another to form the complex protein molecule—the

$CHNH_2$ group of one amido acid uniting with the COOH group of another, somewhat in the same way as a base and an acid unite to form a salt. All protein-digesting ferments act on this point of union, and cause smaller groups of amido acids to separate off from the main protein molecules. Albumoses and peptones may be regarded as the higher members of such groups. Pepsin and trypsin, when pure, do not appear to be able to break up these groups any further, but another ferment, erepsin, has been discovered in the intestinal mucosa which is able to split albumose and peptone into smaller and smaller groups till ultimately only single amido acids, or combinations of a few amido acids, remain, and it is very widely believed that most protein is digested to this extreme stage before being absorbed.

After absorption the amido acids and peptides may be synthetised immediately into serum proteins, as was formerly believed, but evidence is accumulating to show that these bodies circulate as such in the blood, and serve to restore protein wherever required.

During their passage from the alimentary tract to the tissues they must pass through the liver, and here a considerable proportion of them undergo changes which result in the removal of nitrogen and some carbon to form urea, while the remainder of the molecule, consisting only of carbon and hydrogen, passes on to the tissues. This seems to be designed as a protection to the tissues against an excess of nitrogenous matter, but if this disintegrative action on the part of the liver were thoroughly and constantly carried out it is obvious that no new nitrogenous matter could ever reach the tissues except in the form of urea, which is of course useless for repair purposes. We know of no research work bearing directly on this problem, but it seems to us likely that there may be two ways in which the products of protein digestion may escape the action of the hepatic cells.

1. The more complex the molecule the less likely is it to be attacked. Thus protein itself is not attacked, and therefore the larger peptide groups may escape, while single amido acids are broken up, especially the simpler ones. Immunity to hepatic action of complex aromatic amido acids, such as tryptophane and tyrosin, would explain why these substances are so abundant in proteins such as the caseinogen of milk and the vitellin of egg yolk, which are provided by nature for building up the tissues of young animals, while proteins like gelatine, which contain only very simple amido acids, are unable to support life.

We have no evidence to show that the digestion of raw protein

leads to the formation of larger peptide groups than in the case of cooked meat, but the idea is suggestive, and it is easy to imagine how much more useful than single amido acids such large molecules would be in repairing waste and in helping to form specific antibodies.

2. In the second place it may be that, owing to the rapidity of digestion and absorption of protein, the portal blood becomes so rich in amido bodies that some may escape the hepatic influence, just as one may have an alimentary glycosuria after a large ingestion of sugar. If this supposition be correct raw protein must supply a greater amount of nitrogenous matter to the tissues than cooked, where, owing to the slowness of digestion and absorption, the concentration of amido bodies in the blood at any given moment is low, and the liver cells have a better opportunity to exercise their disintegrating function.

Some experiments done by one of us (J. J. G.) may be mentioned here, because it is possible that the above suggestions as to what occurs may explain the results. Two sanatorium cases and two healthy individuals were put on fixed diet, and the nitrogen intake and output estimated. The protein of the diet was given raw for one part of the time, and during the rest of the time the same amount was given cooked. During the raw meat period the amount of nitrogen (= protein) retained by the body and presumably built up into flesh was greater than during the cooked protein period, and this took place in spite of the fact that, owing to the indigestibility of the uncooked connective tissue, there was diminished absorption of nitrogen during the raw meat period.

VI. Fat and Carbohydrate

The digestion of fat and carbohydrate does not call for such detailed treatment here as that of protein. The older views in regard to fat being absorbed in the form of fine droplets have been abandoned in favour of the view that there is a universal splitting of fat into glycerine and fatty acid throughout the small intestine. The ferment steapsin of the pancreatic juice effects the change, and in cases where the food contains much fat the ferment is increased in amount or in strength, in conformity with the singular "adaptation" of the digestive juices to the work required of them which we have previously noticed. Similar adaptations are seen in the case of the ferments necessary for changing starch into dextrins and sugars (disaccharide), and for convert-

ing disaccharide into monosaccharide (glucose), in which form the bulk of the carbohydrate is absorbed.

When present in excess fat is apt to enclose protein particles, preventing digestion and absorption, while allowing of bacterial action with resulting toxin formation.

VII. General Principles of Dieting

Apart from digestibility, cost, and other obvious conditions there are two essential principles to attend to in making up a dietary for either normal or abnormal individuals.

1. A sufficient amount of oxidisable material (protein, carbohydrate, and fat) must be supplied to replace the energy lost from the body in the form of heat and work, reckoned in heat units (calories). This should be such that the person receives 30 to 40 calories per kilogramme bodyweight, but there are several factors to be taken into account. Thus, the calories per kilogramme must be increased for muscular work, cold weather, small build of body (*i.e.* relatively large surface for radiation of heat), and there are other minor conditions which need not be mentioned here, because in dieting tuberculous cases the caloric value of the food should be as high as is consistent with healthy alimentary functions.

2. In the second place the diet must contain a sufficient amount of protein to repair or prevent tissue waste. The amount just necessary to maintain an individual in health has been variously stated. Of late years the tendency has been to regard the older figures, such as Pflüger's 118 grm. daily, as too high, but there is little doubt in the minds of those who have to treat chronic wasting diseases like tuberculosis that in these cases the supply of protein in the diet should be liberal. This, of course, entails a relative diminution of the fat and carbohydrate, for there is a certain limit to the number of calories which an individual can dispose of per day. Above this limit the person is apt to have "bilious" attacks, or to develop body fat, which is not desirable in all cases because of the extra strain thrown on the circulation and respiration. In cases of tuberculosis it should be the aim of the physician to get the patient to put on "flesh" or muscle; there seems to be some intimate connection between the toxins of tubercle and muscular substance, as shown by the loss of tone of skeletal, cardiac, and non-striped muscle which is constantly seen in tuberculosis.

VIII. Types of Tubercular Cases from the Dietetic Point of View

The importance of proper dieting in tuberculous disease is emphasised by the fact that the tubercle bacillus exerts a toxic action which interferes with nutrition directly through the alimentary system. One of the earliest features of the disease, frequently before the establishment of physical signs, is a lassitude and unfitness for work, combined with anorexia or want of appetite. This is present in as many as 98 per cent., with symptoms amounting to actual dyspepsia in 83 per cent. of all cases, and it is to be noted that this abnormality is present in the very earliest stages of the disease, before the condition is aggravated by the multitudinous organisms of secondary infection. It is a matter of common experience that in pathological conditions of the gastro-intestinal tract the re-establishment of normal digestion is most easily attained by dieting, those articles of food which give rise to such symptoms as fermentation being diminished, while those permissible are given in easily assimilable form. It is only when a suitable diet is given that the action of such drugs as are best fitted to correct the chemical errors have full scope and can produce the desired result.

In sanatorium treatment the correction of faulty nutrition is brought about by several factors:—The alteration and regulation of the patient's habits with regard to the taking of food, the stimulating effect of the open-air life already alluded to, and the administration of a dietary of the proper caloric value with correct adjustment of the various elementary constituents. In early cases these are sufficient and improvement ensues, but frequently special dieting has to be prescribed to meet the wants of individual cases.

In practically all cases there is anorexia, and, it may be, a certain degree of consequent functional dyspepsia, using the word in its widest sense. These, however, react quickly to routine treatment, and all that has to be considered is the administration of a correct physiological dietary of sufficient caloric excess to enable the patient to gain weight, with the proper relative proportions of nitrogen and hydrocarbon. The successful results got in such favourable conditions have led many sanatorium physicians to condemn all attempts at special dieting. If all cases sent to sanatoria were thus easily treated the roblem of dieting would be one of simple arithmetic, the results would

leave little to be desired, and the necessary duration of treatment would be much shortened.

But it must be borne in mind that the disease is insidious, and that the patient may be ill for long periods before he realises that anything particular is amiss and consults his medical man, and even then the condition may not be recognised. The early condition of interference with physiological function may be succeeded by actual changes in the secretory mucosa, which require special consideration in dieting. On the other hand, a patient with pre-existing and quite independent gastro-intestinal derangement may become the subject of tuberculous disease. In both these conditions the restoration of nutrition is rendered difficult, and improper feeding, especially any attempt at superalimentation, may actually aggravate the symptoms.

Cases with acute toxæmia and consequent gastro-intestinal derangement usually, if not invariably, have a swinging temperature. The toxæmia may be so grave that the patient's appetite and digestion grow worse and worse, and he may succumb. In such cases the conditions are entirely different from those obtaining in ordinary febrile affections, in which the disease has a definite cycle, and in which it is merely necessary to keep the patient alive until the period of crisis or lysis, when the toxic symptoms naturally abate and convalescence sets in. In tuberculosis with fever there is no such natural ending to the disease, and nutrition must be maintained in spite of the continued temperature. The dieting, therefore, is arranged with a different object in view. The pyrexia is also different in nature. The imperfect temperature control which characterises the disease admits of a temperature perturbation out of all proportion to the disturbing cause. Thus a patient with a temperature maximum of 102° F. can take and assimilate a diet without difficulty, and even gain weight, in a manner impossible in ordinary primary febrile conditions. In such cases perseverance with suitable diet is often rewarded by a fall in temperature, remission of symptoms, and general improvement.

Another group of cases which present difficulty are those suffering from chronic and subacute tuberculosis, with gastro-intestinal symptoms out of all proportion to the general toxæmia, and indicating long-standing gastric derangement with, almost certainly, secondary changes—fibrosis of the mucosa and consequent permanent difficulty of digestion.

The metabolic error affects practically the whole alimentary canal

in every case, but certain patients exhibit variations in the seat of the more prominent symptoms. Some cases, especially those of the more acutely toxic type, may suffer chiefly from gastric symptoms, want of appetite, sickness, and vomiting; others, again, exhibit signs of intestinal mischief rather than gastric. Intestinal cases are characterised by relatively high morning temperature, excess of decomposition products in the urine, and intestinal flatulence, with depression and headache coming on at a definite period after the ingestion of food, generally some hours after a meal, when the ill-prepared gastric contents have entered the intestine and have begun to undergo fermentation with production of toxins which are absorbed into the blood-stream, giving rise to the symptoms complained of.

Such are the main groups of cases which require special dieting, and in order to do so scientifically one must take into account—(1) The state of the gastric secretion and by inference that of the intestinal; (2) the relative digestibility of various foods and the influence which they exert on secretion.

IX. State of the Digestive Secretions in Tuberculosis

One of us (J. J. G.) has made observations on the gastric secretion of tuberculous patients with the view to determine the secretory defects. The cases investigated included those with definite digestive difficulties as well as those with apparently normal digestion. The characteristics of the gastric secretion were found to be a marked deficiency of mineral acid and a low peptonising power. After a test meal the gastric contents showed no free acid and very little combined. Hyperchlorhydria was not found to be present in any of the cases investigated, though there was usually a considerable degree of organic acidity. This deficiency of mineral acid permits of gastric fermentation, with consequent flatulence, and, since the hydrochloric acid is the great means of stimulating the flow of pancreatic juice (see IV.), one is justified in believing that the pancreatic juice is also defective. Though this cannot be directly investigated, the fact that symptoms of intestinal dyspepsia are present in varying degree supports the view that such is the case. The aim of specific dieting should be to correct secretory deficiency, and at the same time to limit fermentative changes as far as possible.

The second point to which we referred above, viz. the digestibility

of foods and their influence on the secretions, has been considered under III.

X. Practical Hints as to Dieting in Tuberculosis

The physiological facts and views discussed in the preceding parts of this chapter throw light on some of the perplexing questions of dietetics, and indicate the general lines on which the dieting of severely dyspeptic cases may be proceeded with.

It must, however, be borne in mind that in dealing with the dyspeptic tuberculous subject the digestive tract is already damaged, and reacts less readily to stimuli than the normal, and, in addition, that there is a constant toxæmia impeding the recovery of the digestive power. The main lines indicated are that while a carbohydrate diet, such as is commonly prescribed in dyspeptic cases, passes through the stomach fairly rapidly, it does not in any sense stimulate gastric secretion or exert a corrective action on the gastric mucosa. Since the characteristic of tuberculous dyspepsias is a deficiency of acid, our object should be to adjust the dietary so as to obtain an increase of that constituent. When the appetite is gone and "appetite juice" presumably weak or absent altogether, it is important to furnish the stomach with a direct chemical stimulant in the form of the extractives contained in raw meat, beef juice, or meat extracts. These can induce a flow of juice which supplies the place of the appetite juice and starts the process of digestion.

Moreover, raw protein is as "light on the stomach" as carbohydrate diet, and, as already explained in III., it excites a strongly acid gastric secretion.

Besides the constituents of the diet, the time of taking meals is important. The secretory activity of the stomach should be conserved by giving food as seldom as possible, thus ensuring a thorough rest to the glands. This is best attained by giving three meals a day at, say, 8.30 or 9 A.M., 1 P.M., and 7 P.M. The evening meal should be the lightest meal of the day. The diet of an aggravated gastric case should therefore be arranged somewhat on the following plan. Before breakfast one or more raw eggs should be prescribed, on an empty stomach, allowing a reasonable interval to elapse before any further food is taken, so as to enable them to pass into the intestine. The eggs frequently exert a surprising effect on the appetite for breakfast, probably by carrying with them into the intestine the germ-laden mucus which may be found

in the stomachs of such cases in the early morning. The eggs should be taken plain, not beaten, and should on no account be mixed with milk or any other food material, otherwise they remain in the stomach until the milk is digested, and defeat the object of administering them in this form and at this special time. Given on a stomach already containing food, the effect of raw eggs is to delay still further the emptying of the organ, and thus, in the presence of a weak gastric juice, to give opportunity for increased fermentation. Raw meat should be administered at the meals, either alone or in addition to properly cooked meat. It should be finely minced and freed from fat and fibre, and given plain, or stirred into warm meat extract till of the consistence of gruel. It is in this way disguised, and may be flavoured to suit the taste of the individual. In cases with incessant sickness raw meat given plain, varied with beef juice (prepared by extracting finely minced meat with cold water or saline), in quantities representing the juice of a pound or more per day, will frequently allay sickness, diminish irritability, and restore a measure of secretion. Milk may now be added to the dietary two hours after meals. Milk, owing to the fat it contains, inhibits secretion, and is best given when the summit of the secretory wave is past. If no disturbance is caused carbohydrate in the form of bread or milk pudding may be introduced by degrees, until an ordinary dietary is gradually reverted to. An occasional day of non-fermentable diet, such as is described above, may have the effect of keeping the stomach sterile. When the raw meat is not tolerated beef juice may be substituted, alternating with some predigested invalid food. It is well also to aid matters by washing the contents of the stomach through into the bowel by administering the familiar glass of very hot water, slowly sipped, half an hour to an hour before meals. The effect is to cause contraction of the stomach and expulsion of its contents into the duodenum. The above type of dietary also does good in cases where the digestive error manifests itself in the duodenum and lower down. The symptoms in this class of case have been already noticed, and are familiar from clinical experience in dyspepsias other than those of the tuberculous. The rationale of the treatment has been touched on already in IV. The increased secretion of hydrochloric acid resulting from a raw protein diet leads to an increased pancreatic secretion, and, consequently, to more perfect digestion and absorption, and to diminished putrefaction in the intestine. More remotely the raw meat is of value in that it leads to better nutrition of the tissues, and thus aids the restoration of muscle. The pulse of the patient improves, and this may be taken as the best

indication as to the state of the muscular nutrition of the body. Muscular malnutrition is evident in many cases of the disease which in other respects appear relatively slight.

Cases of intestinal, as opposed to gastric, dyspepsia are characterised, as already mentioned, by rises of temperature, especially in the morning, causing a rise in the daily mean temperature. The morning rise may be attributed to the absorption of toxic products resulting from the fermentation in the bowels during the night. This pyrexia frequently takes the form of recurrent attacks, or waves, with quiescent intervals. In such cases great benefit is often derived from the administration of lactic acid milk. This may be given at short intervals (a pint every two to four hours) for a day or two, with no other food. The result is a surprisingly rapid defervescence, with abatement of the symptoms. The ordinary dietary can then be reverted to, substituting in it prepared for ordinary milk. With this treatment the improvement is greater than can be got by dieting with plain milk, which may even cause a rise of temperature in such cases.

The treatment of cases of gastric dyspepsia may be aided by direct gastric antisepsis. The administration of intestinal antiseptics, on the other hand, is uniformly disappointing, while much better results are got by the indirect method of flooding the bowel with the proper varieties of lactic acid organisms. The administration of lactic acid milk may be used to ameliorate the gastric condition. By the correction of the intestinal toxæmia the gastric condition is indirectly improved. The question of the quantity of food to be given to severe dyspeptic cases is subsidiary to the treatment of the gastro-intestinal condition. Once improvement of the digestion sets in the quantity can be increased until the full dietary indicated by the caloric need of the individual is attained.

One feature of the raw meat treatment which is especially noteworthy is that fermentation of the raw protein in the intestines does not take place, and no diarrhœa or other symptoms occur, such as would inevitably ensue were a similar quantity of cooked protein administered. It is only when all reasonable limits are passed, and the diet continued too long, that any such symptoms arise. This clearly indicates a more rapid absorption of raw protein than of cooked, and, consequently, a lessened duration of exposure to decomposition.

One point which may be alluded to here, though not strictly within the scope of the chapter, is that the dyspepsia of tuberculosis is frequently aggravated by dental caries and by the presence of septic sinuses

in the mouth. A necessary preparation to the treatment of any case presenting digestive difficulty is the clearing away of all sources of sepsis and toxin formation in the cavity of the mouth. When this is impracticable, through the patient not being able to stand the shock, a palliative measure is to make him chew a sponge soaked in antiseptic. This expresses all pus and septic matter from among the decayed roots, and prevents its reaching the stomach. This alone frequently breaks the vicious train of processes, and enables the gastro-intestinal tract to benefit sufficiently to place the patient's nutrition on a proper basis.

The above are some of the special lines on which the dieting of cases of tuberculosis may be carried out. The special employment of raw animal protein is undoubtedly of great practical value in such cases, provided it be used intelligently. In the light of what has already been said of the recent advances in our knowledge of the physiology of digestion, we would desire to emphasise that the employment of raw protein to correct digestive secretory abnormalities is therapeutic, and based on the pharmacology of the substances. They are to be regarded as drugs as well as foods, and as taking the place of, or aiding, the time-honoured but frequently disappointing empirical combinations of inorganic and vegetable drugs. The type of alimentary derangement must be recognised, and the diet adjusted to the requirements of the case. The points on which we would desire again to lay emphasis are that digestion and digestive secretion are purposelike, the type and quantity of the secretion being specific, in the dog at least, for each food constituent; that certain chemical substances exert a stimulant action on secretion, others a depressant; that while cooked protein takes the familiar clinical time to digest, the digestion and absorption of raw egg and meat proteins are governed by different laws; and that this fact can be taken advantage of to improve nutrition with the least strain and fatigue to the digestive organs, while the action of the meat extractives provides a helpful stimulus which has a specific relationship to secretion.

Taking into consideration the various physical and chemical differences which we know to exist between the digestive fluids and processes, it will follow that the above specific relationships of food to secretion are what we would naturally expect to find. We must, however, again mention the fact that we are dealing with a damaged system in these cases, and a damage which is progressive, the detrimental action of toxin poisoning being still in operation, instituting the vicious cycle

which starts with the beginning of digestion, and which exerts its influence throughout the whole digestive tract. It is only an intelligent application of dietetic principles, applied with a definite aim in view, that in many excessively difficult cases will turn the scale in favour of the patient whose condition is uninfluenced by a routine system, that makes "the sauce for the goose to be also the sauce for the gander."

JOHN MALCOLM.
J. J. GALBRAITH.

CHAPTER XI

OPEN-AIR SCHOOLS

Incidence of Pulmonary Tuberculosis at School Age—Clinical Examination of School Children—Biological Tests—Post-mortem Examinations—Prevalence of Tuberculosis in Early Life—Observations of R. W. Philip—Accuracy of Methods of Examination—Old and New Conceptions of Tuberculosis—Diagnosis of Pulmonary Tuberculosis in the Child—Stigmata of Tuberculosis—Two Lines of Progress—Condemnation of the Structural Requirements of the Education Acts—Increased Mortality Associated with School Life—Open-Air Schools—Origin of Open-Air Schools—Cost of Sheffield School—Tuberculosis Open-Air Schools—British Climate—Type of Open-Air Schools for Tuberculosis—Royal Victoria Hospital School—Paddington School.

Open-Air Schools.—In considering the utility and place of open-air schools in a co-ordinated campaign against tuberculosis, we distinguish between schools under sanatorium or dispensary auspices for those cases of pulmonary tuberculosis at school age in which active treatment is required, and the larger question of the desirability for a higher degree of aeration in all schools throughout the country.

Incidence of Tuberculosis at School Age.—From either point of view the incidence of tuberculosis at school age is of first importance, and the divergence of opinion as to what percentage of children are tuberculous, is indicated by figures which range from ·3 per cent. to 80 per cent.

The amount of tuberculosis at this period of life may be gauged by the results of post-mortem, biological, and clinical examination, of which different methods the following figures are examples:—

Clinical Examinations of School Children

	Number Examined.	Percentage of Pulmonary Tuberculosis.
Fraenkel[1]	220,000	·39
Berlin School Medical Inspection[2]	39,666	·45
Squire and Gowdey[3]	1,670	·47
Mèrz, Dufestel, Delille[4]	447	·24

BIOLOGICAL TESTS ON SCHOOL CHILDREN

	Method.	Percentage of Tuberculosis.
Grancher [5]	Ophthalmic Reaction.	16 %
Von Pirquet [6]	Cutaneous Reaction.	18 %
Monte and Hamburger [7]	Subcutaneous Reaction.	42 %
Herford [8]	Cutaneous Reaction.	from 55 % to 78 %
Krang [9]	Ophthalmic Reaction.	80 %

POST-MORTEM EXAMINATIONS ON CHILDREN AT SCHOOL AGE

	Percentage of Tuberculosis.
New York Infant Asylum [10]	8 %
New York Babies Hospital [11]	16·8 %
Albrecht [12]	33 %
Müller [13]	40 %
Hamburger and Schluka [14] (ages 1-14)	47 %

Prevalence of Tuberculosis in Early Life.—Many writers hold that pulmonary tuberculosis is more frequent in infancy than at any period of late childhood, and the occurrence of this disease as a sequel of the acute infectious fevers, such as measles, whooping-cough, or influenza, is indicative of a pre-existing latent lesion usually in the bronchial glands. According to Finkelstein,[15] the mortality from tuberculosis in the first year of life (1·28 per cent.) is greater than in any other period of childhood. Later figures, however, tend to show that tuberculosis increases with age.

R. W. Philip has recorded two observations on the incidence of tuberculosis in childhood. At the Royal Victoria Dispensary for the Prevention of Consumption, 11 per cent. of the patients are children under the age of 15 years. Again, in the examination of various groups of school children, selected at random and without reference to previous health, he found that 30 per cent. of these children presented the stigmata of pulmonary tuberculosis, that is, clinically determinable infection.

It is obvious that a wide divergence exists between the results of post-mortem and biological investigations on the one hand and the majority of the results as ascertained by clinical examination, so that the question turns on the relative accuracy of these various procedures.

Accuracy of Methods of Examination.—The incidence of tuberculosis in childhood, as determined by post-mortem and biological methods, is fairly constant. Of these latter the most frequently practised are the ophthalmic reaction, in which a drop of tuberculin solution is instilled upon the conjunctiva, and the cutaneous reaction, where a scarification of the skin is inoculated with a stronger solution, in both of which a subsequent inflammation may indicate the presence of tuberculous infection. These tests are generic—a small lesion in an obscure mesenteric gland will give a positive reaction—but the value of this procedure is enhanced rather than diminished provided that by clinical methods we are able to localise the seat of the lesion.

Old and New Conceptions of Tuberculosis.—On the one hand is the old conception that pulmonary tuberculosis is due to the direct inhalation of tubercle bacilli, which reach the terminal alveoli of the lung, there inducing in almost geometrical progression catarrh, consolidation, and excavitation. Were this the case, crepitations could be regarded as an early sign and of diagnostic importance. If, on the other hand, as already indicated (Chapter II.), the infection commences by the absorption of the bacillus in the upper portion of the respiratory track, followed by a slow lymphatic infiltration of the cervical chain, and later in the interalveolar tissues of the lung, it is clear that crepitations will occur comparatively late, when the disease has attacked the alveoli and bronchioles.

Diagnosis of Pulmonary Tuberculosis.—If the disease has not passed the stage of lymphatic infiltration the only signs present will be the existence of Philip's lymph nodes, relative dulness on percussion, diminished expansion of the affected apex on inspiration, and weakened breath sounds due to the diminished elasticity of the lung. The fact that over 60 per cent. of healthy persons have been at one time or another infected with pulmonary tuberculosis is proof that the disease may never pass the earliest stage. We term these early changes the stigmata of pulmonary tuberculosis, the significance of which is this, that every such case is, under unfavourable circumstances, a potential case of advanced disease. By the above clinical methods Philip [16] found some 30 per cent. of children presented these stigmata, and one of us (H. G. S.), in a rural school in Westmorland, found 33 per cent. of the children with definitely determinable signs of such infection. The figure ·4 per cent. probably represents the number of children with well-marked aggressive disease, but the potential cases are at least of equal importance from a medical and sanitary standpoint.

Stigmata of Tuberculosis.—It is frequently stated in the medical and in the lay press that if so large a number as 30 per cent. of children present these stigmata, this degree of infection must be so universal that it ceases to have any practical significance. Further, it is argued that if 40 per cent. of children react to the tuberculin tests before entering school, the conditions of school life have little part in disseminating the disease.

No one has ever suggested that 30 per cent. of children should be removed from school to be placed in sanatoria, but we do hold that as each of these children is a potential case of advanced pulmonary tuberculosis, the conditions of childhood, and particularly of school life, should be such that resistance against the disease is increased, and the child strengthened against the time when he enters the critical age periods of life.

Two Lines of Progress.—To this end there must be progress along two lines—greater refinement in our methods of diagnosis, and improved conditions of aeration in our schools. These are of the first scientific and economic importance. A higher standard of living, whether attained by State-provided meals or improved economic conditions, will have little influence on the prevalence of tuberculosis if the first essential of life—fresh air—be neglected.

The ideal to be striven for is that every school in the country should be conducted on open-air principles. A régime that is beneficial to individuals weakened by so profound a systemic infection as pulmonary tuberculosis is of necessity the best mode of life for the strong. Our present ideas of school architecture demand revision. The central hall, Oriental in conception and expensive in construction, makes ventilation difficult, the huge playground were better given to larger classrooms, and we have yet to see the schoolroom in which the air is pure and fresh at the end of an hour's teaching. In general, the minimum structural requirements of the Education Acts are absolutely incompatible with the highest degree of health in the child.

Increased Mortality Associated with School Life.—The following remarkable increase in mortality from pulmonary tuberculosis during the period of school life, to which R. W. Philip [16] first called attention, demands the most careful consideration. He finds that in Scotland during the last three quinquennia, while there is a fall in the mortality from pulmonary tuberculosis in children under the age of 9, there is a striking increase in the death-rate of children from 10 to 14 years of age.

"Thus, taking the mortality from pulmonary tuberculosis in Scotland during three successive quinquennia from 1891-1905, I find that while there is a remarkable decrease in the rate as between children under 1 year and children under 5 years, amounting to 31·08 per cent. (1891-1895), 29·03 per cent. (1896-1900), and 15·30 per cent. (1901-1905), there is, contrariwise, a most striking increase in the death-rate of children from 10 to 14 years of age, the increase amounting in the respective periods to 90·48 per cent. (1891-1895), 105·88 per cent. (1896-1900), and 90·63 per cent. (1901-1905). These facts are suggestive and of far-reaching importance. Evidence is rapidly accumulating that it is especially during childhood and school life that the tuberculous seed finds a nidus. An exact estimate of the incidence of tuberculosis in childhood is urgently needed, not alone in the interests of the child, but also in that of the population as a whole. This is a scientific and social question of the first moment."

Open-Air Schools.—Open-air schools may be considered as prophylactic and as curative agencies. As already indicated, a realisation of the truest conception of education would mean that every school in the country was a prophylactic agency against disease, and in this connection the school medical service as a flying column should, if suitably equipped, constitute a reconnoitring force in the tuberculosis campaign. As curative agencies open-air schools may exist for general diseases or for the treatment of tuberculosis.

Origin of Open-Air Schools.—The open-air school movement originated in Charlottenburg in 1904, and in 1907 the first open-air school was opened at Bostall Wood, Woolwich, under the auspices of the London County Council. Three London schools were opened in 1908, and the movement spread to Halifax, Norwich, and Bradford. In 1909 an open-air school was opened at Whiteley Wood by the Sheffield authorities. These schools are for the treatment of diseases of childhood in general, the following being the cases first treated in the Sheffield school:—[17]

Morbid Affections.	No. of Cases.
Anæmia and malnutrition	43
Oral sepsis	13
Tuberculosis of the lung	3
Tuberculosis of the lung?	9
Tuberculosis of glands	2
Pneumonia convalescence	1
Kidney disease	1
Debility after tonsils and adenoids	4

School work was carried on 3¾ hours *per diem*. The cost of working this school from 21st June to 29th October was £366, there being forty children. From this the Government grant of £70 and parents' contributions amounting to £18 should be deducted.

Tuberculosis Open-Air Schools.—The tuberculosis open-air school differs from the foregoing in its conception, scope, and management, and is an integral part of the Edinburgh system.

In every sanatorium which accepts children special provision is required for their treatment, supervision, and education. To be effective sanatorium treatment must be of somewhat long duration, and as the majority of children during this period are comparatively well, their education should be continued under sanatorium conditions.

Allowing graduated activity to be an essential principle of treatment, special provision is needed.

It has been our frequent experience to attend cases of pulmonary tuberculosis in childhood, where, in spite of physical improvement, we were unable to sanction a return to crowded, insufficiently-aerated schools. Too often a return to one of such means a recrudescence of disease and the reappearance of symptoms.

From the educational standpoint open-air schools are of the first importance. Pulmonary tuberculosis in the child is the cause of prolonged absences from school. The following are the absences of a group of children prior to their admission to the Royal Victoria Hospital School:—

J. K. (age 15).	Left school	11	months	before admission.
B. K. („ 13).	Do.	12	do.	do.
W. W. („ 13).	Do.	3	do.	do.
K. S. („ 13).	Do.	5	do.	do.
J. B. („ 13).	Do.	5	do.	do.
W. S. („ 12).	Do.	15	do.	do.
R. H. („ 12).	Do.	22	do.	do.
S. W. („ 13).	Do.	1	week	do.
L. C. („ 11).	Do.	11	months	do.
M. T. („ 9).	Do.	17	do.	do.
K. A. („ 9).	Do.	14	do.	do.
S. M. („ 8).	Do.	10	do.	do.
F. C. („ 8).	Do.	6	do.	do.
D. W. („ 8).	Do.	6	do.	do.

British Climate and Open-Air Schools.—There is nothing in the climate of the British Isles to prevent the operation of open-air schools throughout the whole year. Complete aerotherapy has been practised

at the Royal Victoria Hospital for Consumption without a single instance of acute "cold," the only complication being chilblains, to which tuberculous patients are peculiarly liable. It has further been the experience that improvement is more marked during the winter than during the summer months.

Types of Schools for Tuberculosis.—These schools are of necessity of two types, the one for the sanatorium, the other a day school for those children who are for one reason or another unable or unsuitable to undergo sanatorium treatment. Provided that the sanatorium is easily accessible to the centre from which the patients are drawn, the sanatorium school and the day school may be worked as one. Such has been the method at the Royal Victoria Hospital.

As previously indicated, much might be done in the existing schools to improve the conditions of school life, but further measures are required for the tuberculous child. Thus efficient ventilation, as the term is popularly misunderstood, is not sufficient. A constant superaeration is necessary, which can only be attained in specially modified schools.

Royal Victoria School.—For several years past the Royal Victoria Hospital has endeavoured to mitigate the loss to the child of months, or even years, of idleness by the possession of an open-air school. All the children treated are suffering from definite pulmonary lesions, some but slightly affected, others with pronounced bilateral lesions.

The number constantly under treatment averaged about 20, of which 75 per cent. were resident patients and 25 per cent. visitant patients (day scholars). The visitants are selected from districts in the vicinity of the sanatorium, where they are fed, and they return home to sleep. In age they range from 6 to 14 years, some having had no schooling before admittance.

The great majority of the children treated at this school are sent in from the Royal Victoria Dispensary for Consumption, many being discovered in the routine examination of "contact" cases.

Experience has shown this to be a fairly satisfactory method. The day patients improve markedly, but not to the same extent as the resident patients, the reason being that during the night it is almost impossible for the former to maintain the ideal hygienic principles enjoyed by the resident patients. Until recently no special accommodation could be provided for the school, the arrangement being that on fine days it was held in a shelter in the central park, and in wet or very cold weather one of the wards was utilised as a schoolroom.

Photo by Marshall Wane & Co., Edinburgh.

CLASS AT THE ROYAL VICTORIA HOSPITAL.

The teaching staff consisted of a female teacher (B.A., Aberdeen) and a drill-sergeant, both being patients suffering from pulmonary tuberculosis.

The hours for school work should be somewhat shorter than at ordinary schools. A suitable time-table is the following :—

10 A.M. to 12 A.M. Ordinary school work.

12 A.M. to 12.30 P.M. Drill and physical exercises.

12.30 P.M. to 1 P.M. Absolute rest.

1 P.M. to 2 P.M. Dinner.

2 P.M. to 2.30 P.M. Absolute rest.

2.30 P.M. to 4 P.M. Light work, such as sewing, nature study, reading, etc.

The drill and exercises are carried out (under medical supervision) with a view to increase of chest expansion and improvement of posture.

It is hoped that the foregoing simple arrangement will be the precursor of a larger and more efficient scheme.

Extension of Royal Victoria Hospital Open-Air School.—Under the Education of Defective Children (Scotland) Act, 1906, and sections 3 (subsection 4), 5, and 17 (subsection 8) of the Education Act, 1908, a mutual agreement is possible between the Royal Victoria Hospital and the Board of Education.

Under this scheme the hospital would agree to supply land for the erection of suitable school buildings within the grounds, also spaces for a playground, drill-ground, and nature study. The Board of Education would undertake to build the school, to provide the necessary equipment, and to pay the teachers' salaries.

As regards the architecture of the building, it would be best to follow closely the model of the present pavilions within the hospital, these being adapted to ensuring dryness, the maximum amount of sunlight, and ideal aeration at a minimum expense.

Under this scheme the number of children would be increased, 50 per cent. to be resident patients and 50 per cent. visitant patients residing in the neighbourhood.

A teacher is provided for every twenty pupils, and the teachers themselves should be patients under treatment for pulmonary tuberculosis. The usefulness of the school is thereby increased, as treatment is extended to the teachers without them incurring financial loss, which might otherwise preclude the possibility of sanatorium treatment. These teachers also more readily recognise the extreme importance of super-aeration not only in summer but also in winter. As improvement

and arrest occur both in the pupils and teachers they return to the ordinary schools, thus giving place to new cases, and also acting as an object lesson to others in the advantages and necessity of rational aeration.

For this school the Royal Victoria Dispensary would be the chief collecting and distributing unit, as it is for the other branches of the Edinburgh system. All medical supervision should be in the hands of the hospital staff.

Further Extension.—A further extension is contemplated at the Royal Victoria Colony. It is suggested to erect there a larger school at which all the children will be resident patients.

The Paddington and Kensington Dispensary School.—An arrangement such as the above is obviously impossible in large centres such as London, because of the inaccessibility of the sanatoria.

The Paddington and Kensington Dispensary have established an open-air school in North Paddington which accommodates about 120 children. It differs from the open-air schools which have already been started in England, in that the work is carried on during the whole year, and not merely during the summer months.

The dispensary has provided the ground and building, the London County Council undertaking to bear the cost of maintenance. Children are selected from among the dispensary patients, the Board of Education stipulating that they must be definitely tuberculous. Children showing signs of a tuberculous infection with the possibility of definite active pulmonary disease in later years will not be admitted.

E. Goss.

Halliday Sutherland.

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Photo by Marshall Wane & Co., Edinburgh.

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CHAPTER XII

THE PLACE OF THE FARM COLONY IN TREATMENT

In the year 1887 there was established in Lauriston Place, Edinburgh, the first dispensary for the prevention and treatment of pulmonary tuberculosis. From this nucleus has grown and developed what has since come to be known as the Edinburgh Scheme for the solution of the tuberculosis problem. The second step was the institution of the Royal Victoria Hospital for Consumption. A third step was taken when the municipality agreed to provide accommodation for advanced cases at the Edinburgh City Hospital. Working in co-operation with the Public Health Authority and with various charitable agencies, these three factors formed the basis upon which the Scheme has operated.

At the dispensary, in the quite early days of its existence, a course of classes in respiratory exercise was formed, and graduated exercise was prescribed in the nature of walks of varying length and gradient, just as medicine is regulated as to dosage. To this the hospital added more systematised work, until the patient was brought to a point of relatively high physical efficiency, and was able to undertake most kinds of ordinary manual work. The problem that now presented itself was how to ensure his retaining that efficiency, and to obviate the tendency to relapse if restored immediately to what are often insanitary homes and dusty occupations. Something in the nature of normal working life, yet under medical supervision, would, it was thought, attain this end. For the majority of the patients such treatment was complete in the hospital, but it was found that in the case of 25 per cent., after the disease had been arrested and they had put on flesh again, a return to their ordinary avocation was apt to result speedily in their relapse.

Accordingly the colony was formed in order to continue the cure of such cases and fit them for situations in which they might be expected to suffer no detriment to health. The influence upon the patient of this transference from hospital to colony life is psychological as well as physical. The psychological element is of pre-eminent importance and must not be lost sight of. The stimulus of creative effort and restored

Planting Potatoes.

Securing the Potato Crop.

social usefulness is one of the primary tonic factors in the colony *régime*. The regular routine and the cultivation of systematised habits stimulate and increase a wider outlook. These psychic factors together form a most powerful adjunct in the body's struggle with its material enemy, the tubercle bacillus. The physical influence is that of carefully graduated work. In tuberculosis we have, as Dr. Philip has shown, to deal with a constitutional disease with a local manifestation in the lung and a systemic toxæmia affecting principally neuromuscular structures, although muscle itself is one of the few tissues on which the tubercle bacillus does not readily grow. In our efforts to eliminate the toxin and aid the tissues in their struggle against the bacillus rest is sometimes of use, and in certain conditions imperative; but the continuance of rest when once the disease is in a quiescent state is a source of danger rather than an advantage. The essential muscular dystrophy is thereby maintained. The patient may put on weight and may be even heavy and corpulent by fatty deposits, but pallor, softness, and lethargy reveals the physiological inefficiency. On the other hand, nothing repairs the debilitated muscle so certainly as natural movement. The cardiovascular system is raised in tone, and increased aeration of the tissues resulting from open-air work adds its effect and lessens the commonly associated anæmia.

In carrying out this plan for the continuation treatment of hospital cases the Royal Victoria Hospital was singularly fortunate in the acquisition of the mansion-house and lands of Springfield in the parish of Lasswade, which were formally opened for the purpose by Lady Dunedin on 2nd July 1910. It comprises fifty acres of land, most of which has good soil and is suitable for cultivation. The property adjoins the classic domain of Hawthornden, situated upon the river Esk. From the lodge on the main road a fine avenue of beech trees leads to the mansion-house, a large, roomy building, three storeys in height to the front and four to the back. There is a walled garden between one and two acres in extent, and the fields of fine loamy soil lie around and below the mansion-house one being on the side of the Esk. Springfield lies about 280 feet above sea-level, and, like the lower part of the parish of Lasswade, enjoys a mild climate with soft and agreeable air, the effect of which is everywhere seen in the luxuriant vegetation. The property is well wooded, with a rookery in one corner, and the river scenery of the Hawthornden boundary and its steep wooded bank is of the most romantic character. With some slight modifications the house was readily adapted to accommodate from twenty-five to thirty colonists—in two divisions—male and

female, presided over by a matron. The front portion of the building constitutes the residence of the physician-superintendent.

The persons considered eligible for promotion to the colony comprise those who are free from constitutional manifestation of the disease, with no rise of temperature and with the local manifestation reduced to dormancy. Such patients, capable of at least three to six hours' work per day, are passed on. On admission they are examined carefully and their condition recorded. Those who are not already provided are furnished with a mackintosh, thick boots, and leggings. The daily routine of the colony begins at 6 A.M. in summer, 7 A.M. in the winter months. The colonists then rise, bath, make their beds, and are served with a cup of tea and bread and butter. Half an hour later they proceed to their work. At 9 A.M. they breakfast. This meal includes porridge and milk, followed by a second course which may consist of eggs, bacon, or fish of some kind, together with tea and bread and butter. Work is resumed at 9.45, and is continued until 1 P.M., when dinner is served—vegetable broth made with good stock, meat, either beef, mutton, or pork, with potatoes and other vegetables, followed by milk pudding. Each person gets half a pint of milk. After dinner there is an interval of rest until 2 P.M., when work is resumed and goes on until 5 o'clock, when it ceases for the day. Up to this point the colonists remain downstairs, lavatory accommodation of ample dimensions being provided on each side of the entrance hall. All then dress for tea at 5.30 P.M. At this meal fish or cold meat is served, with tea and bread and butter *ad libitum*. After tea the colonists are at liberty to amuse themselves either in the grounds or with the books and games provided in the recreation room. At 8.30 P.M. a cup of hot milk, coffee, or cocoa made with milk is taken. 9.45 is the hour for retiral, and lights must be out by 10 o'clock.

Such is the daily alternation of work and rest. Once a fortnight each colonist is carefully examined by the physician-superintendent and any change of condition recorded. If indications require it the work prescribed is altered. A complete record of all cases is kept, from which statistics are regularly prepared.

All outdoor work is prescribed definitely by the physician-superintendent and carried out under the direction of a skilled farm grieve. Up to the present time the colonists have been chiefly town workers, and not, therefore, familiar with farm work. But they have proved quite as apt and industrious as the average farm hand. They have engaged with interest and hearty co-operation in all departments.

The grade of work allotted to the colonist depends upon the physical

Selecting Seed Potatoes.

The Corn Harvest.

condition, sex, and age. It ranges through raking, weeding, fencing, hoeing, feeding stock (poultry, pigs, etc.), to joinery, digging, ploughing, and other heavy work. The property has been fenced in considerable part, roads have been bottomed and levelled, fowl-houses have been built, poultry runs have been erected, and a considerable acreage of virgin land has been ploughed, cropped, and harvested: all by the colonists. The character of the work is also taken into consideration; poultry feeding, *e.g.*, although light in itself, involves considerable exertion where distances have to be covered and gradients are high. Special care is taken with any case that has shown a tendency to hæmorrhage. We refrain from giving a task which keeps the blood-pressure at a sustained high tension; for example, machine grass-mowing, where continuous muscular effort is made without the repeated relaxations between strokes that occupations such as digging afford. The indications of excessive work that we look for are loss of appetite, malaise, headache, rise of temperature, and increased pulse-rate. More or less complete rest should be ordered where the temperature rises above 99° F. or the pulse above 95 per minute, or where the blood-pressure is persistently lowered. The women colonists are given the lighter outdoor occupations, such as raking, weeding, potato collecting, fruit picking, flower growing, poultry feeding, and harvesting. They also work indoors under the supervision of the matron.

The colony aims at being self-supporting, and for this it depends on market gardening, poultry, pig rearing, flower growing, and, to a lesser degree, on general farm produce. The various products are partly consumed at the colony, partly supplied to the Royal Victoria Hospital, and the surplus, of which there is a very considerable quantity, is marketed. The most profitable source of income has been the rearing of pedigree stock. The stock of pigs was founded by a fine pedigree sow presented by Lord Rosebery, and there is now a large and thriving herd. The poultry, though not so remunerative, form a useful adjunct. Incubators are largely used for hatching, and are worked with intelligence by the colonists, who show great interest in the rearing of the hatches. From the experience we have already had there is every reason to believe that the colony can be made self-supporting in a very short time.

As regards its relation to the problem of tuberculosis, it is obviously much too soon to make wide generalisations. At the same time certain points that are not without interest have been clearly established.

1. We have established the fact that many patients in whom the disease has been reduced to dormancy can be safely passed on from the hospital to the colony, although they may not be in a fit state to go home.

By such transference the pressure of the sanatorium is relieved, while the patients are kept under observation for a much longer period than would otherwise be possible.

2. We have proved that there is practically no difficulty in getting the ordinary patients of the hospital, whatever their previous occupation may have been, to adapt themselves to the colony life. They are led to understand from the outset that they are quite able for a certain amount of graduated work, under medical supervision, and that it will be of the utmost benefit to their health; and our experience has been that while firm discipline has occasionally been necessary, the great majority have worked most willingly, and have uniformly admitted the great benefit it has been to them.

3. The patients who have been thus transferred have been transformed once more into useful citizens. It has been usual to have an initial fall in weight to the extent of a few pounds, but this has usually been regained by the end of the first fortnight or so. Then follows a rise in weight and a conspicuous increase in muscle tone. With the exception of one who developed renal and hepatic disease, every colonist transferred from the hospital has, up to the time of writing, gained in all directions during his period of farm life.

We may, therefore, sum up the advantages of the farm colony system in relation to tuberculosis as follows:—

(1) The tuberculous individual is restored to his place as a working unit at an earlier date than is otherwise possible without risk of relapse. He is taught, moreover, a new occupation under favourable conditions.

(2) The colonist is hardened physically, and the conditions under which he works aid materially in the complete overthrow of the tubercle bacillus and the neutralisation of its toxic products in the tissues of the body.

(3) The return to social function of the individual has a most potent effect upon his whole system. He is no longer leading a mere hospital existence. He forms one of the productive community, and the stimulus and interest of personal effort speedily shows itself in his brightened countenance and alert bearing. The colonists are men and women once more, and happy with a sense not only of fitness but of creative activity.

A. H. Macpherson.

Bunching Flowers for the Market.

Berry Picking

CHAPTER XIII

THE HOSPITAL FOR ADVANCED CASES

Responsibility of Municipalities—Circular of the Local Government Board—Necessity for Notification—Poorer Classes chiefly Affected—Spread of Infectious Disease—The Problem of Advanced Pulmonary Tuberculosis—Relation of Disease to Overcrowding—Distinction between Early and Advanced Cases from Public Health Aspect—The Duty of a Municipality—Provision for Advanced Cases—Inadequate Accommodation—Municipal Hospitals—Their Successful Operation—The Causes of Failure—The Provision in Edinburgh for Advanced Cases—Open Shelters—The Lighting of Shelters—Deaths and Discharges from the Hospital—Duration of Stay in the Hospital—Cost to the Municipality—Results of the Work in Edinburgh.

From the time when, as a result of scientific progress, pulmonary tuberculosis was proved to be a disease of an infectious nature, a distinct duty in regard to the measures which were necessary to prevent its spread was laid upon municipalities and their public health officials. At a very early stage the legal question arose and was freely discussed as to whether or not municipalities were warranted in incurring the expenditure necessary for the provision of hospital accommodation for sufferers from this disease.

Municipalities' Responsibility

Public opinion has long accustomed itself to the urgent necessity for accommodation being provided in which all of the commonly occurring infectious diseases can be treated, and at first the possibly great increase of expenditure by the addition of pulmonary tuberculosis to the already existing list sufficed to raise some initial legal doubts. These, however, were speedily settled by a circular issued by the Local Government Board, in which it was clearly set forth that the expense connected with the provision of hospital accommodation for the prevention of the spread of tuberculosis would constitute a charge which a municipality could legally incur in common with other infectious diseases.

This circular provides that pulmonary tuberculosis is an infectious disease within the meaning of the Public Health (Scotland) Act, 1897; that the sections of that Act applicable to other infectious diseases

apply to this also; and that the statutory obligation resting on the local authority to deal with and to control infectious disease extends to tuberculosis.

Necessity for Notification

It is at once apparent that in order that municipalities may obtain the fullest advantage of hospital accommodation as a means of segregating patients with the view of preventing the spread of the disease from which they suffer, it is a primary necessity that the fullest information in regard to its existence should be in the hands of the Authorities. This, obviously, can only be attained by adopting compulsory notification, or, in other words, by adding pulmonary tuberculosis to the list of diseases specified in the Infectious Disease (Notification) Act, 1889.

Much remains yet to be done in order that this desirable end may be attained. It is somewhat difficult to realise that despite the knowledge which science has shed upon the whole question of the etiology of this disease, its means of spread and the consequent precautions which are necessary to combat this, there still remains 45 per cent. of the whole population of Scotland to whom compulsory notification does not apply.

This clearly indicates that over a very large area of the country even elementary precautions are not adopted, and such a condition of affairs is likely to persist until the notification of the disease is made compulsory—a step which may safely be anticipated in the immediate future.

The Poorer Classes chiefly Affected

It has long been known that tuberculosis lays its hand most heavily upon the poor and working classes in a community, and that fact of itself increases very materially the responsibility of a municipality in regard to the steps which it adopts towards safeguarding the interests of the patient and those who are resident in the same house.

The danger of the spread of an infectious disease is, of course, greater in proportion to the limitations of house accommodation. This fact is recognised in the Public Health Act, under which provision is made for the compulsory removal to hospital of a person suffering from an infectious disease if he be (*a*) without proper lodging, or (*b*) in a room occupied by others.

These public health enactments were made in order to prevent the spread of ordinary infectious diseases and to enable the constituted authorities to adopt the necessary precautions for the attainment of this end. In view of the somewhat recently recognised infectious nature of tuberculosis, however, that disease falls to be included within the category of those thus referred to in the Public Health Act. Indeed, if we regard its widespread prevalence and the at-first-sight astounding death-rate from it, as compared with all forms of zymotic disease, the necessity for the exercise of preventive measures becomes increasingly great and clamant.

The Problem of Advanced Cases

In the city of Edinburgh, where the anti-tuberculosis crusade has been actively adopted with comparative success during the past few years, the fact nevertheless remains that the total deaths from tuberculous disease are nearly one and a half times greater than those of all zymotic diseases put together, and represent a number almost equal to the total deaths caused by the two groups, cancer and zymotic diseases.

In view of this the necessities for municipal interference become apparent when it is stated that in the city of Edinburgh 13 per cent. of the deaths from pulmonary tuberculosis are among persons residing in houses of one apartment, 46 per cent. in two apartments, and no fewer than 96 per cent. in houses consisting of four rooms and under.

The altogether undue proportion of cases of the disease occurring in small houses renders it all the more urgently important that a municipality should provide such hospital accommodation as will prevent the necessity for patients who suffer from the disease residing in houses where serious danger is implied to the other inmates, particularly in the later stages of the disease. The relationship of the almost unvarying proportion of cases to the number of small houses in a district is capable of proof of the most convincing description.

If Edinburgh be taken as an example it is found that if each of the wards in the city be considered separately the number of cases which occur in them is unduly greater or smaller in proportion to the number of small houses which they contain. In one ward, for example, which contains 6900 houses of one and two apartments, there occur 3·6 cases of pulmonary tuberculosis per 1000 of the population, while in another more fortunately circumstanced ward which contains

only 600 houses of one and two rooms the number of notifications is only 1·5 per 1000.

This proportion is almost invariable, and it may be stated as an unvarying rule gathered from statistical experience that the disease increases in proportion to the increase in the number of houses of limited accommodation. When this fact is accepted the necessity for providing hospital accommodation for advanced cases of the disease becomes at once apparent. When tubercle bacilli are found present in the sputum the suffering patient must at all times be regarded as a source of infection to those with whom he resides and comes in contact, just in proportion as the apparent necessary precautions are scrupulously observed or neglected.

Distinction between Early and Advanced Cases

It is perfectly clear that however conscientiously these may be carried out by a patient who is still in the early stage of the disease, who maintains in large part his activity, and who is well able to carry into effect the hygienic instructions which have been impressed upon him, the circumstances are entirely changed when the disease after some months or years in its ordinary course has made marked advance; when the patient is more or less dependent upon others, and is probably confined to bed, when the expectoration is profuse, is teeming with tubercle bacilli, and is apt, despite the patient's best intentions, to be found on the floor, bed, bed-clothes, and clothing of himself and the house in which he resides. Here, then, is a case of extreme urgency, and one representing the conditions with which preventive authorities are brought face to face almost daily.

If no action is taken the result can be at once forecast. Without doubt the disease spreads, and in due time other members of the household certainly fall victims to it. This has been the unvarying experience in past ages, but a continuation of like inactivity on the part of a municipality would be now indefensible in the light of the present-day knowledge which science has so freely revealed during the past few years.

Provision for Advanced Cases

In the case of the poor provision is narrowed down to either obtaining entrance to the infirmary (in Scotland this being a voluntary hospital) or accepting the other alternative of spending their last days or months in the poorhouse hospital. The former alternative as a

possible solution of the difficulty can be at once disposed of as amounting almost to the impracticable, as for very apparent reasons the authorities in charge of such institutions are evincing an ever-increasing disinclination to accept the responsibilities in connection with the treatment of such cases. This position is a perfectly defensible one. The same dangers to others as exist among home surroundings would persist during his term of residency in a general infirmary, and the patients there would be subjected to an undeniable source of danger to which infirmary managers and physicians in charge of wards very properly refuse to subject them. There remains, therefore, only the poorhouse hospital as the alternative institution to which such cases can be removed. Here also, however, a serious difficulty presents itself, as in the great majority of cases the patient and his friends object to the brand of pauperism which treatment in such an institution inevitably carries with it.

Municipal Hospitals

There remains, however, a third possible alternative in certain favoured districts where private munificence has provided the establishment of sanatoria. As, however, such institutions are almost invariably utilised for curative purposes, they can hardly be taken into account in dealing with the serious problem attending the segregation of advanced cases of the disease. It is at once evident, then, that a duty of an unquestionable nature falls upon municipalities to provide hospital accommodation for this form of disease, just exactly as is necessary in the case of others of a like infective nature.

It is very interesting to find that the recognition of this fact in the city of Edinburgh resulted in accomplishing the very desirable end of increasing markedly the number of "institutional" as compared with the number of "home" deaths.

Prior to the provision of municipal hospital accommodation 73 per cent. of the deaths from pulmonary tuberculosis occurred in the homes of the patients, 14 per cent. in parish hospitals, and 13 per cent. in other institutions. After the provision of hospital accommodation, however, the position of matters was quite altered, as only 51 per cent. of deaths took place at the homes of the patients, and actually 20 per cent., or in round numbers one-fifth of the whole, occurred in the municipal hospital. It is interesting to note, also, that the deaths occurring in the parish and other hospitals remained almost the same, which clearly indicates that the patients who spent their last weeks

or months in the municipal hospital were not of that class who would have been likely to take advantage of other institutions.

Thus we at once find that the provision of municipal hospital accommodation for advanced cases of the disease has accomplished the highly desirable end, from a preventive point of view, of diminishing the number of deaths occurring at patients' homes from 73 per cent. to 51 per cent., and that actually one-fifth of the whole of the deaths from this disease occur in that institution removed from all possibility of the danger of the spread of infection to other members of the community.

There is, however, a very evident and essential preliminary necessity which must be observed if hospital accommodation for advanced cases is to be expected to prove a success. Attempts on the part of various municipalities to take this apparently important step have in several instances proved unsuccessful. The reason for this in most instances has been quite apparent, and it is in the first degree, therefore, important that everything which would tend to interfere with the successful accomplishment of such an all-important step in the present crusade against tuberculosis should be avoided.

The Causes of Failure

In those cases where failure has marked the attempt this has usually been traceable to the fact that patients and their friends have been permitted to regard the institution as a "home for the dying" or a "hospital for advanced cases."

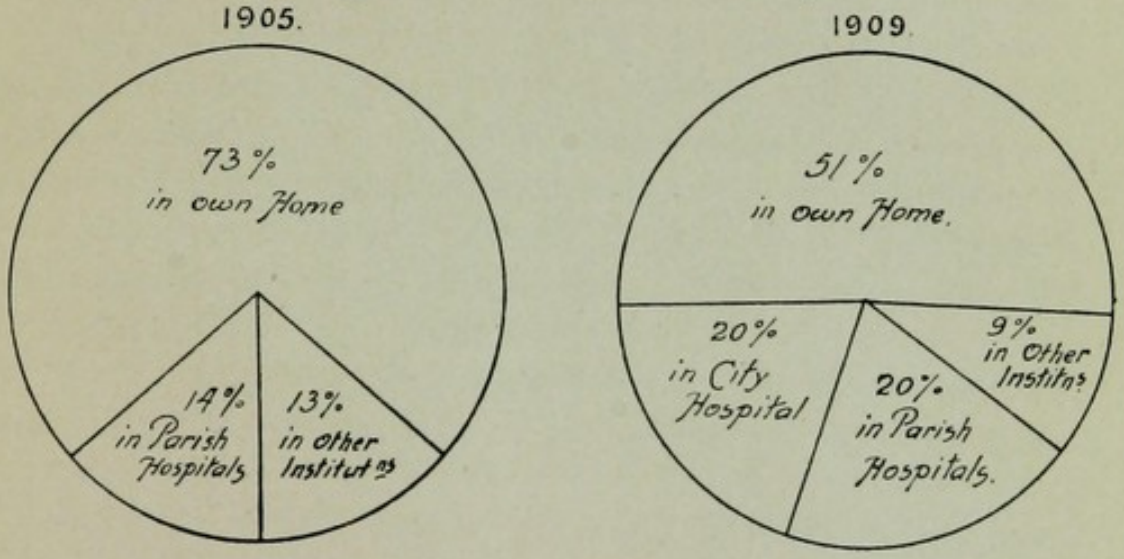
The great success which has attended the steps taken in this direction by the municipality of Edinburgh has been largely due to the fact that the accommodation offered has been of the most superior and attractive nature, and, indeed, has included all of the apparent essentials and advantages connected with a well-equipped sanatorium for the care and, if possible, the cure of patients suffering from the disease.

Provision in Edinburgh for Advanced Cases

Towards this desirable end one of the stone pavilions of the recently erected and beautifully equipped City Hospital was set apart for the reception of such cases. This pavilion provides accommodation for twenty-five males in the upper ward and twenty-five females in the lower.

Associated as this pavilion is with the general hospital, it is obviously equally associated in the minds of the citizens with hospital treatment, and the fear and natural disinclination on the part of patients and

Diagrams showing where Phthisis Deaths occur –



their friends to take advantage of accommodation in a home for the dying is therefore removed. The result is, in consequence, found to be a most satisfactory one. The demand for admission has frequently exceeded the available accommodation. This has applied much more to male patients than to females.

Urgent cases among the former requiring attention and removal have been found altogether disproportionately greater. This fact a year ago rendered it necessary to still further increase the number of beds available for men, and advantage was consequently taken of that opportunity in order to add to the attractive nature of the accommodation, and in order to increase the "sanatorium" nature of the building and its surroundings.

The extra accommodation, therefore, took the form of a number of open-air shelters for men only, and these are placed in a splendid open area of ground in the immediate rear of the stone pavilion. A great deal of importance falls to be attached to the type and construction of shelters used in a hospital for advanced stages of the disease. Of course it is essential to bear in mind the necessity for the provision of open-air treatment in late as well as in early cases. It is also, however, of great importance to keep prominently in mind that in many respects an essential difference exists between the two classes which must not be overlooked.

In the treatment of early cases it is common experience that, within reason, the more open an out-door shelter is, the more it will be appreciated by the patients who occupy it, and, other things being equal, the more satisfactory will be the result. For advanced and dying patients, however, much more protection from the elements must be at least rendered possible. The type of shelter provided at the Edinburgh City Hospital for the use of such was well considered before being constructed, and experience has fully justified the expectations which were held in regard to it.

Each shelter is constructed for two persons, and rotates on a thick foundation of cement. This provision is of the first degree of importance, and that for several reasons. Rotation of the shelter is much facilitated, the possibility of any dampness of the floor is effectually removed, and the shelter itself is preserved in a good state of repair for a much longer period. The construction and the dimensions of those in use for two patients permit of a sufficiency of accommodation together with a compact and smart appearance.

These dimensions are :—

Diameter of circular concrete base, 15 feet.

Width of shelter, 10 feet.

Height from floor to eaves, 6 feet 3 inches.

Size of windows, 4 feet by 3 feet 6 inches.

Floor area, 90 square feet.

Height of floor over base, 9 inches.

Depth of shelter, front to back, 9 feet.

Height from floor to ridge, 9 feet 9 inches.

Capacity of shelter, 720 cubic feet.

Shelter can be turned on 6 4-inch diameter rollers.

Cost, £23.

Very special attention must be paid to the provision of a sufficiency of windows which, according to the condition of the weather and other circumstances, can be opened or closed at will. Originally there was no such provision on the back wall of the shelters, and in warm weather a "stagnation of the air" and "general stuffiness" were perfectly perceptible. A very great improvement, however, was effected by having large windows introduced there, and this, of course, has resulted in greater brightness together with much better ventilation of the shelter.

Some provision also falls to be made for closing the front of the building, either in whole or in part. At first an experiment was made to do so by means of a light folding door. This, however, speedily gave place, as a result of experience, to a canvas roller blind which can be unrolled to any extent as necessity requires. This type of shelter, then, with all its brightness and convenience, is much appreciated by patients, who prefer it, practically in all weathers, to the accommodation which is provided for them even in the bright and attractive ward.

The question of lighting such shelters is of importance. Paraffin lamps and candles obviously imply the presence of a serious danger, and the laying down of a special set of electric wires, as has been suggested, is attended by undue expenditure. A small three or four candle-power electric lamp supplied by a battery placed on the shelter floor and charged generally once a week proves itself to be highly efficient in every respect.

Of course where provision of this description is made it may be anticipated that some patients, however acutely ill at the time of their admission, will respond to the treatment and surroundings, and for the time being show a marked improvement in general condition. This

THE MALE WARD OF THE PAVILION ALLOTTED TO ADVANCED PHTHISIS PATIENTS AT THE CITY FEVER HOSPITAL, EDINBURGH.

is actually found to be so in a considerable number, although each has been visited by the Medical Officer of Health prior to admission and a bacteriological examination of the sputum has revealed the presence of tubercle bacilli usually in large numbers.

Frequently where improvement takes place the patient applies for discharge. Indeed the proportion of deaths to discharges is in about the ratio of three to two.

The object which a municipality has in view in providing and carrying on hospital accommodation for advanced cases is not in any way vitiated by this somewhat large number of persons who take advantage of the provision, although only for a limited period. Even in such cases an educative process has been in force, and it is safe to conclude that when a patient returns to his original surroundings the exercise of the precautions which he has been accustomed to adopt in hospital transforms him from a source of infection into a comparatively harmless inmate in his home.

The chief success, however, of such hospital accommodation lies in the fact that such a large proportion of cases are retained there during the last few months of life.

The following tables, indeed, are full of interest as showing the proportion in which this occurs. It will be found that of 550 patients admitted to the hospital 336 died and 214 were discharged, the percentage of mortality being 55·8, and an additional interest in connection with these statistics is afforded by the fact that 74 per cent. of the deaths took place within three months of admission, and indicates that this large number had been removed and housed in safety, so far as the public were concerned, during the most infective period of their illness.

EDINBURGH CITY HOSPITAL

PULMONARY TUBERCULOSIS WARDS

	Males.			Females.			
Age.	Died.	Discharged.	Remaining.	Died.	Discharged.	Remaining.	Total.
0-10	2	3	0	2	3	0	10
10-20	18	13	6	33	18	1	89
20-30	48	27	4	70	39	7	195
30-40	52	35	12	36	23	6	164
40-50	28	27	7	23	8	2	95
50-60	11	15	5	3	1	1	36
60-70	8	1	1	1	0	0	11
70-80	0	0	0	1	1	0	2
	167	121	35	169	93	17	602

Deaths.	
Within 1 week . .	40
„ 2 weeks . .	44
„ 3 weeks . .	25
„ 1 month . .	35
„ 2 months . .	66
„ 3 months . .	43
„ 4 months . .	22
„ 5 months . .	20
„ 6 months . .	10
„ 9 months . .	17
„ 12 months . .	6
„ 18 months . .	6
„ 2 years . .	2
Total .	336

Discharges.	
Detained under 1 month	14
„ 1-2 months .	40
„ 2-3 months .	45
„ 3-4 months .	34
„ 4-5 months .	27
„ 5-6 months .	20
„ 6-9 months .	18
„ 9-12 months .	12
„ 12-18 months .	2
„ 18 months-2 years	1
„ over 2 years .	1
Total .	214

Mortality per cent. of total admissions up to date = 55·8.

Of the deaths 42 per cent. occurred within 1 month
„ 19 per cent. from 1 to 2 months
„ 13 per cent. from 2 to 3 months
} = 74 per cent. within 3 months.
„ 15 per cent. from 3 to 6 months, and the remainder after 6 months.

Procedure for Removal to Hospital

In order to determine whether or not a patient requires the attention of the Public Health Authorities and removal to the hospital set apart for advanced disease several preliminaries must be observed.

The case, of course, must be notified to the Medical Officer of Health. If an anti-tuberculosis dispensary exists, as in Edinburgh, it will certainly be found that the great majority of notifications in regard to such cases emanate from that institution. Indeed in Edinburgh 55 per cent. of all notifications are received from the Victoria Dispensary, while only 32 per cent. come from the medical practitioners in the city, the remainder being received from various charitable and other institutions.

Full details are furnished to the Medical Officer of Health as to the patient's physical condition and as to urgency or otherwise. A bacteriological examination of the sputum is then made, and in the event of this giving a positive result, and an application being received from or on behalf of the patient, the Medical Officer of Health pays a visit, on which occasion the whole circumstances and surroundings are taken into consideration, and

TYPE OF SHELTER ADOPTED BY THE CORPORATION OF EDINBURGH FOR THE SEGREGATION OF ADVANCED PHTHISIS PATIENTS.

if these appear to justify removal, such a procedure is at once resorted to.[1]

Attention to such details prevents the possibility of the provision of hospital accommodation for advanced cases being taken advantage of by those probably more suitable for treatment in a public or private sanatorium.

Cost of Provision for Advanced Cases

The cost to a municipality of providing hospital accommodation of the foregoing description is, of course, an important question, and in coming to a conclusion in regard to this it must be first decided whether the accommodation is to consist of:—

(*a*) A ward in an existing hospital; (*b*) the provision of shelters alone; (*c*) a combination of these two as in Edinburgh.

In the former case the ordinary cost of maintenance with a slight increase in the cost of food and drugs for each tuberculous patient must be calculated upon. Thus in Edinburgh City Hospital, while the cost of food for each fever patient amounts to £18, 12s. 5d., the amount necessary for those suffering from pulmonary tuberculosis is £20, 7s. 4d., with an addition of £2 per patient for drugs, stimulants, etc. Any calculation of cost where shelters were partly or wholly used would include the necessary outlay upon these. The cost of each shelter described and in use in Edinburgh is about £23.

Results of the Work in Edinburgh

It is beyond all reasonable doubt that much good from a public health point of view has resulted from the segregation of advanced pulmonary tuberculosis in the City of Edinburgh. Other preventive measures have been concurrently in operation. The name of Dr. Philip will ever remain associated with the establishment of the Royal Victoria Anti-Tuberculosis Dispensary, the Royal Victoria Hospital, and now recently the Farm Colony in connection with these. The wonderful organisation of these institutions and the very many activities in connection with them which have been devised and carried out under his own immediate supervision have without doubt contributed enormously

[1] The method followed by the Royal Victoria Dispensary is explained in Chapter V., page 52.

towards the splendid position which the city of Edinburgh occupies among other large centres of population so far as its tuberculosis mortality is concerned.

The somewhat recent co-operation between the municipality in its efforts and those carried on by the Victoria Hospital and Dispensary may be expected to develop still more effectively the activity of the crusade against the disease, and so to reduce its death-rate more markedly.

A. MAXWELL WILLIAMSON.

Twenty Years' Phthisis Mortality in Edinburgh.

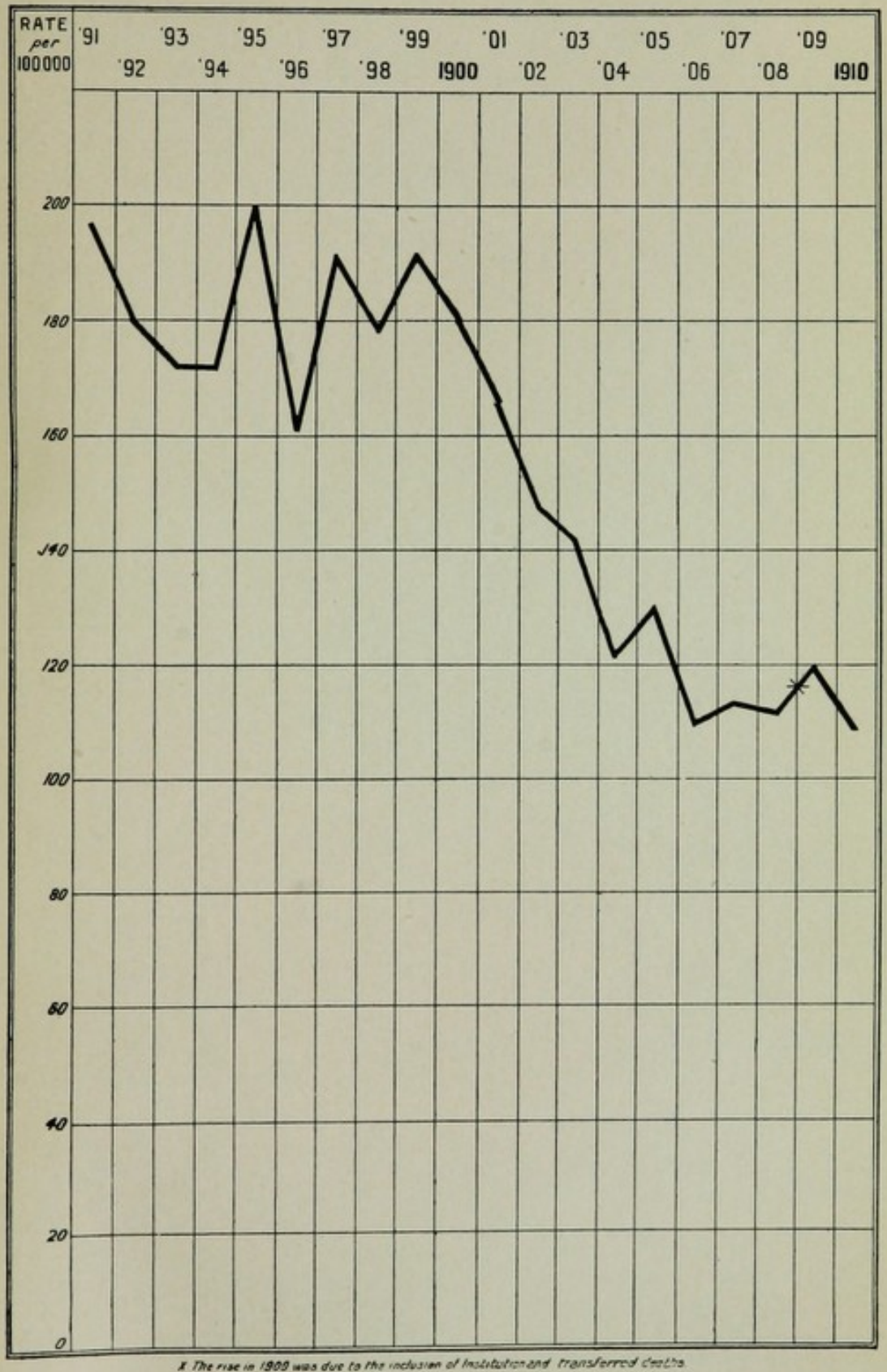


CHART SHOWING THE DECLINE WHICH HAS TAKEN PLACE DURING THE LAST TWENTY YEARS IN THE PHTHISIS MORTALITY RATE IN EDINBURGH.

CHAPTER XIV

THE PUBLIC HEALTH ASPECTS OF THE EDINBURGH SYSTEM

Notification of the Disease—Dispensary—Sanatorium for Early Cases—Hospital for Advanced Cases—Working Colony—Disinfection of Infected Houses.

Notification.—It is now generally acknowledged that a system of notification of cases of pulmonary tuberculosis is essential. Whether it should be compulsory or voluntary is a debatable point. Each method has achieved a certain measure of success, and it will depend largely on the local authority and on the nature of the community which it controls as to which method is adopted in any particular locality. In England at present only four towns, namely Sheffield, Bolton, Burnley, and Oldham, have adopted compulsory notification, in each case under a local Act, whereas voluntary notification is in existence in numerous towns, notably Manchester, Liverpool, Birmingham, and Brighton. In England, by order of the Local Government Board, notification of cases treated in public institutions is compulsory.

Unfortunately voluntary notification has been instituted in certain towns which do not possess any means of dealing satisfactorily with the cases notified to the Medical Officer of Health. This has tended to make the local authority underestimate the value of notification, as it does not see any very markedly beneficial results. Notification of cases can do no material good unless it be combined with measures for helping the patient and for preventing the spread of infection.

Notification *per se* is of little value, but notification as one factor in the co-ordinated scheme is essential. So far the numbers of notifications of pulmonary tuberculosis received by Medical Officers of Health have been relatively limited. It may be interesting to see roughly what percentage of the probable existing cases are notified to the local authority. For this purpose the following figures have been worked out. They are obtained by estimating the probable number of cases in the town by multiplying the number of deaths from this

disease by ten; the number of notifications received is then calculated as a percentage of the probable existing cases. The figures are calculated for 1907 and 1908.

Manchester (voluntary) . .	1907	14·6 per cent.
	1908	13·8 „
Brighton (voluntary) . .	1907	21·2 „
	1908	21·4 „
Liverpool (voluntary) . . .	1907	19·9 „
	1908	16·9 „
Sheffield (compulsory) . . .	1907	23·6 „
	1908	22·9 „
Bolton (compulsory) . . .	1907	10·4 „
	1908	9·3 „

In this respect Scotland is ahead of England, as 55 per cent. of the population are under compulsory notification, including Edinburgh and Glasgow, the lead being given by Edinburgh in 1907.

It is somewhat difficult to explain why under either system so small a percentage of the probably existing cases should be notified. There is on the part of most general practitioners a distinct hesitancy in notifying a case unless it be well advanced. Again the diagnosis is often delayed, and in some is only arrived at shortly before death.

Under the voluntary system many practitioners cannot obtain the patient's consent to notification. Without doubt, however, the greatest deficiency is simply due to a lack of interest and knowledge on the part of the general practitioner, and one can only hope that as time goes on this may gradually disappear.

Co-ordinated Scheme.—Within the last few years it has been the lot of many local authorities to decide as to what means should be taken towards this end, and even now many others are considering the matter.

What has not, however, been taken into sufficient consideration is the real question at issue. The mere isolation of a few advanced cases, or the treatment of a few early cases in a sanatorium, though each is excellent in itself, is of little value where a large community is concerned, and does not by any means go to the root of the evil.

It seems curious that what is now by most authorities acknowledged to be the central pivot of the whole system, namely the Tuberculosis Dispensary, should be in every town practically the last thing to be thought of, and that even now in other towns where anti-tuberculosis measures are in force the dispensary is non-existent.

In *Brighton* the following factors are available:—(1) Voluntary notification. (2) Disinfection of houses. (3) Sanatorium treatment for 25 patients at the Borough Fever Hospital. Preference is given to those patients who have not at home a bedroom to themselves. Both early and comparatively advanced cases are admitted. (4) Visitation of notified cases at their homes at regular intervals by a sanitary inspector.

In *Birmingham* the Medical Officer of Health has the following means at his disposal:—(1) Voluntary notification. (2) Disinfection of houses, bedding, etc. (3) Sanatorium for 40 patients. Only early cases admitted. (4) Notified cases visited and advised by an officer of the Health Department.

In *Manchester* the means of dealing with this disease are as follows:—(1) Voluntary notification. (2) Disinfection of houses, bedding, etc. (3) Supply of sputum flasks. (4) Sanatorium for early cases. (5) Hospital for advanced cases. (6) Notified cases visited and advised by an official of the Health Department.

Liverpool also possesses much the same means of dealing with pulmonary tuberculosis, viz.:—(1) Voluntary notification. (2) Disinfection of rooms, bedding, etc. (3) Three sanatoria for early cases. (4) A hospital for advanced cases. (5) Notified cases visited and advised by a member of the sanitary staff. (6) Various general dispensaries throughout the city.

In all the above towns sputum examinations are undertaken free of charge by the corporation.

Consideration of the methods employed in these four large towns will bring clearly before one the enormous scope of the work undertaken in dealing with pulmonary tuberculosis. It must be borne in mind that these four towns exhibit what is at present in England probably the high-water mark of preventive medicine as applied to this disease. Many of the smaller towns in England are now making efforts to combat the ravages of tuberculosis, and as a general rule are proceeding in the paths already made manifest by the larger and more wealthy corporations.

The general measures undertaken are, when considered individually, of undeniable importance, but it is open to question whether the maximum benefit is at present being derived from them. The organisation of all the different factors involved means an immense tax upon the time and energy of the Medical Officer of Health and his staff, and already more than one Medical Officer of Health seems to think that

the limit has been reached of what can reasonably be expected from the staff at his disposal. Thus Dr. Niven, of Manchester, writes as follows:—"The work is outgrowing the machinery provided to cope with it, and, as pointed out in previous reports, there are serious obstacles to progress."

What appears to be necessary now is a headquarters devoted entirely to the organisation of the work.

The tuberculosis dispensary fills this position. At present in most towns all the administrative work in connection with this disease is performed at the office of the Medical Officer of Health, and thereby immensely complicates the working of his department. It is here that all notifications are received, all instructions as to visiting cases are issued, all orders for disinfection of bedding and houses are given to the disinfectors, and all arrangements regarding removal of cases to sanatorium or hospital are considered.

This must of necessity entail a great increase and complexity of the usual work of the Health Department, and moreover it cannot receive the attention as a separate unit which it deserves and requires.

Where a tuberculosis dispensary is in existence it will form the central bureau, and to it all inquiry and information regarding tuberculosis will be directed.

It will be seen from the measures adopted against tuberculosis in the various towns given above that in every case some of the essential factors of the Edinburgh system are in evidence to a greater or less extent. There is the one notable exception of the tuberculosis dispensary. This is to be regretted, as its value cannot be overestimated.

The Dispensary.—Few local authorities or Medical Officers of Health have fully grasped the significance of the tuberculosis dispensary.

To the Medical Officer of Health it forms an invaluable asset. It is impossible to have any co-ordinated scheme without the dispensary as the basis of operations, and yet it is the one part of the scheme of which it seems impossible to make local authorities realise the value. A local authority in many instances finances a sanatorium, or a certain number of beds for advanced cases, but it fights shy of the minor expense of a dispensary.

Several Medical Officers of Health seem afraid that the tuberculosis dispensary will run contrary to the interests of general practitioners, but this most emphatically has not been the experience either in Edinburgh or in the metropolitan boroughs of London. In all these places

it has been found that the medical men have been only too willing to co-operate in every way with the dispensary.

The dispensary should be the headquarters of the fight against tuberculosis. To it all patients of the poorer class should be directed from other hospitals in the town, and it should be common knowledge in the town that any poor person, suffering from cough or "chronic cold" can obtain advice and treatment at the dispensary. In all probability the majority of these people would not otherwise consult a medical man until the disease was too far advanced for there to be any reasonable expectation of cure. Others, again, would be treated with bottles of cough mixture at the various hospital out-patient departments, but there would be no control over their home lives or surroundings, and they would rapidly infect the other members of their households. At the best, treatment at our various out-patient departments can only be described as tinkering, without the least attempt to go to the root of the evil. At the tuberculosis dispensary the home conditions are carefully inquired into, and the Medical Officer of Health is thus enabled to remedy any insanitary conditions so far as is in his power.

Another aspect of the dispensary of value in preventive medicine is the physical examination of all "contacts" or other members of the patient's household. The economic value of this process can be well understood by anyone who has seen the enormous prevalence of family infection, and the numerous cases which are thus brought to light and treated while in an incipient stage.

It is acknowledged that notification is an important factor in any scheme, because it directs the attention of the Medical Officer of Health to the sources of infection. The dispensary forms a most important aid in this direction, as patients by attending there and being found tuberculous practically notify themselves. It is an interesting fact that in Edinburgh no less than 50 per cent. of the total notifications are received from the Royal Victoria Dispensary.

It may be well to look more minutely at the economic aspect. Let us consider a local authority having the whole Edinburgh scheme in its area. The medical officer to the dispensary examines the contacts of an advanced case living in the same house with six other members of the same family and finds, say, two members of the family in an early stage of the disease. He recommends the removal of the advanced case to the appropriate hospital, and the two early cases to the sanatorium. In perhaps three or four months these

two cases are discharged cured from the sanatorium, and can become once again useful members of the community. Had there been no dispensary the result would probably have been that the advanced case would have continued to infect all the other members of that household (and this is no unusual state of affairs), until, when the original patient came to the notice of the Medical Officer of Health, all seven cases might require removal to the hospital for advanced cases, where they must be kept at the expense of the local authority until death, or, as rarely happens, until they are sufficiently recovered to be considered non-infectious.

The amount of organisation and clerical work of the Medical Officer of Health which should be transacted at the dispensary, will depend on whether the dispensary be supported by voluntary or municipal funds. Should the dispensary be a municipal institution, and under the control of the Medical Officer of Health, it seems likely that he will deem it advisable to leave the transaction of all tuberculosis business to the dispensary, and thus clear his office of this ever growing work.

Where a municipal dispensary exists the following arrangements might with advantage be adopted:—(1) All cases notified to the Medical Officer of Health should be transmitted to the dispensary. (2) Instructions for disinfection of houses, etc., should be issued from the dispensary. (3) Instructions for visiting the cases should be issued from the dispensary. (4) Notices of discharge from sanatorium should be sent to the dispensary. (5) Patients at the dispensary should be classified as to whether fit for removal to sanatorium, to hospital for advanced cases, or for treatment at home.

It will thus be seen that in a properly co-ordinated scheme the dispensary should act as the organising centre for the whole, and in addition should form, through its dealing with incipient cases, the most important branch of the system from the point of view of preventive medicine.

The Sanatorium.—Although it is freely admitted that a hospital for the reception and isolation of advanced cases is a necessity, and comes within the province of the Medical Officer of Health, yet it is doubted by many whether a sanatorium whose primary object is the cure of early cases should be included in a preventive scheme.

This view is often urged by those who wish to curtail the public

health expenditure. When one considers the larger outlook of the sanatorium and the ultimate aim of its existence, it is clear that it more than justifies its position in any scheme formulated by those interested in the prevention of tuberculosis.

There are many cases which come under the notice of the health authorities where efficient home treatment is an impossibility, owing to inadequate housing accommodation, insufficient aerotherapy, or constant reinfection from another more advanced case.

If no sanatorium existed these would simply drift on until they became seriously affected, involving removal to the hospital for advanced cases, and detention therein at the expense of the local authority until death.

Tuberculosis is acknowledged to be one of the greatest, if not *the* greatest, cause of pauperism in this country. This means an immense and constantly increasing drain on the resources of the community. A rate-supported sanatorium taking its proper place in the co-ordinated scheme should be a most powerful preventive of pauperism through tuberculosis, and should thus in a short time fully compensate financially for its initial expense and annual expenditure.

A difficulty has been experienced in some localities in persuading wage-earners, especially fathers of families, to undergo sanatorium treatment. In the present day the difficulty of obtaining employment is constantly facing the working classes, and a man is afraid that if he vacates his position for a few months he may be unable to regain it on his return. This matter was discussed in some detail at the Tuberculosis Conference held in Edinburgh in 1910, and the trend of feeling seemed to be that any system of State Invalid Insurance should keep in view the support of families while the wage-earner is undergoing sanatorium treatment. It was also urged that employers of labour should do their utmost to reinstate workers who have temporarily resigned their employment for this purpose.

In addition to the cure of the individual patient, the sanatorium has an immense power for good over the lives of those with whom a discharged patient is brought into contact. In the sanatorium he has learned the value of fresh air, sunlight, and a physiological life, and on his discharge, in the majority of cases, he continues this life and illustrates to others its good effects. This may be termed the educative side of the sanatorium. So much has this been realised that in certain

towns patients are kept in the sanatorium only until they have learned to look after themselves properly, and not until they are thoroughly cured. This may have economic advantages, but is not to be recommended, as it is better to thoroughly cure a small number than to half cure a large number.

Since the year 1897 working men's insurance societies in Germany have in self interest spent £10,550,000 sterling in building sanatoria.

The percentage of patients who five years after treatment were still able to work and did not require any allowance from their insurance fund was, 27, 31, 32, and 31 for years 1897, 1898, 1899, and 1900 respectively.

Hospital for Advanced Cases.—As the patient who enters such a hospital is benefiting the community by diminishing the chances of infection, there is a clear indication that such institutions should be provided and maintained out of the rates. It will be readily admitted that if it is the duty of the sanitary authority to erect hospitals for the isolation of cases of infectious disease such as scarlet fever and diphtheria, it is equally if not more urgently their duty to maintain an institution for the isolation of advanced cases of pulmonary tuberculosis.

The Local Government Board for Scotland, in a circular dated March 1906, stated "that the isolation of such dangerous cases is a primary duty of a local authority."

It is now becoming comparatively common in this country to find that so many beds in the local fever hospital are devoted to the reception of advanced cases of pulmonary tuberculosis. This is a system which appears to answer the purpose in a satisfactory manner without materially increasing the expenditure of the isolation hospital.

A matter to which attention may be drawn is that under some local authorities it is the custom to have a certain block of the isolation hospital devoted to pulmonary tuberculosis, and to this block patients in all stages of the disease are admitted, preference being given in most instances to those patients whose home conditions are unsatisfactory.

The above system is not one to be encouraged. It is impossible to treat early cases satisfactorily in the same wards where patients are dying of the disease. Both mentally and physically this has a deleterious effect on the incipient cases.

Patients suitable for sanatorium treatment should be kept entirely apart from those sent to a hospital for advanced cases for purposes of isolation.

It is our contention that such cases can only be suitably dealt with by the institution of hospital isolation, and this forms a most important factor in the Edinburgh system. Before leaving the subject it may be well to emphasise a fact which is apt to be neglected, namely, that all such patients sent to the isolation hospital should be kept there if possible until death, unless they can be discharged as cured, which is most improbable. This is an important point if full success is to be derived from isolation.

The Working Colony.—This may be considered, from an administrative point of view, as an extension of the sanatorium. After undergoing sanatorium treatment, a proportion of patients should be transferred for some time to a working colony until they are medically fit to resume their employment. The great benefit derived from this institution is that many cases are made so thoroughly fit for their work before discharge, that there is less risk of a recrudescence of the disease. One of the greatest arguments against sanatorium treatment is that in many instances, after the patient re-starts work, the disease breaks out afresh. It is with a view to preventing this that the working colony is brought into the scheme.

One of the constant difficulties in dealing with patients after discharge from a sanatorium is to find suitable work for them. One does not want a patient to go straight from a sanatorium into a stuffy office, and so undo the good he has received. All kinds of manual labour should be undertaken at the working colony, and if properly managed it will be self-supporting. The first working colony for tuberculous patients was opened in Edinburgh in July 1910, and its results and possibilities are awaited with interest. To the Medical Officer of Health this will only commend itself after he has got all the other branches in working order. It is perhaps the least absolutely essential part of the scheme, but nevertheless one for which there is a distinct necessity, if one is to get the maximum benefit from the sanatorium.

Disinfection.—It is now recognised that tuberculosis can be transferred from one person to another through the agency of an infected room, bedding, or clothing. Tubercle bacilli have been found on the walls and floor of a room occupied by a tuberculous patient.

Under these circumstances it is clearly incumbent upon the Medical Officer of Health to mitigate as far as possible this source of infection.

In England in a town where pulmonary tuberculosis has been made a "dangerous infectious disorder" within the meaning of the Public

Health Act, 1875, the power of the Medical Officer of Health is identical with that which he holds with reference to disinfection after any other infectious disease. The procedure usually followed in towns where voluntary or no notification is in force is as follows:— On receiving notice of the death of any person from tuberculous disease a sanitary inspector calls at the house and requests the occupier to permit disinfection of the rooms occupied by the deceased. He explains fully the infectious nature of the disease, and the great need for disinfection in the interest of the present and future occupiers. In the majority of cases no opposition is offered, and disinfection is accordingly carried out. Should, however, the occupier refuse to accede to the requests of the Health Department, nothing further can be done. It is unfortunately impracticable to disinfect the house before it is occupied by a future tenant, unless the new tenant has known of the existence of the disease, and requests the Medical Officer of Health to disinfect. It is impossible for the Health Department to receive notice of all changes of tenancy of infected houses after the death of a patient. While the patient is alive and is being periodically visited by a nurse, or other official, notices of removal are of course available, and the house is accordingly disinfected unless the new tenant objects.

In Scotland, by means of sections 46, 47, and 48 of the Public Health (Scotland) Act, 1897, the Medical Officer of Health has now full powers as regards disinfection of tuberculous houses, etc., and does not require to obtain the patient's consent.

In what circumstances disinfection should be carried out is a matter of opinion, but the following are generally accepted as the most essential:—1. *On receipt of notification.*—(*a*) All rooms in the patient's house, (*b*) all bedding which has been used by the patient, and which is going to be used for other members of the household, and (*c*) the workplace of the patient, should be disinfected. 2. *At frequent intervals,* if patient is treated at home, all rooms occupied by him since the first disinfection should again be disinfected. 3. *On removal of the patient to a sanatorium* or other hospital, the house, bedding, clothing, and all utensils used by the patient should be disinfected. 4 *On removal of patient to another house* the house previously occupied must be disinfected. 5. *On death of patient* thorough disinfection of house, bedding, clothing, etc., should be performed.

It is also important that disinfection should not be left to the patient's relatives or friends, but that it should be undertaken by a member of the sanitary staff.

Apart altogether from the disinfection of houses known to be infected, it is well for the Medical Officer of Health to periodically, if possible, cause disinfection to be performed in places which he has reason to suspect may be factors in spreading infection. In this regard particular attention should be paid to public-houses, churches, theatres, public halls, schools, railway stations, tramcars, railway carriages, and other vehicles for public conveyance. In several towns it is the custom to wash out the tramcars nightly with a disinfectant solution, and although it is doubtful whether the solution used is of sufficient strength for bactericidal purposes, the practice is certainly one to be encouraged.

A. Middleton Hewat.

CHAPTER XV

THE ADMINISTRATIVE CONTROL OF PULMONARY TUBERCULOSIS

1. Presuppositions of Administrative Control—2. The Growth of Administrative Control in Scotland—3. Systems of Notification—4. Isolation and Treatment—5. Work by Poor Law Authorities—6. Insurance and Tuberculosis.

I. Presuppositions of Administrative Control

Let it be assumed that there are three, roughly separated, classes of cases—incipient, intermediate, and advanced. Let it also be assumed that each case runs an irregular history, varying from weeks to years. Let it still further be assumed that thousands of patients, though affected in varying degrees with the disease, are yet fit to pursue their callings and to maintain economic independence for years. Here we have all the factors of the administrative problem.

To meet these what have we administratively? We have sanatoria; general hospitals; infectious disease hospitals; poorhouse hospitals; methods of disinfection; educational organisations; housing improvement schemes; town planning; improved drainage, water and ventilation; inspection of factories, of workshops and of workplaces; vast legal powers for the removal of nuisances, the prevention of overcrowding, improvement of house structure, selection of house sites, cleansing of houses, cleansing of persons, the isolation of patients, the supervision of dairies and the milk supply, the examination of cows, the destruction of tuberculous meat, the maintenance of paupers and their dependants, and many other minor powers and organisations. To see that the laws are effectively applied for all these objects we have the local authorities for public health, that is the town councils in towns and the district committees in counties; we have also the parish councils, who must deal with pulmonary tuberculosis as one of the largest pauper-producing agencies. In the sequel I shall show how these official and unofficial agencies may be brought into correlation and so secure that one vast organised army shall march forward to the extirpation of the enemy.

II. The Growth of Administrative Control in Scotland

As an illustration of the growth of administrative control, I prefer to give, as nearly as possible, a statement of the facts as they have emerged in Scotland. Such a statement, though somewhat localised, will bring out the facilities and difficulties of administrative control better than any set of general propositions. Every country has to face the same difficulties; every country has approximately the same forms of organisation, at least functionally; every country, therefore, may benefit to some extent, by the administrative experiences of every other. This is my apology for the following record. In this record I have given the dates that mark official departures, but in Scotland as everywhere else these departures are the climax of a prolonged education of the general public. Not once but many times in the last twenty years have definite official measures, notification for example, been proposed, but they were always blocked somewhere in the administrative machine. For instance, in the year 1891, I suggested to several county local authorities in Galloway (the ancient name for Kirkcudbright and Wigtown) that they should apply the Notification Act to pulmonary tuberculosis, and many of them were willing to do so; but when I laid the proposal before the Board of Supervision—the predecessor of the present Local Government Board for Scotland—I was informed that the necessary sanction could not be given. No reason was offered, but probably the real reason was the expense. The general opinion of that day was hardly ripe for such a step. Possibly it was more important at the moment to deal with the ordinary notifications; yet I have frequently thought that, as no disease, except perhaps typhus, is more sensitive to its surroundings than tuberculosis, it might have been better, and we should now have been further ahead, if the long, dreary, weary, uphill fight against dirt, dampness, bad drains, bad milk, bad meat, and the other innumerable filthinesses of country life had started with the disease that was most widely diffused, most widely feared, and most widely fatal. But in those days the whole education of the counties was yet to begin. It was easier to stimulate the corporate mind by exploiting the terrors due to diphtheria, scarlet fever, typhoid fever, and typhus. For almost nothing else could any authority be persuaded to provide hospitals, medicine, or attendance. To-day the campaign against those diseases, though far from ended and not uniformly successful, has at least carried persuasion into practice, and the hospital accommodation for infectious

diseases is among the best organised sections of public health. Pulmonary tuberculosis is now to benefit by the strenuous campaign against the other infections. Yet, although to-day the available resources for an anti-tuberculosis campaign are immensely greater than twenty years ago, I cannot help feeling that the public health movement in Scotland might by this date have attained a vastly wider sweep if we had been enabled to organise our energies against this disease half a generation earlier. Pulmonary tuberculosis, however, directly and indirectly, always had a share of official attention; for by lectures, by diffusion of information, by improvement in housing, in milk and in food, by the disinfection of infected houses and other minor activities, the official authorities have, incidentally, done a great deal to improve the tuberculous patient's environment.

In the year 1902 the Local Government Board for Scotland, in response to various proposals by town and county public health authorities, considered in detail how pulmonary tuberculosis was affected by the Public Health (Scotland) Act, 1897. Lord Balfour of Burleigh was at that time His Majesty's Secretary for Scotland, and therefore, *ex officio*, President of the Local Government Board for Scotland. All the elements of the problem were fully discussed by the Board and were considered in detail also by Lord Balfour himself. The general result is recorded in the Board's Annual Report for 1903, pages xxxv.-vi. There it is laid down that this disease is to be regarded as infectious within the meaning of the Public Health (Scotland) Act, 1897. As that Act contains no definition of infectious disease, the denotation of that term is to be determined by the scientific opinion of the day. Further, all local authorities for public health (that is, in Scotland, all the town councils and all the county district committees —the equivalents of the English sanitary authorities) are entitled to do for pulmonary tuberculosis all that they are entitled by Statute to do for any infectious disease, in the special circumstances and conditions in which its infectivity becomes operative. The medical member of the Local Government Board at that time was Dr. J. B. Russell, whose name is a revered name in the Public Health Movement of Great Britain. He died in 1904.

In the three years following 1902 the Board were persistently asked to consider special questions, such as the legality of paying fees for voluntary notification of pulmonary tuberculosis, the legality of establishing laboratories for examination of sputum, the legality of paying for sputum examined, the legality of using for the isolation and

treatment of tuberculosis wards in infectious diseases hospitals, and, among the most important, the legality of adding pulmonary tuberculosis to the list of diseases compulsorily notifiable under the Infectious Disease (Notification) Act, 1889. His Majesty's Secretary for Scotland for part of those three years was Lord Dunedin, who, both officially and personally, has powerfully supported the anti-tuberculosis campaign.

In 1905, several local authorities having on various administrative issues raised afresh the questions I have indicated, the Board reconsidered the whole legal position. At that date His Majesty's Secretary for Scotland and, therefore, *ex officio*, the President of the Board, was the late Marquis of Linlithgow, one of the finest spirits that ever occupied a public office in this or in any other country. The law officers of the Crown went exhaustively into the individual questions raised. The result was the Board's circular of 10th March 1906. In this circular the great step taken in 1902 was followed by another great step; for the local authorities were told that not only were they under obligation to deal with tuberculosis as they dealt with other infectious diseases, but that the Board would be prepared to approve the addition of the disease to the list of diseases compulsorily notifiable under the Notification Act. This entirely new departure in official policy was due to the *imprimatur* of Lord Linlithgow himself, who had not only strong personal convictions on the problem, but felt that public opinion had sufficiently ripened to justify him in assenting to the proposal to furnish the local authorities with all the machinery available for the execution of their duties as determined in the great decision of Lord Balfour in 1902.

The resulting circular gathered into one coherent sequence all the leading administrative ideas. Edinburgh, in the work done under Dr. Philip's guidance at the Royal Victoria Dispensary and the Royal Victoria Hospital for Consumption, had offered a fine object-lesson in the value of maintaining unity in administrative organisations, dispensary and sanatorium being working elements in a single organisation. As a deduction from the primary proposition that tuberculosis of the lungs, in all its stages and varieties, is an infectious disease within the meaning of the Public Health Act, the circular set forth the obligations of the local authority to disinfect, to isolate, and to treat. On the lines of papers published by Dr. Philip, it elaborated in some detail the functions of a dispensary as a factor in the anti-tuberculosis campaign, laying stress on its value both as an organising centre and as

a medical clinic. It was indicated how, in the various types of community, those functions could be taken on by the local authority, or arranged for with voluntary organisations, or adjusted, through a hundred details, to the specific needs of the given district. Obviously, what suits a city does not necessarily suit a rural area. Each local authority elaborates its own organisation according to its needs and resources, the cardinal condition being that, as with any other infection, the administrative machinery shall provide for every phase of the disease, clinical and preventive.

In the circular, too, it was shown how desirable a system of notification was, and into how many varieties hospitals could be classified—residential hospitals for early cases, all-day camps, all-night camps, convalescent and work colonies, wards for educative treatment, wards for advanced cases, etc. The Public Health Act provides for every variety. But, as of equal and essential importance, the Board reminded local authorities that these direct measures towards the control of pulmonary tuberculosis must be supplemented by indirect measures—"the unremitting and systematic removal of nuisances, prevention of overcrowding, enforcement of good ventilation, reconstruction of insanitary houses, improvement of insanitary areas, improvement of drainage of soil and houses, stringent supervision of meat, *of cowsheds, of dairies*, cleansing of streets, proper disposal of refuse, etc. Direct prevention should go hand in hand with general sanitation." Curiously, one critic accused us of omitting "milk"! He must have supposed that "dairies" are meant to provide water!

Two years later—15th July 1908—the Board issued another circular, which summarised the work done by the local authorities as the result of the first. The record was of the most gratifying kind. But, meanwhile, another great step forwards had been taken; for it had been felt that certain clauses of the Public Health Act of 1897 were somewhat too inelastic to suit the peculiar conditions and the varied history of a disease like phthisis. In 1907 His Majesty's Secretary for Scotland and, therefore, *ex officio*, President of the Board, Lord Pentland of Lyth, carried through a short relieving Act, whereby the over-stringency of the principal Act was adapted to the administrative conditions of all the infectious diseases that affect the west, pulmonary tuberculosis included. Lord Pentland's short Act of three clauses, by adapting the Public Health Act fully and in detail to tuberculosis, has meanwhile superseded the need for any "special" legislation, local or general. Tuberculosis is in no sense a local disease; it is a national disease; and

it is better that the country as a whole should advance along the lines made possible by the general law.

This short record brings us to the present date. The policy embodied in these various circulars and decisions has been justified by the event. I shall now indicate some leading results.

III. Systems of Notification

There are many ways of finding out cases of pulmonary tuberculosis, and all of them are open to the local authority for public health. For instance, the Medical Officer of Health may arrange with the local registrar for regular and early returns of deaths, including deaths from pulmonary tuberculosis. Such an arrangement is in operation all over Britain. The death intimation may lead to inquiry, to disinfection of house and clothing, to discovery of other infected persons; or, in the course of investigating the commonly notified infections, the Medical Officer of Health frequently finds pulmonary tuberculosis; or, when he can offer hospital treatment, he usually has many more applications than he can deal with; or, again, he is consulted by parents of tuberculous school children, or by tuberculous parents of healthy children, or by medical attendants on tuberculous cases, or by medical officers of voluntary hospitals or dispensaries. His activities as a medical officer of health are not limited by any statutory need for a preliminary notification under compulsion. He can act on information obtained in any way—it may be in the round of his ordinary inquiries; it may be through the school inspections; it may be through the Poor Law authorities; or it may be by chance. Many a time, as medical officer of health, have I been approached with pathetic pleading for isolation and treatment, and, in those days, I had to admit my want of power, for the hour of the layman had not yet come. And when I have listened to public discussions on "notification," I have, time and again, wondered whether the violent disputants had ever tried to discover how many scores of eager patients were knocking at their doors. Surely "compulsory" is a foolish word to associate with notification. It has come to us from a police-minded generation, which thought in terms of compelling folk to do what no one wanted to do. But "notification" has, with practical experience of it, passed into a method of enabling the ailing citizen to invoke the public health service when his personal and private efforts are not equal to his hygienic needs. Once provide treatment for pulmonary tuberculosis and you will need no "compulsion" for patients. They are waiting hundreds deep to be treated.

When, therefore, statutory notification, or, as we might pedantically say, isonomy (or equal law) in notification, was proposed officially, it came simply as a means of systematising the old methods of bringing cases to the notice of the responsible public health official—the Medical Officer of Health. Notification, therefore, grew naturally out of existing administrative practices. Instead of leaving the discovery of cases to chance remark, or the cumbrous methods of house-to-house inquiry, or death intimations, or the like, the local authority, by a stroke of the pen, requires the patient and his medical attendant to regard a case of pulmonary tuberculosis just as they do a case of typhoid fever—so bringing to each private patient the full resources of the public service.

How has this systematising of the methods of discovering cases developed in Scotland? It has developed with a rapidity so great that only one explanation of the pace is possible—notification is understood as the natural and common-sense climax of the methods already in operation. As an illustration take the following facts:—

In 1906, out of the 313 Scottish local authorities for public health, not one had applied the Notification Act of 1889 to pulmonary tuberculosis. Many of them had some rough system of seeking out cases, or welcoming intimations from medical men or patients, but none had applied statutory compulsion. The Board's Circular was issued on 10th March 1906. In 1907 the Notification Act was applied to pulmonary tuberculosis by 8 local authorities—4 towns, 4 county districts—representing a population of 589,698, or 13·2 per cent. of the population of Scotland. By the end of 1908 the number of notifying local authorities numbered 10—5 towns, 5 county districts—representing a total population of 634,467, or 14·2 per cent. of the population of Scotland. This was a very small increase. But, meanwhile, Lord Pentland's relieving Act of 1907 had been passed and the pace at once quickened. In 1909 the number of notifying authorities rose to 53—30 towns, 23 county districts—representing a total population of 1,160,344, or 26 per cent. of the population of Scotland. By the end of 1910 the notifying authorities (82) represented a total population of 2,281,388, or nearly 50 per cent. of all Scotland. In September 1911 the notifying authorities represent some 55 per cent. of the population of Scotland. Hardly a month passes that does not see some large or small authority added to the list.

This is a phenomenal record for a little over five years. No official pressure has been used at any time, but sympathetic advice has always

been offered. The primary feature of the movement has all along been the spontaneous working of the town councils, county councils, and district committees. The warmth of good feeling shown everywhere, the readiness to discuss ways and means, the eagerness to do something for a disease now known to be among the most tractable and preventable, have come as a revelation to those not prepared by experience for such manifestations of personal interest by the members of the representative executive corporations both in county and in town. And the spontaneous good feeling has characterised the laymen as well as the experts.

One test of notification is worth specifying: Many local authorities first put the disease on the notifiable list for a limited period—one, two, three, four, or five years. When the period expires the Act has always been applied for another period. Surely no better proof can be given that notification has been found acceptable to local authority and patient alike.

In England and Ireland notification has taken a very wide sweep, but it has been applied in a different way. In England one Order (1908) by the Local Government Board required notification of all Poor Law cases by Poor Law officers in unions, workhouses, and infirmaries. But the Order did not carry with it the power to apply the Public Health Acts in the same way as to any ordinary infectious disease. In 1911 another Order has been issued. This extends compulsory notification to public dispensaries and hospitals, and sanitary authorities are required to take certain preventive measures. In this way by central Order much the same results will be secured as are being secured in Scotland by the spontaneous action of the local authorities. In Scotland, of course, it is open to the Local Government Board for Scotland to issue a central Order on the same lines as the English Order, but hitherto, as the above figures show, the need for such an Order has not been pressing. The English Local Government Board has refused on several occasions to confirm a local authority in a resolution to apply the Notification Act of 1889 to pulmonary tuberculosis.

In Ireland the Local Government Board for Ireland, under a special Act, has power to require notification of this disease. Certain limitations are placed on the kind of case to be notified, but substantially the same results are ensuing in Ireland as in England and Scotland—each case is getting more and more individual attention. In all three countries the official authorities form the point of repair for the

science and enthusiasm of the propagandist organisations. The driving force of the voluntary workers thus informs the statutory machinery of the local and central executives.

This simple history will explain why we shall not hear much more about the social terrors of notification. The very folk that were to be frightened are coming in crowds to be treated.

IV. Isolation and Treatment

Notification has absorbed some of the space meant for isolation and treatment, but, briefly, it may be said that everywhere in Scotland, whether notification has been made obligatory or not, something is being done for individual cases of tuberculosis. In two large counties a combination of local authorities own and manage a central sanatorium for early cases. In other two large counties a central sanatorium is available, and in one of them the accommodation has been recently doubled. In yet others the medical officer of health is authorised to keep a certain number of sanatorium beds filled with selected cases. In certain counties wards are set aside in infectious disease hospitals. In some others vacant smallpox hospitals are available and used for pulmonary tuberculosis. In the towns there is also great progress. In Edinburgh the municipality has made arrangements with the Royal Victoria Dispensary and with the Royal Victoria Hospital, and has also allocated sixty beds in the Public Health Hospital. This is a good beginning. In Glasgow the municipality has made arrangements with four dispensaries for special handling of tuberculous cases, and has appointed a whole-time medical officer and a staff of visiting nurses. In Dundee the municipality has instituted a dispensary, with visiting nurse, and has certain arrangements with a sanatorium; special provision is being made for advanced cases. In Aberdeen the municipality has allocated some fifty or more beds in the Public Health Hospital for the treatment of all forms of tuberculosis. In Leith the municipality has for at least seven years had special provision in the Public Health Hospital, and recently has more than doubled the original number of beds. But to detail the work in town and county would somewhat overload this chapter. All I am concerned to do is to illustrate how the local authorities for public health have everywhere adapted their machinery to the varying clinical phases of the disease, and continue to specialise their administrative resources as the intensive study of the disease continues to reveal the best methods of treatment.

V. Work by Poor Law Authorities

But we must not forget the splendid work constantly done for years by the poor law authorities. Last year we obtained a special return for 745 parishes out of the existing 874. At that date there were 878 cases of pulmonary tuberculosis under treatment in the poorhouses, and 471 cases under outdoor supervision. In the Edinburgh poorhouses 100 cases were under treatment; in the Lanarkshire poorhouses, chiefly Govan and Glasgow, there were 620 cases. This number has steadily increased. Among the causes of pauperism tuberculosis stands very high. The facts exhibited in Dr. John C. M'Vail's recent report to the Poor Law Commission deserve the most careful study. Probably no single disease contributes so much to the roll of the poor. But the treatment of this disease is a heavy burden to place on the shoulders of the poor law authorities. So far as Scotland is concerned, the Local Government Board have taken the view that the treatment of tuberculosis is the duty, not of the parish council, but of the town or county council. And this view will no doubt ultimately be realised. The transfer from poor law to public health administration is rapidly taking place now, and will continue until all cases of the disease are within the full control of the preventive medical authority.

There are indications that in Scotland the poor law authorities themselves are anxious to assist in the transfer of tuberculosis cases to the public health authority. For the moment, both the poor law and the public health authorities have power to deal with the cases. The poor law authority relieves every case of destitution, whatever the cause of the destitution may be. The public health authority is bound to deal with infectious disease. But these two points of view are rapidly passing into one, namely, prevention. For it is felt that the prevention of tuberculosis is also the prevention of the destitution due to this cause, and as, for the present, the poor law authorities are equipped mainly for the relief, not for the prevention, of destitution, they are beginning to welcome the activity of every organisation that, by reducing the causes of destitution, will relieve them of administrative trouble and expense. Incidentally, however, the segregation of tuberculosis by the poor law authorities has, at least to some extent, been fulfilling the ends of the public health organisation. The unification of the two standpoints, poor law and public health, has been admirably illustrated in the Order issued by the English Local Government Board in 1907. By this Order, which was issued under the powers of the Public Health Act, all

poor law medical officers are required to notify pulmonary tuberculosis to the medical officer of health. Here we are at the transition from the standpoint of curative to the standpoint of preventive medicine.

It is perhaps appropriate to note the curious confusion in some minds between "curative" and "preventive." I have frequently heard it said that the public health authorities have powers to "prevent," but they have no powers to "cure." Whatever the case may be in England, the public health authorities in Scotland have full powers to provide, furnish and maintain hospitals, reception houses, and convalescent homes for infectious disease. They have also powers, in place of or in addition to such hospitals, to provide nursing and medical attendance at the houses of patients and to supply medicines. These powers, in the widest sense, may be applied to pulmonary tuberculosis. It is difficult to see what further powers are necessary, for a sanatorium is a hospital within the meaning of the Public Health Act, 1897, and medicines may include the extra nitrogenous diet necessary for tuberculous patients. Thus prevention and cure blend into a single system. The point would hardly be worth noting but for the fact that the municipal mind is ready to use the distinction for obstructive purposes. In pulmonary tuberculosis, if in any disease, surely the cure of the case is the most certain preventive of fresh infection.

VI. Insurance and Tuberculosis

With the National Insurance Bill there enters a new factor in the administrative control of tuberculosis. If this Bill becomes law, the acceleration of the growth of administrative control will be enormous, for the Bill itself provides new funds, and, incidentally, large grants outside the Bill have been promised. It is only right that I should indicate the bearing of the Bill on the administrative problem.

A good deal of criticism might have been saved if the critics had read the Bill as amended in Committee. In particular, we might have been spared the talk about "sanatoria" not being "the last word"—as if any responsible person had ever said so. Even since the amended clauses have been printed this sort of criticism continues to flow. No doubt it is easier to criticise without reading than it is to read without criticising; but reading, I submit, is the first duty; understanding is the second; criticising is at least the third.

What is "sanatorium benefit"? By section 8 (1) (*b*) an insured person will be entitled to "treatment in sanatoria or other institutions

or otherwise when suffering from tuberculosis, or such other diseases as the Local Government Board with the approval of the Treasury may appoint." This is "sanatorium benefit." It includes treatment in sanatoria (in the narrow sense), in any other form of hospital or suitable institution, treatment through dispensaries, treatment at home, treatment, in fact, by any method suited to the individual case. Nor is this all. Sanatorium benefit covers all forms of tuberculosis—not pulmonary alone. Why, then, all this talk about "sanatoria" being "the last word"?

By section 15 (1) the new Health Committee (however constituted) is placed under obligation to "make arrangements, to the satisfaction of the Insurance Commissioners—(*a*) with a view to providing treatment for insured persons suffering from tuberculosis or any other such disease as aforesaid in sanatoria and other institutions, with persons or local authorities having the management of sanatoria or other institutions approved by the Local Government Board; and

"(*b*) With a view to providing treatment for such persons otherwise than in sanatoria or other institutions with persons and local authorities other than poor law authorities undertaking such treatment in a manner approved by the Local Government Board, which treatment (including the appointment of officers for the purpose) it shall be lawful for a local authority, if so authorised by the Local Government Board, to undertake."

These words are wide enough to cover every reasonable form of treatment—sanatorium, hospital, dispensary, home, colony, open-air school, holiday-home, vacation school, and any other treatment available. To speak, therefore, as if the money to be set aside for "sanatorium benefit" were all to be spent on stone and lime, or even on wood and iron, is peculiarly inept.

For what is the money available?

There is, first, the sum (estimated at about £1,000,000) formed by the contributions of insured persons. This will be available each year for the appropriate treatment of insured persons alone.

Second, there is a building grant of £1,500,000. This is to be distributed by the Local Government Boards of the respective countries in "making grants" for the "provision of sanatoria and other institutions for the treatment of tuberculosis or such other diseases as the Local Government Board with the approval of the Treasury may appoint." These words are from section 47; but this section has not been discussed in Committee, and must be taken in its present form only provisionally.

The conditions of "distribution" will, no doubt, be subsequently elaborated. But, even for the provision of sanatoria proper, that is curative and educative hospitals, the sum of £1,500,000 will be found none too large, whatever be the view taken of the "failure or success" of sanatoria.

Third, in Committee the Chancellor of the Exchequer promised a grant of some £2,500,000 as a 50 per cent. grant-in-aid to such local authorities as undertake the treatment of the tuberculous dependants of insured persons. This large yearly grant-in-aid of rates should enormously strengthen the resources of the local authorities for public health and enable them to handle, if not the whole, at least the great mass, of the cases needing treatment. This grant has not been further specified and need not be further discussed.

Whatever ultimate form these proposals take, obviously the organisations, both official and voluntary, will receive a great accession of strength. It will be easy to squander the money, but the safeguards against misuse are very powerful. It would greatly help the administrative authorities if those concerned mainly in clinical work would remember that no single organisation meets the whole problem; that no one anti-tuberculosis institution can properly be regarded as an exclusive alternative to any other; that with a disease so various, so widely diffused, so treacherous, the only road to success is patient study of individual cases, patient study of individual environments, and patient correlation of all administrative methods to the purpose of treating each individual patient according to his needs and each individual's environment according to its condition. Then we should hear less about "fads" and more about facts. Then, too, the whole vast campaign would go forward by intelligible strategy and the sinking death-rate would tell its tale of success. But I, for one, am wearied with the myths about death-rates that go down "of themselves," and with the futile abstractions about tuberculosis being a "problem of poverty," a "housing problem," a "food problem"—every kind of problem except the one that needs strenuous individual effort and individual dealing. Of course tuberculosis *is* all this and much more; yet I am not without hope that, as the administrative control increases in subtlety of method, the disease will decrease in deadliness and the vast army of those now marching to the grave will slacken in its stride.

W. Leslie Mackenzie.

CHAPTER XVI

THE TUBERCULOSIS LABORATORY

I. PRESENT BIOLOGICAL PROBLEMS

1. Agglutination—Value of the Reaction—2. Precipitation—(*a*) Precipitin—Value of the Reaction—(*b*) Precipitinogen—3. Complement-Deviation—(*a*) Antigen —(*b*) Antibody — Method of Complement - Deviation — 4. Opsonisation and Phagocytosis — History and Constitution of Opsonins — Mode of Action of Opsonins—Anti-opsonins—Method of Estimating the Opsonic Index—Measurement of Anti-opsonin—Value of the Method—5. Cobravenin Test—6. Bacteriolysis — 7. Cytolysins — Methods—Constitution — Value — 8. Experiments on Animals.

THE subject of immunity in tuberculosis is of special interest in that here we are dealing with a peculiarly widespread and fatal disease, caused by an organism which is usually difficult to reach and exceptionally difficult to destroy. The tubercle bacillus belongs to the group of acid-fast bacteria, characterised by their resistance to the action of heat and of chemical agents. When stained with carbol-fuchsin they resist the action of decolourising agents on that stain for at least 116 days (Willson and Rosenberger). Again, they behave peculiarly towards a powerful alkaline oxidising agent—antiformin. Uhlenhuth and Xylander have shown that where other organisms are quickly dissolved in antiformin, and all manner of tissue rapidly disappears under its action, bacteria of this group remain not only entire but alive. We have therefore to deal with a bacillus in many ways more resistant to treatment from without than the tissues round it. On this account we look to the natural forces of immunity with the greater interest.

Almost all serum tests associated with immunity have been applied to this disease, along with others peculiar to it. Many of these reactions are of great diagnostic value. Some are characteristic of early tubercle, others of advanced disease. Some demonstrate the presence of bacterial products, others that of the antibodies produced in response to them. It is important to remember that different tests belong to different stages of the disease, as otherwise disappointment might result

from depending too much upon any single test. Antibodies cannot be hoped for in a rapid infection where the body-fluids and excretions are flooded with bacterial products. Antigens are not found in arrested cases, or in those obviously tending towards recovery. Again, as pathology teaches us that latent tuberculosis is exceedingly common, we must expect that a delicate test for traces of antibody will single out a large number of apparently normal persons. Probably no test is absolutely characteristic of tuberculosis in all stages of the disease. This is, however, positively an advantage, as the tests acquire thereby a prognostic value which they would not otherwise possess.

1. *Agglutination.*—This is the oldest serum reaction in tuberculosis. For its introduction in 1898 we are indebted to Arloing. He grew homogeneous cultures of the bacillus on potato in 6 per cent. glycerine water, with subcultures, which were shaken in glycerine bouillon to keep the bacilli separate. Five, ten, to twenty drops of this culture is added to one drop of serum. After 1 to 24 hours the bacteria in a positive case fall to the bottom of the tube, leaving the supernatant fluid clear. Koch used a different method of preparing the bacteria. He dried the bacillary skin on the surface of bouillon, weighed a part and rubbed it up with $\frac{1}{50}$ normal NaoH to $\frac{1}{100}$, centrifuged, almost neutralised the upper fluid, and diluted it up to $\frac{1}{10000}$ with a solution of 0·5 per cent. phenol in 0·85 per cent. NaCl. He recommended also dried and ground bacteria to be rubbed up with the same phenol-NaCl and diluted to $\frac{1}{10000}$. The method is otherwise the same as Arloing's.

Value of the Reaction.—Arloing found that in pulmonary tuberculosis 94 per cent. of cases were positive, in surgical tuberculosis 91 per cent., in diseases other than tubercle 32 per cent., and in healthy persons 22 per cent. Of tuberculous cattle, 69 out of 70 reacted at a dilution of $\frac{1}{10}$ at least, while of 80 healthy cattle the 40 which agglutinated did not do so above $\frac{1}{5}$. Arloing and Courmont found in 1200 cases that the test was best for early tubercle; in advanced cases, or miliary disease, the reaction was often negative.

The test has been severely criticised. Romberg found agglutination in 56·4 per cent. of normal sera. Beck and Rabinowitch and Vincent noticed no difference between normal and tuberculous cattle, almost all reacted, and equally well whether normal, tuberculous, advanced, or early.

The diagnostic worth of the reaction does not appear very great, although Arloing believed that agglutinating sera are really indicative

of very early or latent tuberculosis. Koch held that the test is of some prognostic value, especially as a measure of the immunisation afforded by injections of tuberculin.

It is probable that the critics of the method have used serum too concentrated so that the test appeared less specific.

2. *Precipitation.*—The question as to whether agglutinin and precipitin are identical is still unsettled. Whether or not this is the case with other bacteria, there is some probability, as Neufeld suggests, that the agglutination and precipitation tests in tuberculosis depend upon the same body. Microscopically, the agglutination of tubercle bacilli is far from complete, many bacteria depositing in the tubes singly. The reaction is used to demonstrate either (*a*) precipitin, or (*b*) precipitinogen.

(a) *Precipitin.*—The first paper describing this test (except for a slight allusion by Koch in 1901 in an article on agglutination) came from Kitajima in 1902, unfortunately in Japanese. He used filtered bouillon cultures diluted $\frac{1}{5}$. A most interesting paper followed in 1907 by Bonome, in which the author attempted, by means of the precipitin reaction, to distinguish between human and bovine types. He ground the bacilli with sand and made an extract consisting of 3-4 parts of the sand mixture to 12-14 c.cm. of 5 per cent. glycerine water. He found that human tuberculous organ extract precipitated to bovine bacteria only less intensely, and *vice versa.* His slight cases precipitated less intensely than his advanced cases, but the numbers were rather small.

In 1909 Stoerck, Szaboky, Calmette and Massol, Fornet and Kreucker, and the writer applied the test clinically. Stoerck found that 75 per cent. of tuberculous human sera reacted if phenol were present in addition to tubercle extract. This result appears rather low when it is remembered that the serum was diluted only to $\frac{1}{3}$. Sixty per cent. of these sera reacted to 0·5 per cent. phenol in 0·85 per cent. NaCl solution alone, and only a small percentage answered to tubercle extract alone without phenol. Normals precipitated in diabetes, malignant tumours, infectious diseases, and, in certain cases, after a fatty diet. The author used ether extracts of bacterial lipoids. Szaboky was able to obtain the reaction with a bacterial residue after the lipoids had been removed. Using dilutions of $\frac{1}{2}$-$\frac{1}{3}$, Szaboky found the reaction in 91·7 per cent. of tuberculous persons and 40·6 per cent. of normal, 71·5 per cent. of tuberculous cattle and 28·5 per cent. of normal. In examining 682 human sera I found 31·6 per cent. of 301 normal cases positive and

84·6 per cent. of 381 tuberculous. These reactions were got with dilutions of over $\frac{1}{40}$. Fewer advanced cases precipitated (73·8 per cent.) than early (81·9 per cent.). The chronic, long-standing cases gave the most striking result—91·2 per cent. As in Stoerck's cases, 0·5 per cent. phenol in physiological salt solution was sufficient to give rise to precipitation, but tubercle extract without phenol gave a much higher percentage than phenol without tubercle extract, *i.e.* 82·7 per cent. to 70 per cent. The phenol precipitate is not easy of explanation; it seems to be characteristic of human tuberculous serum; bovine serum practically never gives it. Of 378 normal bovine sera examined (diluted $\frac{1}{40}$), 28 per cent. precipitated to bovine and 21·2 per cent. to human tubercle extract. Six sera precipitated only to human extract and 21 only to bovine. We have here serum reacting at a dilution above that generally found necessary in the agglutination test. Again, Bendix found that his agglutinating sera did not react to Koch's old tuberculin, but it is very easy to demonstrate a precipitate with old tuberculin. Sobernheim demonstrated the test by means of old tuberculin with tuberculous serum diluted to 1-10,000.

The test is best carried out by means of an extract of tubercle bacteria in 0·5 per cent. phenol and 0·85 per cent. NaCl, after 36 hours at 37°, diluted to $\frac{1}{50}$, and filtered through a Berkfeld or porcelain filter. If the bacteria are treated with distilled water for 24 hours before phenol and NaCl are added, the extract is perhaps better. One drop of serum is placed in a tube and diluted with physiological salt solution to, say, $\frac{1}{10}$, and an equal number of drops of tubercle extract added. The tube is stoppered with sterile wadding, and placed in the incubator for 12 to 24 hours. The reaction is not deferred longer than this time.

Value of the Reaction.—The reaction is unfortunately not restricted to tuberculous sera, but appears not rarely in perfectly healthy persons. In cattle, when normal sera do react they do so often more intensely than tuberculous. In advanced tubercle, especially in cattle, it is generally slight or absent. On this account the test may be taken as an early indication of disease, or as of favourable import. According to Szaboky, the tuberculin injection test is the most satisfactory of all, yet it is common knowledge to every cattle-dealer that a very large number of animals react which after slaughter are apparently perfectly sound, while many piners do not react at all. It appears most likely that such reacting normal cases really possess some hidden focus of disease, easily overlooked by the eye, but demonstrable by a reaction so delicate as the

precipitin test. If this be so, the test becomes very valuable from the point of view of prophylaxis. Its commercial value, as an indication of the condition of meat, is of less moment.

Clinically the test appears at least equally useful to the opsonic test and very much easier to carry out, especially if phenol in physiological salt solution alone be used.

(b) *Precipitinogen.*—If precipitation and agglutination have had, so far, no practical significance in the diagnosis of tuberculosis, this is without any doubt referable, not to technical difficulties, but to the peculiar biopathological conditions present in tuberculosis. In typhoid and other infectious diseases, in the recognition of which agglutination and precipitation are commonly used, we have acutely running illnesses, in which the infection comes proportionately quickly to a resting stage, to death, to recovery, or to the condition of carrying bacilli. Quite otherwise is the position in tuberculosis, which from this point of view must be looked upon, not as a general infection of the whole organism, but as a sum of many local infections. In tuberculosis we do not have, as in other diseases, an antibody formation corresponding to a straight line, or a falling or rising curve, but a zig-zag line. In the troughs of the waves immune bodies are sought for in vain. It may well be, however, that metabolic products of the bacteria themselves may be successfully demonstrated, whose presence is later to stimulate the production of antibodies. Technically these bacterial products, known as antigens, are best demonstrated in the form of precipitinogen by adding homologous precipitin to the fluid containing this precipitinogen. To prevent non-specific heterogeneous precipitation it is well to use the same solvent for both precipitin and precipitinogen, that is to say, in this case, human serum. For this purpose tuberculous human serum, which is known to contain precipitin, is brought in contact with the serum of a patient suspected of tuberculosis but in which precipitin has not been found. This is best done by bringing together the two undiluted sera in separate layers, a white line developing at their junction in a positive case. In this way a diagnosis of tubercle can generally be made certain, although the preparation and keeping of good precipitating human sera for the purpose presents certain difficulties in smaller sanatoria. Unfortunately strongly precipitating tuberculous sera obtained from animals by artificial immunisation has not shown itself sufficiently reliable. The method has been described and used successfully by Fornet and Kreucker.

3. *Complement-Deviation.*—In 1902 Bordet and Gengou first described

in a classical experiment the phenomenon of complement-deviation in the presence of antigen and antibody. The union of the two bodies absorbed complement, so that when blood corpuscles and hæmolytic amboceptor were added no hæmolysis could take place for want of complement. This phenomenon is made use of to test for—

(*a*) Antigen, by adding antibody and complement.

(*b*) Antibody, by adding antigen and complement.

(a) *Antigen.*—By means of a highly immune serum containing antibody, Wassermann and Bruck were able to demonstrate antigen, or tuberculin, in extracts of tuberculous organs. No trace of a precipitate occurred, but complement was deviated.

Meyer and Cohn were not successful in finding tubercle antigen in tuberculous extracts by this method, but Marmorek noticed complement-deviating substances in the urine of persons suffering from pulmonary disease.

Bergeron investigated 213 cases. Of 133 tuberculous urines 131 deviated complement in the presence of antibody, the two which failed were earlier cases. Of 74 non-tuberculous urines 67 were completely negative.

Jacobson states that in localised or latent tuberculosis the urine did not deviate. Of 68 normal persons only 2 gave a partial deviation.

I have tested the urine of 36 tuberculous persons—12 early cases, 12 advanced, and 12 between the two stages. Two advanced sera only showed complete deviation, 10 advanced and 4 medium cases allowed a slight degree of hæmolysis, 5 medium cases were partial, and the remaining 15 cases did not deviate complement at all. The test appears to be more characteristic of advanced than of early disease.

(b) *Antibody.*—Bordet and Gengou first applied this principle in 1903 for the purpose of testing for tubercle antibody. They absorbed tuberculous serum with tubercle bacteria and noticed that it was possible for complement to be bound by a union of bacilli and antibody.

Wassermann and Bruck used a bacillary derivative, tuberculin, as antigen. This antigen, when added to extracts of tuberculous organs, yielded no precipitate, but deviated complement, proving thereby that antibody was present in the tuberculous organs. Antibody and antigen could exist together in the same organ. They found no antibody in human serum by this means, except in cases which had been treated beforehand with injections of tuberculin, although it might be present in the serum of untreated tuberculous animals. This work was criticised,

especially by Morgenroth and Rabinowitsch, and Weil and Nakajama. Morgenroth and Rabinowitsch found that extracts of normal lungs were able to bind complement in the presence of antigen, just as much or more than tuberculous lung extracts. Weil and Nakajama found that antigen alone, without any antibody, could deviate antigen, if enough were used, 2·0 c.cm. They suggested that where Wassermann and Bruck had used too little antigen to affect complement by adding to it the antigen in the tuberculous tissue extract, enough antigen was then present to effect this purpose, so that this test for antibody was really a test for antigen. Wassermann and Bruck replied that they could bind complement where the sum of antigen and antibody was less than half the amount of antigen Weil and Nakajama found necessary to bind complement in the absence of antibody.

Citron corroborated Wassermann and Bruck's observation that antibody existed in the serum after tuberculin injections, and could be demonstrated by this method. Weil and Strauss and Czastka found that antibodies could also be detected in the serum of untreated tuberculous persons. Szaboky and the writer have also seen complement-deviation in untreated tuberculous serum. Of the serums examined by Szaboky, 87·6 gave this test, but a rather greater number of the same serums, 89·1, gave the precipitin test. I found that complement was frequently deviated by advanced sera with which no precipitation took place, also that precipitates between phenol-NaCl and tuberculous serum left complement free. This observation with regard to complement-deviation in the absence of precipitation is a very common one, both in other diseases and with specific animal precipitates. Sobernheim in 1906 was the first to notice this in the case of tubercle.

Apparently deviation has no relationship with precipitation, and must depend upon some other factor. The possibility that there is any union whatsoever between precipitinogen and precipitin has been rendered somewhat unlikely by the work of Moll, and Welsh and Chapmann, who find that the antigen takes no part in the precipitate, which is formed entirely by antibody.

The deviating factor may be regarded, on account of its affinity for complement, as an amboceptor, but the work of Neufeld and Handel goes to prove that it is distinct from bacteriolytic amboceptor. Seligmann has obtained interesting cases of complement-deviation by mixing two non-specific substances, such as gelatine and shellac for example, which deviate complement when together but not separately, while causing no precipitation. All we can say so far is that whatever the deviating

factor in tuberculosis, its existence may be taken advantage of, thereby adding another serum test to our methods.

Method of Complement-Deviation.—Tubercle extract and tuberculous serum are added to a quantity of fresh complement, sufficient to complete the hæmolytic system added later. The test may be conveniently combined with the precipitin or precipitinogen test, the tubes being examined for precipitate after a certain number of hours, and then complement added and the complement-deviation test proceeded with. This mixture of antigen, antibody, and complement is placed at 37° for one hour, and at the end of this time amboceptor and blood corpuscles are added. The amboceptor is obtained by injecting blood cells belonging to one species into an individual of another species, the serum of which thereby acquires the property of sensitising red blood cells of that species against which it has been rendered immune. Such immune serum may be obtained commercially. When amboceptor and the corresponding red cells washed and suspended in physiological saline solution are added to the mixture of antigen, antibody, and complement, hæmolysis takes place in a negative case after a farther period in the 37° incubator. This occurs when either the necessary antigen or antibody is missing. In a positive case no hæmolysis takes place because the complement has become bound by this antigen and antibody, and is therefore not free to act upon the sensitised red cells. After two to three hours in the incubator the tubes are placed in the ice-chest and looked at again after several hours. By this time the uninjured red cells have sunk to the bottom, leaving a clear supernatant fluid which is not at all red. In a negative case the fluid is red, and there are no cells at the bottom. It is important that amboceptor and complement should be first standardised so that suitable quantities may be employed, and every possible control should also be made.

4. *Opsonisation and Phagocytosis — History and Constitution of Opsonins.*—In 1895 Denys and Leclef described substances in the serum which promoted phagocytosis by acting on the bacteria, and which were not identical with any known immune bodies.

Wright in 1903 also described phagocytic substances which acted upon the bacteria, and were of simple constitution and not identical with other immune bodies. He gave them the name of opsonins.

In 1904 Neufeld independently discovered substances in the serum which aided phagocytosis, agglutinating bacteria and leucocytes together, and were of simple constitution and independent of other immune substances. To these Sauerbeck gave the name of tropins. In a recent

paper Neufeld distinguishes between Wright's opsonins and his own tropins, believing the latter identical with those substances described by Denys and Leclef, but holding that opsonins are complex bodies consisting of complement and amboceptor. According to him these bodies —opsonin and tropin—exist side by side in both normal and immune serum.

The majority of authors have kept to the name opsonins, but they hold between them a great diversity of opinion as to their constitution and mode of working.

According to Metchnikoff and Wassermann opsonin is identical with amboceptor. Others, Muir and Martin and Levaditi, think that normal opsonin is simple, being really the complement of the serum.

The majority of authors—Hektoen, Neufeld, Meyer, Haetjens, Sawtschencko, Cowie and Chapin—hold that opsonins are complex, consisting of two interacting constituents which most call amboceptor and complement.

Still another view is held by several—Wright and Douglas, Bächer, Bullock and Atkins, Hamilton, and Fornet and myself—namely, that opsonins are both simple and independent. Egger believes that opsonins vary in different persons; 75 per cent. of his sera had simple opsonins, and 25 per cent. complex, to the same bacteria.

Neufeld explains this great diversity of opinion in this way. Complexity is proved by the test known as reactivation, that is, adding inactive amboceptor and inactive complement to the bacteria separately, they complete one another and only then phagocytosis should take place. But Neufeld believes that reactivation is apt to be obscured not only by the presence of simple tropins, but because the particular amboceptor is rather apt to be washed away from the bacteria. Reactivation is therefore not always to be seen.

The opsonins to different bacteria appear to vary in this respect. Very striking instances of reactivation have been noticed in the case of certain bacteria, but I know of no satisfactory example of reactivation in the case of tubercle. Caulfield failed entirely to reactivate normal serum; with tuberculous serum a small rise of 0·1 or 0·2 bacteria per leucocyte well within the error limit was sometimes noticed, while on one occasion a fall occurred instead. Fornet and I were no more successful in reactivating 50 tuberculous sera than in the case of 27 normal. We were able to separate opsonin from complement completely. We removed the complement by heat, by treatment with acid, by keeping outside the body for 27 days, and observed opsonic action in its absence.

We removed the opsonin by dialysis through collodion and observed the action of complement, at least for a time, in its absence.

Haetjens found that hæmolytic complement in fresh normal serum was not deviated by a mixture of tubercle bacilli and certain heated immune serum, but that opsonin disappeared. With the preconceived idea that opsonin was identical with complement and amboceptor, he could only argue from this that deviation of complement was more easily demonstrable by want of phagocytosis than by want of hæmolysis. His experiment, however, as it stands, is that in the absence of tubercle opsonin, complement is able to act.

Sobernheim left tubercle bacteria at 37° for one hour in the presence of immune serum and complement, and found that complement was untouched, and could hæmolyse sensitised blood corpuscles as perfectly as control complement. The reason which Sobernheim gives for this result is that his immune serum did not contain a deviating antibody.

Importance of Opsonin.—On account of the fact that human serum is incapable of bacteriolysing tubercle bacteria, phagocytosis becomes of especial interest. The question as to whether ingested bacteria are destroyed inside the leucocyte is of special importance.

Broll, who found tubercle bacilli in fair numbers circulating freely in the blood of two cattle with very early tuberculosis (no fever, etc.), suggested that the phenomenon might be due to the danger of phagocytosis, the leucocytes carrying bacteria into the bloodstream and depositing them there.

Bacteriolytic agents in leucocytes against all manner of bacteria have been described, but the digestion of tubercle bacilli in leucocytes has been more difficult to prove. Von Baumgarten, for example, could not observe any such digestion. Markl, however, has studied a very complete bacteriolysis of tubercle bacilli in leucocytes removed at intervals from the peritoneal cavity of guinea-pigs which had received an injection of the bacilli intra-peritoneally. Kling also has obtained some bacteriolysis through treatment with leucocytic extracts.

There are in serum two apparently independent opsonins, one labile, the other stabile. The amount of stabile opsonin as measured in heated serum is often increased in tuberculosis, but not nearly so much so as in other diseases where immunity is greater. No relation appears to exist between the amount of labile opsonin possessed by a race, and its susceptibility or resistance to tubercle. Susceptibility seems to depend rather upon the amount of potential anti-opsonin, of which more will be said later.

Mode of Action of Opsonins.—There are several theories of the mode of working of opsonins. Metchnikoff holds that the bacteria are prepared by amboceptor, while complement, which he regards as only in the leucocytes under normal conditions, destroys the bacteria after ingestion.

Wright, and most of the earlier authors, believed that the opsonin acted on the bacteria and not on the leucocytes, and that its combination with the bacteria was a very firm one.

More recently this has been called into question. Dean, Meyer, Sellards, Hektoen, Centanni, Neufeld, Hektoen, and Fornet and the writer, have all noticed that the opsonin (or a part of it, according to some) can be "washed away" rather easily.

Sawtschencko believes that hæmo-opsonin acts normally by agglutinating the red cells and leucocytes together, and Neufeld has certainly proved this for his immune tropins. We ourselves are strongly inclined to this view on account of the almost instantaneous rapidity with which phagocytosis takes place in spite of the slow movements of leucocytes. Rosenow has made drawings of his results under the microscope illustrating this. In the presence of opsonin and dead leucocytes the bacteria were agglutinated in thick rings round each leucocyte. Meyer has remarked that leucocytes clump together during phagocytosis, and that clumped leucocytes contain an especially large number of bacilli. Hektoen thinks that two substances act together, one to prepare the bacteria, and the other to agglutinate bacteria to leucocytes.

Centanni believes that a pre-opsonin in the serum unites with a substance on the bacillary wall to form opsonin. This is the explanation whereby he explains the fact that sensitised bacteria from which the opsonin has been washed away are less capable of further sensitisation by fresh serum. In anti-opsonins we have, however, a better explanation of this phenomenon.

It may at least be said that it is extremely likely that the absorption of opsonin by bacteria in the absence of leucocytes is an unnatural process.

Anti-Opsonins.—Hektoen has shown that various chemical substances—alcohol, chloroform, lactic acid—act as anti-phagocytics. The experience of Fornet and myself in the antagonism of heated serum against fresh has been confirmed by Rosenthal, and farther corroboration can be seen in results obtained by several authors. Hektoen and Ruediger observed that when bacteria were absorbed with opsonin and

then heated they were less capable of phagocytosis by fresh serum afterwards. Caulwell noticed in one case that when heated tuberculous serum was added to fresh diluted, the opsonic value was not raised but lowered. Then Haetjens, who treated bacteria with heated tuberculous serum, and then added fresh normal serum, found that no phagocytosis took place. If, however, fresh active normal serum was absorbed with bacteria, and leucocytes were added later, phagocytosis took place without difficulty. This result of Haetjens' has been my common experience. Lately Pribram, who was successful in reactivating normal typhoid opsonin, has met also with this antagonism, depending on the proportion of heated serum present.

This inhibitive quality in heated serum varies greatly in different persons, and is not present in every serum. It is seen, of course, to best advantage when undiluted serum is used, where there is a substantial count to be lowered. Heated agglutinins and precipitins are also antagonistic to fresh solutions of the same (Welsh and Chapman), and an analogous behaviour has been noticed in ferments by Bearn and Cramer, etc. Bezzola has also noticed the productions of anti-hæmo-opsonins or anti-hæmo-tropins in serum which has been kept.

Fornet and I invariably noticed an antagonistic property in serum which had been in contact with bacteria. Ledingham was the first to describe this phenomenon, which, however, he attributed to the throwing off of bacterial receptors. I regard the theory of bacterial receptors as untenable, for this reason. The count of bacteria per leucocyte depends, as every worker knows, on the thickness of the bacterial emulsion. If a weak serum be able to act upon a large number of bacteria, as in the case of a thick emulsion and high phagocytic count, why, then, with a thin bacterial emulsion is there any difference between a weak and a strong serum, as the weak serum has already shown itself able to satisfy the receptors of a greater mass of bacteria? In my opinion this lowering of the phagocytic count in serum through which bacteria have been passed is almost certainly similar to the production of anti-opsonins in the presence of other membranes than bacterial ones, especially collodion membranes. It is interesting that antiferments like anti-opsonins are produced in the presence of a collodion membrane. Weil has proved for agglutinin, and Pfeiffer and Friedberger, and Bail and Kikuchi for amboceptors, that in the presence of bacteria these substances undergo deterioration, becoming agglutinoids, etc. The theory of deviating free receptors is untenable, because they

prove that agglutinin and amboceptor are not absorbed by bacterial extractives but only by the bacteria themselves.

If we are right in our belief, the anti-opsonins are of considerable importance in the scheme of immunity. If they are activated in the presence of bacteria, it becomes of vital necessity that bacteria should meet with serum and leucocytes at once. If for any reason they meet with serum and the leucocytes are held back, anti-opsonins may be activated and distributed through the blood. Now it has been proved by Bail that bacterial excretions, the aggressins, are able to keep the leucocytes back. He noticed that washed tubercle bacteria, injected into a tuberculous guinea-pig, attracted leucocytes, but that when the bacteria were unwashed the leucocytes stayed away. Also the anti-phagocytic action of culture filtrates, noticed by Hektoen and Fornet and Levy, has been also noticed by Fornet and myself in the case of tubercle culture filtrates. This is very possibly the reason for the negative phase noticed after injections of tuberculin. Wright also speaks of areas of lowered bacteriotropic pressure in the neighbourhood of tuberculous foci.

The amount of anti-opsonin is most conveniently measured in heated serum. If we find the serum of one person very antagonistic and that of another not at all, there would appear to be an actual inborn susceptibility in the one case and not in the other. The serum of every advanced case tested by Fornet and myself showed a considerable amount of potential anti-opsonin. In twenty experiments fresh normal serum with an average value of 2·97 bacteria per leucocyte was lowered by heated normal serum to average 2·08, and by heated tuberculous serum to 1·6. In five experiments fresh tuberculous serum with an average value of 3·91 was lowered by heated normal serum to 1·51, and by heated tuberculous serum to 1·39. In 118 cows which I tested there were striking individual cases where the amount of anti-opsonin was very large indeed. Tuberculous cows, especially those reacting to the precipitin test, showed sometimes very little anti-opsonin if any, but most advanced sera tested had a considerable amount.

Method of Estimating the Opsonic Index.—The first attempt made to measure the phagocytic power of blood was done by Leishman. He drew blood and bacteria into a capillary pipette, which he had previously marked, mixed them on a slide, and incubated. He then made a film, stained, and examined microscopically, counting the number of bacteria ingested by a number of leucocytes. This simple method was farther improved by Wright, who separated the leucocytes from the serum,

thereby using the same leucocytic emulsion for each serum examined in one series.

The blood for serum should be taken in a capillary tube with a bulb upon it, which is very easily made. The blood flows up the short end by capillary attraction, and after the long limb has been heated and then sealed the blood is sucked up into the bulb by the contraction of the air above. The lower end is then sealed, and after the blood has set, the upper end can be broken and the tube centrifuged. The thin glass is then cut across just above the bulb and the serum secured. Less blood is needed by using a tube of this form than by Wright's curved tubes.

Leucocytes can be obtained by injecting aleuron in broth, broth, or only physiological salt solution into the peritoneal cavity of a guinea-pig. Two injections of 5 or 10 c.c. should be made, one 18, and the second 4, hours before the exudate is extracted by means of capillary tubes. It is not necessary to kill the animal, which can be used several times. Human blood leucocytes, taken from the finger, can be substituted. They have the disadvantage of being fewer in number, but as the presence of red cells tends to hinder the agglutination of the leucocytes, counting is often rendered easier. The blood or peritoneal exudate is caught in 1½ per cent. of sodium citrate in 0·85 per cent. NaCl, and washed afterwards with 0·85 per cent. NaCl solution.

The bacterial emulsion should be very dilute. Results are more accurate if an emulsion is used such as to give with normal serum about one bacillus per leucocyte. The commercial preparation of moist tubercle bacilli for opsonin estimations sold by Allen & Hanbury, London, is very useful. These should be carefully ground, suspended in 1-1000 salt solution, and centrifuged. The supernatant fluid is then removed and diluted as desired.

Mixing of bacteria, leucocytes, and serum may be done by means of a graduated pipette into tubes, but with human leucocytes and serum the more economical method of Wright is employed. He makes a mark near the capillary end of a capillary pipette, the large upper end of the pipette being capped by a rubber teat. Serum leucocytes and bacteria are each drawn up to the mark, a bubble of air being let in between each to mark the place. They are then mixed on a slide, and the mixture finally drawn up into the capillary tube again, the end is sealed, and the tube placed at 37° for a quarter of an hour. After this time the contents of the tube are again mixed, and a drop placed at the end of a slide and drawn out in a film by means of a second slide. The

film is fixed and then stained. Ziehl stain is useless, as the protoplasm of the leucocyte must be coloured sufficiently to determine the margin of the cell. Ehrlich's acid hæmotoxylin for 1½ to 24 hours should be first used. After washing and drying, boiling carbol-fuchsin is poured on the slide, which after ten minutes is washed and decolourised in 2 per cent. aniline hydrochloride and 60 per cent. alcohol. It is then washed in water and dried. It is then stained with 1 per cent. aqueous methylene blue for ¼ to ½ minute. The protoplasm becomes a beautiful violet, the nucleus blue, and the bacteria bright red. The number of bacteria ingested by a particular number of leucocytes is counted in each slide. The middle point between the values of two normal sera is regarded as the normal line, or 1. The number given by a serum under investigation is divided by this number, the result, above or below 1 being expressed in decimals, *i.e.* 0·8, 1·2.

Measurement of Anti-Opsonin.—This is most conveniently done by adding serum which has been heated above 56° for ½ an hour to fresh serum, both being undiluted. The test is carried out as above, except that four sections instead of three are taken up into the capillary pipette — leucocytes, fresh serum, salt solution and bacilli, again leucocytes, heated serum, and salt solution and bacilli, then leucocytes, fresh serum, and heated serum and bacilli. The opsonic index can be estimated at the same time. If salt solution be added to each serum tested results will be uniform. It is necessary for the test that heated serum should touch the bacilli before the fresh serum can reach them, otherwise the antagonism may be missed.

Value of the Method.—I am not able to agree with those adverse criticisms which have been expressed on different sides against Wright's method of estimating the opsonic index. It has been already mentioned in connection with the detection of precipitinogen that peculiar biopathogenic conditions exist in tuberculosis, and these render a single opsonic estimation sufficient for a reliable diagnosis only in few cases. As Fornet and Kreucker have pointed out, in advanced consumption antigens and antibodies undergo a continual quantitative change or swinging, which is often the only specific serum change in tuberculosis. On this account two or three opsonic estimations are generally necessary for diagnosis, and it is only natural that those authors who have been content with a single estimation have looked unfavourably on the method.

For the proper carrying out of the method a certain technical skill and practice are essential. One can only advise critics to estimate the

index of one or more healthy persons daily for weeks or months, and they must find, as others have done, that the opsonic index of non-tuberculous persons varies generally only between 0·9 and 1·1, at most between 0·8 and 1·2, while the serum in pulmonary tuberculosis is never continuously strong or continuously weak, but is always fluctuating between strong, middle, and weak. The opsonic mechanism of the patient with pulmonary tuberculosis, like his temperature mechanism, is abnormally sensitive. Artificial injections of tuberculin are followed by oscillations of an especially pronounced nature. A "negative phase," or sudden fall in opsonic power after such an injection, is held to be very characteristic of tuberculosis. This fall is succeeded by a rise, and so on. H. Clarke and Halliday Sutherland have described a preliminary rise before the "negative phase."

5. *Cobravenin Test.* — Calmette noticed in 1902 that cobravenin, unable to hæmolyse red corpuscles alone, could do so in the presence of horse or dog serum heated to 58°. Kyes found that venin could be activated by the addition of lecithin instead of heated serum, and that only heated serum which contained lecithin could activate venin.

Calmette, Massol, and Breton discovered that tubercle bacilli possess a marked affinity for lecithin, with which they are able to unite. This fact led them to investigate whether normal serum differed from tuberculous in respect of the presence or absence of lecithin. They found that while normal human, bovine, and pig serum contains no lecithin, tuberculous individuals of these species do possess sufficient lecithin to activate cobravenin, and hæmolyse red blood cells. They regard lecithin virtually as an antibody, because tuberculin bound with lecithin is no longer able to cause the ophthalmic reaction. Calmette, Massol, and Guerin find that lecithin can be produced in the serum of healthy cattle by the injection of tuberculin. The lecithin disappears from the serum during a febrile period and reappears when the temperature is again lowered.

The test is carried out in this way: 0·5 c.cm. of a 1-5000 dilution of venin and 0·5 c.cm. of serum which has been previously heated at 56° to 58° for an hour are added to 1 c.cm. of 5 per cent. horse corpuscles. The tubes should be placed in the incubator for two hours and then transferred to the ice-chest until cells which have not been acted upon shall have had time to fall to the bottom. The degree of hæmolysis can then be noted.

Szaboky regards this test as the best of all serum reactions in tuberculosis; 92·3 of his tuberculous cases were positive.

Pekanovich finds only 87 per cent. positive, and in the third stage of phthisis only 60 per cent. This is probably explained by Calmette's observation that febrile serum is free of lecithin. Dembinski finds 90 per cent. of tuberculous cases positive, the negative 10 per cent. being all advanced cases. Of non-tuberculous cases, however, 10 per cent. are positive.

The test appears to be given by a large percentage of cases, and is therefore of value. Its prognostic worth is somewhat uncertain, but on account of the fact that Deycke and Much, and Calmette, etc., hold that it binds and neutralises the toxin, it may theoretically be held as of good import.

6. *Bacteriolysis.*—Arloing tried to discover whether bacteriolysis accompanied agglutination of tubercle bacilli, but found that the agglutinated bacilli were none the worse for their contact with serum, and grew even better than when untreated. The only blood which has been described as bacteriolytic to tubercle is that of the species Galeria Mellonella, but this property depends on a heat-resistant ferment, and not upon the ordinary mechanism of complement and amboceptor. Sieber and Metalnikoff, who described this ferment in Galeria Mellonella, suggest that the good effects which some have obtained in the treatment of tuberculosis with trypsin have been due to the lipase present in the trypsin preparation. From the large amount of fat—over 25 per cent.—present in the tubercle bacillus, it might be supposed that a fat-splitting ferment would prove destructive. Hanriot has described a lipase in serum. This is in small traces, and is not considered a true lipase. According to Doyon and Morel, and Cohnheim and Michaelis, the lipase of the blood is not contained in the serum but in the red cells. It has been stated, and again contradicted, that the red cells are "anti-tuberculous." Achard and Clerc have observed a diminution in the quantity of Hanriot's lipase in tuberculous conditions which were not improving. Although serum appears to possess no true lipase, it has the property of activating and accelerating the action of true lipase in a remarkable way (Donath, etc.).

Deycke and Much believe that the acid-fast properties of the bacillus and its toxic properties depend upon the neutral fat in its membrane. Any substance dissolving or helping to dissolve neutral fats would have a similar effect upon the tubercle bacillus. Brain substances—cholin, neurin, and lecithin—all possess this power. Lecithin not only aids the solvent action which the other substances possess in a higher degree, but has in addition the property of neutralising the toxins set free by

the breaking up of the bacillus. Loewenstein was unable to notice any effect on the part of cholin and neurin on tubercle bacilli. Ditthorn found neurin and cholin bactericidal. Before the bacilli had lost their acid-fast properties, that is while still staining normally, they were already dead, having no effect upon guinea-pigs when injected. Lindemann also observed bacteriolysis with neurin.

The action of lecithin is curious, as it has probably no action upon fat alone. Bacteriolysis is, however, regarded as related to hæmolysis, both depending upon a solution of lipoids in the bacterial membrane or that of the red corpuscle. Lecithin is able to activate cobravenin as a hæmolytic agent. Maclean has attributed this to a lipase in the venin decomposing lecithin into products which are themselves hæmolytic. Neuberg and Rosenberg have indeed described a lipase in cobravenin. Among the decomposition products of lecithin are cholin and neurin, and it may well be that it is through the presence of a lipase that lecithin exerts a solvent action upon tubercle bacilli. If bacteriolytic through its derivatives, and itself capable of uniting with and neutralising the toxin, lecithin may act as a valuable antibody in tubercle. Zienkiewicz has found that lecithin is increased in tuberculous serum up to 50 per cent.

Tuberculous tissues do actually appear to exert some destructive influence on the bacilli *in vitro*, and *in vivo*. Much has described partially degenerate bacilli in lupus, known as "Much's forms," which have lost their acid-fast properties. Fontes, who also found these forms in tuberculous pus, experimented with extracts of caseous glands on living bacilli. He found that the numbers of the bacilli were thereby reduced, the bacteriolytic substance remaining active for 120 days. Wolff has found Much's forms in the glands of otherwise non-tuberculous children, post mortem. One must remember in this connection the work of Kitasato in 1892, proving that the majority of bacilli in sputum, though staining well, are already dead.

Normal tissues also appear to have some action on the bacilli, especially the leucocytes and the lymphatic glands. Markl has observed a complete bacteriolysis of tubercle bacilli both within and outside phagocytes in peritoneal exudates in guinea-pigs, which he examined at intervals within 24 hours after intra-peritoneal injection of the bacilli. Kling has seen some bacteriolysis of tubercle bacilli when treated with leucocytic extracts. Bartel, Neumann, and Leimsner found that lymphatic tissue at 37° could render the bacilli avirulent.

Tubercle bacilli have no ordinary bacteriolysin, composed of comple-

ment and amboceptor, but these very suggestive facts seem to indicate that their place may be taken by other lytic substances of a different nature. A fresh light is hereby thrown on the importance of phagocytosis. The leucocytes are especially rich in all manner of ferments, they contain also, as all cells, lecithin. It appears possible that the bacilli are intended to undergo dissolution in a place where the toxins freed in the process are cut off from the general circulation by a membrane containing the lecithin which has been shown to neutralise and render them innocuous.

7. *Cytolysins.*—The presence of cyto-, iso-, and auto-hæmolysins in the blood in pathological conditions was first described by Maragliano in 1892. Their occurrence was associated by various authors with cancer especially, but they were also noticed in tubercle and different acute infections. For some time more work was done upon their constitution than on their clinical significance. More lately, however, Crile and Richartz have described the existence of isolysins as even more characteristic of tubercle than of any other infection. Crile finds 92 per cent. of tuberculous cases positive, 85 per cent. in cancer, 10 per cent. in pyogenic infections, and in 211 normal sera absolutely negative. All his tuberculous cases showed reversed hæmolysis, that is to say that the tuberculous corpuscles were hæmolysed by normal serum. Richartz finds 52 per cent. of tuberculous sera positive, 3 out of 11 acute infections, while 112 normals and 103 sera in other infections were completely negative. Vogt, in addition, found autolysins in 24 per cent. of advanced cases of tubercle, early and normal sera being quite negative.

Methods.—In testing for isolysins both cells and serum must be secured. Crile sterilised the skin over the median basilic vein and thrust a needle through the skin into the vein, drawing off 3 c.cm. of blood for cells, and 10 c.cm. for serum. The 3 c.cm. were defibrinated and the cells separated and washed. He added 0·5 c.cm. of undiluted serum to 0·5 c.cm. of red cells, and placed them at 37° for 2 hours, and in the refrigerator for 20. The hæmolytic power of serum is at a maximum 24 hours after it is drawn. Richartz used fewer controls, and therefore required less serum. He added 0·3 c.cm. of normal cells to 0·3 c.cm. of $\frac{2}{3}$ diluted tuberculous serum, also tuberculous cells to normal serum, and tuberculous cells to tuberculous serum. Vogt caught 0·5 c.c. of blood in a solution of potassium oxalate, which he placed in the incubator for 2 hours, and then transferred to the ice-chest.

Constitutions.—There exists a great diversity of opinion as to the

constitution of these hæmolysins. Maragliano thought them thermostable, resisting temperatures between 50° and 80°, and therefore different from the immune body and complement. Camus and Payniez found them inactivated at 55°, but independent of complement, not only incapable of reactivation, but displaying a certain antagonism between fresh and heated serum. Eisenberg, on the other hand, was successful in reactivating heated isohæmolysin with fresh rabbit serum. Moreschi believes that the isohæmolysin has an amboceptor - complement constitution—that after heating it can be reactivated by fresh normal serum which is not itself lytic. The amboceptor is bound in the cold, the complement remains free in the serum, and can be washed away to 0°. Ascoli obtained a positive reactivation in several cases, but not all, and Richartz was able to reactivate 6 out of 24 sera. The others could not be reactivated. Crile and others, again, find hæmolysis increased at 0°. These results are very contradictory. It appears probable that this hæmolysis is not always due to the same substance. Simple hæmolysins are known to exist, as also are simple bacteriolysins. Woelfel, for example, has described a simple alcohol-soluble hæmolysin which is probably a magnesium soap. Crile used controls heated at 55°, in which the hæmolysin under investigation was inactive, in order to exclude other possible hæmolysins. These different experiences in reactivation are rather similar to the difficulties which have been met with in the case of opsonins.

Value.—The reaction appears to be characteristic of very advanced tubercle where serum tests are generally less required. It is not confined to tubercle, but appears very frequently in cancer and other cachectic conditions. On this account its value as a diagnostic of tubercle cannot be said to be great. Its occurrence appears of unfavourable import.

8. *Experiments on Animals.* — All these tests which have been mentioned may be applied to the serum of animals which have been injected with sputum, urine, etc., in order to discover whether this material is tuberculous or not. The pathological test, or the sectio of such an animal, is one of the best laboratory methods which we possess for the diagnosis of tubercle.

In addition to the above, another animal test has been introduced by Yamanouchi. This depends upon a passive hypersensibility. Tuberculous individuals are hypersensitive to tuberculin, they react by fever, a disturbance of the opsonin content, etc., to injections. Yamanouchi was able to carry this hypersensitive condition over to animals by

injecting them with the serum of a tuberculous person. He injected 5 c.cm. of blood or serum into a rabbit, and 24 hours afterwards followed this up by injecting 0·5 or 1 c.cm. of tuberculin or bacillus emulsion. Within a few minutes anaphylactic symptoms appeared, disturbance of circulation and respiration, paralysis, etc., or death. Tuberculous sera were always positive, normal and healed cases negative.

Lesné and Dreyfus varied the test by injecting the tuberculin intracerebrally instead of intravenously. Of those treated with normal serum 5 per cent. reacted, with tuberculous, 20 per cent. These authors also found that if guinea-pigs and rabbits were first injected with tuberculous serum, and then injected subcutaneously with tuberculin, the animals reacted with fever just as actively tuberculous animals in 33 per cent. of cases, but they also found that tuberculin injections in untreated normal guinea-pigs also sometimes give rise to fever. Novotny found that treatment with normal serum also gave rise to anaphylactic symptoms. Other authors, Joseph and Simon, failed to get the reaction at all. It is interesting that Bail, who was successful in producing the anaphylaxis, was able to carry the substance causing it over to a third animal. Helmholz found that if the serum of guinea-pigs, which always gives a positive v. Pirquet reaction, is injected into a second normal animal, the latter acquires temporarily the capability of reacting to the v. Pirquet test.

This sensitivation test, which appears to depend on the proteid rather than on the true toxic constituent of the bacillus, is interesting, but practically of little value.

I wish to thank Dr. Fornet, Saarbrücken, for the advice and help which he has given me in this paper. A. E. Porter.

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II. ANTI-TUBERCULOUS VACCINATION OF BOVINES[1]

PART I.—Introduction—Variation in the Tubercle Bacillus.
PART II.—Anti-tuberculous Vaccination of Bovines—Anti-tuberculous Vaccines—Methods of Immunisation—Vaccination by Intravenous Injection—Ingestion Vaccination—Subcutaneous Vaccination—Phenomena in Vaccine Inoculation—Results of Vaccination—Relative Values of Methods of Vaccination—Duration of the Period of Immunisation—General Remarks.

PART I

Introduction.—In this chapter I propose to consider the immunisation of bovines against tuberculosis by means of artificially attenuated varieties of the tubercle bacillus. In specific non-recurrent diseases, cure confers immunity, and is not attended by sequelæ. By means of an artificially attenuated virus immunity may be conferred against some diseases, as an abortive malady is produced, resembling the actual disease, but free from sequelæ or danger to life.

It has been asserted that immunity to tuberculosis is impossible, firstly, because it is a remittent and recurrent disease, and secondly, because the virulence of the tubercle bacillus appeared to be a fixed quantity, modified by nothing short of actual destruction of the bacillus. Such assertions are inexact, or at least gross exaggerations. It is known that tuberculosis can be cured, and I have demonstrated in researches extending from 1882 to 1902 that the tubercle bacillus has natural and artificial variations, which do not affect its vitality, but modify its pathogenicity and biological properties. This suggested the possibility of obtaining immunity against tuberculosis.

Variation in the Tubercle Bacillus.—About 1882 the evidence of morbid anatomy, then regarded as conclusive, had established the fact that tuberculosis in bone, glands, and joints was allied to pulmonary tuberculosis, in spite of considerable differences in the course and prognosis of these two forms of disease. The classical experiment of inoculating the rabbit and the guinea-pig with tubercle bacilli derived from pulmonary tuberculosis and from meningeal or mesenteric lesions

[1] Translation by Colonel R. L. A. Pennington.

demonstrated a marked difference in the virulence of bacilli from these sources, those from the first being only pathogenic to the guinea-pig, those from the latter being pathogenic to both the guinea-pig and the rabbit.

I deduced that bacilli from pulmonary lesions are less virulent than those from *tabes mesenterica* and tuberculous meningitis. This threw light on the fundamental cause of the clinical differences between these forms of tuberculosis, and also indicated a simple method of diagnosis and prognosis. These conclusions were opposed by those who held that variation in virulence was due to anatomical differences in the sites of the lesions. By systematically extending my method of comparison to bacilli from many lesions in bones and joints, it was apparent that in general the bacilli from these latter sources were weakened, although some from glandular and joint lesions were very active, others being intermediate. Their activity was measured by the number of times the bacillus had to pass through the guinea-pig before it attained a virulence sufficient to overcome the resistance of the rabbit. The question now arose if similar variations occurred in bacilli from cutaneous and pulmonary tuberculosis. It had been asserted that to infect the guinea-pig from lupus it was necessary to introduce some of the granulation tissue into the peritoneum. In collaboration with J. Courmont, it was found that sometimes the guinea-pig could be infected subcutaneously, and that bacilli derived from such a guinea-pig were at times pathogenic to the rabbit. In pulmonary tuberculosis similar variations were found by J. Courmont and Denis, working in my laboratory.

It was also stated by those who opposed my theory that a low virulence was due to paucity of bacteria in the lesion, and not to any variation in their activity. This view I refuted by inoculating animals with an active virus diluted and with the same virus heated. The dilution represented a diminution in the numbers of bacilli present, while the heating represented an attenuated virulence. The results of these experiments confirmed my theory of the variability of the bacilli, and on this I explained at the Tuberculosis Congress in London in 1901 the differences which R. Koch and Schutz had found between bacilli of human and bovine sources. At the formation of the International Anti-Tuberculosis Institute in Berlin in 1902 this view was accepted by those who were formerly its principal opponents. It was still held, however, by Koch and others, that there were fixed cultural, morphological, and pathogenic distinctions, which differentiated the

bacillus of human and bovine tuberculosis. According to them there are two types of bacilli, or rather three, if avian tuberculosis be included. I believe, on the other hand, that there is but one bacillus whose characteristics can be modified according to the host it inhabits. I have shown that domestic herbivorous animals are not absolutely immune to human tubercle bacilli. When these are injected intravenously they always produce some morbid changes, at times very slight, but on other occasions as severe as those produced by the bovine bacillus. It has also been shown that bacilli from bovine sources vary in virulence, although in general they have a higher pathogenic power than human bacilli. Further, tubercle bacilli are found whose characteristics are midway between those from human and bovine sources. Human and bovine tubercle bacilli are simply variations of one bacillus due to long residence in one or other host, but when these acquired characteristics have not had time to develop, the varieties are indistinguishable.

Overwhelmed by similar proofs from different laboratories, the partisans of the duality theory have substituted the word type for species. This is intended to be a simplification, but I protest against the use of this word in the sense that it implies fixity of certain characteristics. In regard to the distinction drawn by some pathologists between the avian tubercle bacillus and that of mammals, I have shown that fowls are not immune to the bovine bacillus, as in nearly all cases the ingestion of bovine bacilli on three or four occasions is followed by microscopic lesions in the liver. It is also possible to communicate avian characteristics to bacilli of human or bovine sources.

In addition to those changes which naturally occur in the bacillus, it is possible to produce very definite artificial modifications. In 1898 I showed that by growing human bacilli in the depths of glycerinated bouillon at 37° C. one obtains a homogeneous culture in which the bacilli are free or in small clumps. Later I communicated the same characteristics to bovine bacilli. Not only had these bacilli acquired an unusual habit of growth, but their virulence was modified so that on being inoculated under the skin, or into the veins, of the rabbit or the guinea-pig, they no longer produced the classic lesions, and at first glance appeared to have lost their pathogenicity. If injected into the peritoneal cavity, however, they produce microscopic tuberculous changes in the mesenteric and perigastric glands. Although they rarely induce generalised tuberculosis, they cause very definite tuberculous changes in the liver and spleen, and on

intravenous injection, similar changes in the lungs and kidneys. In the liver this is marked sometimes by a mononuclear infiltration, and again by polynuclear and scattered giant cells. In the spleen there is an epithelial proliferation and disseminated giant cells, or else an alteration in the cells of the follicles. If a small dose of bacilli be injected these reactions may be negligible.

I have further modified these cultures by growing them at temperatures of 44°, 45°, 46° C., or in compressed air at 2-3 kilos pressure. These methods have produced a definitely transmittible species of bacilli, which proves the variability of the tubercle bacillus.

The importance of these deductions is twofold. They teach us to mistrust the tubercle bacillus whatever be its habitat, and they point to the possibility of vaccination against tuberculosis by means of attenuated cultures.

Part II

Anti-tuberculous Vaccination of Bovines.—The problem of vaccination may be stated in the following terms:—How to convey a variety of curable tuberculous infection to young bovines, which is not calculated to produce or leave behind any lesion constituting a danger to the organism (which should thus be immune to tuberculosis).

The problem was solved the moment I obtained artificially a species of bacilli whose virulence was profoundly modified. However, I prolonged my experiments on bovines from 1898 to 1909 in order to determine the best method of vaccination.

Anti-tuberculous Vaccines.—I have given this name to the species of bacilli obtained by the method of culture above mentioned. These bacilli, of bovine origin, are transmissible indefinitely in glycerinated bouillon at 37° C., and consequently are very easy to grow. They answer all requirements in regard to a virus conferring immunity. Injected in small quantities into the veins of young ruminants, they are *easily assimilated* (*se résorbent aisément*), and if there be any lesions, these are so slight that it is usually impossible to find them, even in ten consecutive histological sections; or if they are visible, the suspicious points contain star-formed cells, showing that they are in process of rapid transformation into fibrous tissue, and will never pass on to caseation.

I would add that these vaccines are innocuous to man in the event

of accidental inoculation. They therefore truly possess the properties necessary for anti-tuberculous vaccination.

Methods of Immunisation.—I vaccinated by the intravenous, ingestion, and subcutaneous methods, and will show later that these three methods do not produce uniform results.

Whichever method is adopted, I inoculate the vaccine on two occasions with an interval between them of three or four months.

Vaccination by Intravenous Injection.—At the first inoculation I introduce into the jugular vein ½ c.c. of a culture about a fortnight or four weeks old. If the subjects are very young calves the dose would be decreased to ⅓ or ¼ of a c.c., but if the animals be of considerable size the dose is increased to 1 c.c.

The technique is simple. The animal, tied up in the stable or outside, is kept in position with the neck slightly raised. The vein is made to swell by the pressure of a rope. When considerably extended, it is punctured by means of a serum syringe, so that the blood escapes into the cannula; the syringe is then used to inject the dose of vaccine. The cannula is withdrawn, and simultaneously the cord compressing the jugular vein is relaxed by an attendant.

The second inoculation is made in the same way, only the dose of vaccine is then:—½ c.c. for young calves, 1 c.c. for animals of middling size, and 1½ c.c. for large animals.

Ingestion Vaccination.—On the first occasion 15 c.c. of culture are given. 2 c.c. at a time are placed in the mouth, at the side of the root of the tongue, by means of a syringe without a cannula. After each injection the animal is allowed to swallow at its ease. On the second occasion the dose is increased to 20 c.c.

In very young subjects 5 c.c. are given at first, increased on the second occasion to 10 c.c.

Subcutaneous Vaccination.—The hair is shaved and the skin cleaned at the point of injection. With a sterilised syringe 4 c.c. of culture is injected into the subcutaneous tissue at each operation. The dose is divided between the neck and flank. The first injection is on the right, the second on the left side.

Phenomena in Vaccine Inoculations.—Phenomena common to all methods of vaccination can be recognised, and also results peculiar to each.

Under the first category must be placed sensibility to the tuberculin test, which is manifest a month after inoculation. It proves that the subjects have undergone tuberculous infection. This sensibility

diminishes by degrees in most cases; often it is doubtful. It reappears after the second vaccination, but to a rather less degree; then it again diminishes, and at the end of 8 to 10 months it is usually a negligible quantity. Probably it shows itself whilst the bacillus is active in the system, and then slowly disappears.

The results of immunisation by ingestion pass unobserved. The first injection into the veins does not produce immediate general symptoms, but towards the middle of the second week a rise of temperature is evident, which may even occur in the last weeks, but is compatible with exterior signs of perfect health. The second injection, however, causes immediate symptoms—a little dulness, loss of appetite, and meteorism. At the end of the day the temperature may rise to 40° C. or more, and falls rapidly during the following days. Before long all symptoms disappear. During the fortnight following the first vaccination the milk is diminished by about $\frac{1}{10}$th, but subsequently returns to normal. Gestation, even very advanced, is not affected by the intravenous injection of vaccine.

Subcutaneous inoculation produces a slightly diffused swelling, hard and uneven to the touch; it persists for some time and gradually diminishes. There is no ulceration of the skin if the injection has been aseptic. It is best to leave this condition alone. The corresponding lymphatic glands tumefy and are sensibly palpable for some time; they then return to their normal state. The rectal temperature rises very slightly. The general condition is excellent.

The second inoculation produces analogous symptoms, sometimes rather slighter. There is generally a slight rise of temperature, but nothing to compare with that following intravenous injection. On the second or third day after inoculation the animal has the appearance of perfect health.

Results of Vaccination.—The young vaccinated bovines and the control animals were inoculated with an equal dose of a very virulent bouillon culture of bovine origin, and a comparison made of its effects on both groups of animals. Clinical examination of these is insufficient. Simple observation, even when assisted by the tuberculin test, tends to inexact deductions. Microscopic examination is the only means of judging of the degree of resistance communicated to the vaccinated animals.

The examination must be complete, made with scrupulous care, and the nature of doubtful lesions determined, if needs be, by histological and bacteriological study.

It is necessary to remember that in the prescribed dose the vaccine does not cause tubercle formation. Consequently such lesions found at the autopsy will be the result of the test inoculation, if they be not anterior to vaccination and due to previously existing tuberculosis.

Following the test intravenous injection, I have been unable to find lesions in the lungs, but a more or less considerable tuberculous infiltration of the mediastinal and peribronchial glands. Consequent on a virulent inoculation into the cervical region I have failed at times to trace lesions in the corresponding subscapular glands, and found them, apparently recent, in the mediastinal glands. This fact opens up a problem on the means of propagation of bacilli in the organism.

More or less defined tuberculisation of the subscapular gland is practically the rule after the test inoculation in the cervical region. If this test is renewed some time afterwards, on the opposite side, few, if any, local symptoms are observable, and the subscapular glands remain unaffected.

It seems to me practically impossible to establish, by means of vaccination, a resistance capable of compassing on the spot the extinction of the injected virus. But as a general rule the resistance established is sufficient to limit the lesions to the subscapular glands.

The virulent bacilli inoculated to test the vaccinated subjects can subsist for longer or shorter periods in glands free from microscopic lesions. This is no reason for apprehension or uncertainty in regard to the vaccination; if the organism of the vaccinated subject be not endowed with a very high bactericidal power, it possesses a defensive action capable of preventing the formation of tubercles in the presence of these bacilli. Thus a tuberculous abscess may remain for months without extending to the corresponding lymphatic glands.

Immunisation artificially obtained is not absolute for all subjects; it may therefore be insufficient for certain animals exposed to severe infection, either owing to the nature and dose of the virus, or to the means of infection, but in this case its value may in some degree be measured by the number and size of the tuberculous lesions whose formation has not been prevented.

According to observations carefully made at the autopsies, vaccination has resulted in complete success, relative success, and failure. On control animals the test injection produced complete infection, partial infection, or failed to produce infection.

The following table gives the results on animals immunised, by different methods, with species of bovine origin:—

Vaccinated	Complete success	50 per cent.
	Partial „	25 „
	Failure	25 „
Controls	No infection	9·2 „
	Partial infection	27·2 „
	Complete infection	63·6 „

In other words, 50 per cent. of the vaccinated animals escaped infection against 9·2 per cent. of the control animals, and 25 per cent. of the vaccinated were severely infected against 63·6 per cent. of the controls. Partial infection appeared in both groups, and its relative importance must be sought. It ought to be less in the case of the vaccinated animals—as a matter of fact, after special examination, it was found that the lesions were three times more serious in the controls than in the vaccinated animals.

Relative Value of Methods of Vaccination.—I have remarked that immunity is sought by intravenous, ingestion, and subcutaneous injections. These three methods are not equivalent. I place them in the following descending scale:—1. Intravenous; 2. Ingestion; 3. Subcutaneous. Under my personal supervision intravenous injection has succeeded in 75 per cent. of cases, ingestion in 50 per cent., and subcutaneous inoculation in 9 per cent.

Ingestion furnished an important number of successes, nevertheless I do not recommend it, for it requires too large a quantity of vaccine. I give the preference freely to intravenous injection, either for primary immunisation, or to ultimately reinforce immunity. This method is the easiest to adopt; it requires little vaccine, and gives the maximum immunity.

Duration of the Period of Immunisation.—In my experimental vaccinations I observed the duration of immunity to be 7, 10, 14 and 22 months after the first inoculation.

It has been said that this duration is not sufficient to arrest infection. Assuredly it would be better that immunity should be permanent, but probably a definitely persisting immunity does not exist. One should further note that immunity may be reinforced, when it threatens to disappear, by a fresh intravenous injection.

General Conclusions.—The known methods of conferring immunity all rest on the employment of attenuated tubercle bacilli. My process of vaccination differs from others in that the vaccines which I employ

do not consist of bacilli modified individually by unknown influences, or otherwise extemporised. Their active elements are living bacilli of bovine origin, powerfully modified in their powers of inducing tuberculosis by a long process of culture in the depths of glycerinated bouillon. The modifications which they have undergone are so well fixed that these bacilli form indefinitely transmissible types. These types, which may be compared with the *anti-anthrax* vaccines of Pasteur, no longer produce tuberculosis of the viscera and glands, under the conditions which I recommend for their employment. I am absolutely certain that they cannot cause any mortal infection in bovines.

All processes are capable of improvement. However, such as it is, the method to which I have referred in this paper may be associated with prophylactic measures to restrain the ravages of bovine tuberculosis.

G. ARLOING.

III. A CRITICAL STUDY OF SERUM AGGLUTINATION AND THE OPHTHALMIC REACTION IN TUBERCULOSIS[1]

Introduction—Clinical Facts—Serum Agglutination—Specific Value of these Tests —Reactions to other Toxins—Conclusions.

Introduction.—To the tuberculin test discovered by R. Koch in 1890, there has been added the serum agglutination test of G. Arloing in 1895, the cutaneous reaction of von Pirquet, Calmette's ophthalmic reaction, and the intradermic reaction of Mantoux and Moussu. That is to say, since 1898 the early diagnosis of tuberculosis has been sought in humoral and tissue reactions.

Clinical Facts.—The comparative investigation of serum agglutination and the ophthalmic reaction was undertaken by the writer singly, and also in collaboration with Paul Courmont, Dumarest, and with Dembourg. The reactions were made on a large group of patients in all stages of pulmonary tuberculosis. The ophthalmic reaction was positive in 73·9 per cent., negative in 17·3 per cent., and doubtful in 8·6 per cent. of cases. The serum agglutination test was positive in 78·2 per cent., negative in 15·9 per cent., and doubtful in 5·7 per cent. of cases. From these results serum agglutination has an advantage over the ophthalmic reaction in such cases. Its superiority is more marked in suspected cases, especially in the aged, also where the disease may be of long standing, cured, or only slightly active. A humoral condition persists longer than a tissue reaction after tuberculous infection.

Serum Agglutination.—Serum agglutination has the advantage when applied to prognosis, as it has more distinguishing characteristics than has the ophthalmic reaction, and its degrees are more readily perceptible. Experience has shown that the humoral reaction is related to the patient's resistance to bacillary infection. The following percentages support these statements:—

	Slight.	Medium.	Strong.
Ophthalmic reaction	56·4 %	25·8 %	17·7 % of cases.
Serum agglutination	($\frac{1}{5}$th) 37 %	($\frac{1}{10}$th) 33 %	($\frac{1}{15}$th) 29 % of cases.

[1] Translation by Colonel R. L. A. Pennington.

In the foregoing, $\frac{1}{5}$th, $\frac{1}{10}$th, and $\frac{1}{15}$th give a more accurate measurement of agglutination power than do the expressions slight, medium, and strong.

The humoral reaction is to be preferred because—

1. *It is more constant in the majority of cases.*

2. *It has more distinguishing features, and is thus of value in prognosis.*

3. *It is present in all stages of the disease and can be repeated.*

4. *It includes very advanced disease.*

5. *It is least disagreeable to the patient.*

Serum agglutination thus bears comparison with diagnostic methods by means of tuberculin, as may be gathered from the following figures prepared by P. Courmont for the Eighth International Tuberculosis Conference (Stockholm, July 1909):—

	Serum Reaction Agglutination.	Tuberculin.		
		Subcutaneous Reaction.	Ophthalmic Reaction.	Cutaneous Reaction.
Tuberculosis (all cases)	84 per cent.	91 per cent.	80 per cent.	67 per cent.
Advanced pulmonary tuberculosis . .	All cases frequently give negative reactions.			
Suspected tuberculosis.	67 per cent.	57 per cent.	60 per cent.	82 per cent.
Non-tuberculous disease	37 „	49 „	25 „	33 „
In health . . .	23 „	50 „	18 „	50 „

One may now consider the specific value of the ophthalmic reaction and of the serum agglutination test, with which is associated the mechanism and clinical significance of these diagnostic tests.

Until quite recently it was held that tuberculin possessed a power of absolute diagnosis, so that every positive reaction, whether occurring in suspected cases or in those presenting every sign of health, was regarded as definite evidence of tuberculous infection.

Some observers, finding a positive serum agglutination present in the blood of healthy subjects, declined to regard the reaction as specific, and doubted its accuracy. Such reasoning was not very accurate from a scientific standpoint.

The question then entered on a new phase. Owing to the ease with which it could be performed, the serum agglutination test was used in affections having no apparent relation to tuberculosis—in typhoid fever and in pneumonia. The results revived former objections, and appeared to destroy its specific value. Matters might have rested here had

the subcutaneous tuberculin test, whose application in practice was restricted to suspected tuberculous conditions, alone been at the disposal of the profession. But the simple and relatively innocuous methods of von Pirquet and of Wolff-Eissner were brought out and largely applied in the most varied clinical conditions. Their extended use was a fatal blow to the dogma of the infallibility and the absolutely specific nature of tuberculin diagnosis. The fact that the ophthalmic reaction was present in more than 50 per cent. of non-tuberculous typhoid cases gave rise to certain doubts which led me to undertake researches, of which the following is a summary :—

The positive results of the ophthalmic reaction in typhoid fever led me to recognise that it occurred in an organism sensitised by any vaso-dilator toxin. In proof of this I found that rabbits, free from tuberculosis, when inoculated with tuberculin, or with diphtheria toxin, or staphylococci, or Eberth's bacillus, gave a positive ophthalmic reaction, whose maximum intensity coincided with the complete absorption of the injected toxin. The reaction became less intense as immunity was created. Tuberculin was the test agent in producing a positive result to the ophthalmic reaction in a non-tuberculous animal. The disappearance of the ophthalmic reaction when the organism is saturated with this poison has been well described by Calmette and others. Again, two horses, which for 12 years had been immunised to diphtheria toxin, gave a positive ophthalmic reaction, as did an animal in the first stage of immunisation and two others immunised to the tetanus toxin. The ophthalmic reaction is therefore present quite apart from tuberculous lesions, and, clinically, has no specific value. Thus in syphilis it is positive in the second stage, although not in the primary, being due to the systemic infection of the syphilitic virus. A positive reaction to the injection of tuberculin in syphilitic subjects was observed by Strauss and Pierre Teissier in 1893, and Nicolas and others have recently shown that such patients react to the von Pirquet test.

Reactions to other Toxins.—In confirmation of my views I would refer to the researches of Schick on the cutaneous reaction to diphtheria toxin in diphtheritic and tuberculous children, and also to the researches of Entz on the cutaneous reaction to various toxins in tuberculous patients. This last observer, in a series of reactions on 126 children, found that 68·4 per cent. reacted to tuberculin, 42·1 per cent. to diphtheria toxin, and 36·8 per cent. to paratyphoid toxin. In another series 60 per cent. reacted to tuberculin, and also to diphtheria and typhoid toxin, and

40 per cent. to paratyphoid toxin. Baur (*Revue de la Tuberculose*, 1908) found the ophthalmic reaction was positive in five out of six patients with icterus, these being non-tuberculous. It would appear that sensitisation of the vasomotor centres may result not only from bacterial toxins, but also from organic poisons due to hepatic insufficiency, and from biliary salts.

Conclusions.—1. The ophthalmic reaction is a diagnostic test simple in application, of considerable clinical significance, but whose specific value is not absolute.

2. It is inconstant, being absent in certain cases of advanced tuberculosis, and present in other intoxications and infections foreign to tuberculosis, so that it cannot discriminate between the tuberculous and the non-tuberculous.

3. It is not always harmless, as while the general reaction is not serious, the local reaction is often severe.

4. It is not superior to serum agglutination, as this is always harmless, more uniform, and its degrees are more readily distinguished.

5. The ophthalmic reaction demonstrates principally the degree of bacterial intoxication, whereas serum agglutination is a measure of the defensive power of the organism.

FERNAND ARLOING.

CHAPTER XVII

THE ANTI-TUBERCULOSIS MOVEMENT IN CANADA. THE CAMPAIGN IN MONTREAL

The Movement in Canada—Montreal, a Double City—The Problem of Race—Educational Crusade—The Anti-Tuberculosis Dispensary—Dr. Philip's Address to the Board of Trade at Montreal—The Work of the Catholic Sisters—"To Lead the World Aright."

The Movement in Canada.—Each city and every country offers its particular problems in connection with the campaign against tuberculosis, wherefore the record of the progress of the work in one centre is not a vain repetition of the experience of another. Indeed the conditions in different communities may be so diverse that the solution of some one difficulty encountered in one society may be incapable of general application. Nevertheless, it is interesting to observe how by different routes societies so differently constituted, as, for example, Scotland and Canada, Edinburgh and Montreal, arrive eventually at the same end.

It so happens that "The Anti-Tuberculosis Movement in Canada," the subject allotted to me, has within the last few weeks been somewhat exhaustively dealt with by Dr. J. H. Elliott of Toronto, in the pages of the *British Journal of Tuberculosis.* I thus find myself in the dilemma of either repeating in other words, and I fear uselessly, the matter contained in Dr. Elliott's paper or, if what I write is to have any freshness and value, of departing from the allotted text. Of the two horns I choose to impale myself upon the latter, and to write regarding that more restricted field of campaign with which I am the more intimately acquainted, namely the development of the anti-tuberculosis campaign in the city of Montreal.

Nevertheless I cannot pass on to my main thesis without first referring to the remarkable influence that the meeting of the International Tuberculosis Congress at Washington in October 1908 has exerted throughout the whole of North America and particularly throughout Canada. Compared with the slow and difficult progress accomplished before that meeting, the events of the last eighteen months have been

most significant. The province of Ontario has made the most notable advance. The Government of that province now contributes one-fifth of the cost (up to $4000) of any sanatorium or hospital for the care of tuberculous patients erected by any municipality or recognised association, and in addition grants $3 (12 shillings) a week for the maintenance of all patients who do not themselves or through their friends contribute over $4.90 a week. As a result, sanatoria and special hospitals are being established throughout the province. Those at Toronto, Ottawa, Hamilton, London, and St. Catherines are already open; Kingston is about to open the Sir Oliver Mowat Memorial Hospital; Galt, Stratford, and other centres are moving towards the establishment of special sanatoria, while the Muskoka and other sanatoria of older establishment are expanding and doing good work. Distant British Columbia is well to the fore. The Provincial Government has there voted $50,000 towards the establishment of a central sanatorium at Tranquille in the dry belt, and this has been opened for patients during the last few months, and branches of the Association have been established in every district. In the province of Quebec I shall refer more in detail to the Royal Edward Institute, the direct outcome of the Congress and more particularly of Dr. Philip's participation in that Congress, but it may be added that at the present moment there is sitting a Royal Commission charged to advise the Government as to the practical measures that may be taken to arrest tuberculosis, while educational work of the first order has been accomplished in Quebec itself, in Three Rivers, Sherbrooke, Lachine and other centres. Nor are the other provinces behindhand; even down to little Prince Edward's Island an active campaign is being waged. Joining and unifying all the separate efforts and individual enterprises is the National Association for the Prevention of Tuberculosis, to which this year, for the first time, the Federal Government has granted $10,000 for publication and lecture work throughout the dominion. In short, the whole country is roused up.

Montreal, a Double City.—The striking feature of Montreal, differentiating it from the other great cities of the Empire, is that it is a double city composed of two distinct peoples. Three-quarters of the population of half a million and more is French-speaking and Catholic, one quarter English-speaking and Protestant. Constitutionally these two elements are accustomed to deal with matters of public health and charity by totally different methods. From the very inception of "La Nouvelle France" the French Canadian has depended upon the Church to estab-

lish hospitals and tend the sick.[1] For matters of public health which the Church cannot undertake he looks to the Government to assume direction and meet the cost. It is almost needless to say that, on the contrary, the Anglo-Saxon conducts his hospitals and various charities by means of direct individual contributions.

The Problem of Race.—Here, then, has been the ever-present crux from the first establishment of our Tuberculosis League in 1902. For the League to be successful its activities must cover the whole population. It would be futile to attempt prevention with one section of the people, leaving the other unattended to. Both peoples must compose its executive. What practical common scheme could be evolved? This was but another of the problems constantly presenting themselves in our mixed, or more accurately, divided community, that add to the complexity and interest of life, and make for the development of a metropolitan as distinct from a sectarian and provincial spirit.

It so happened that at the time the League was inaugurated the great cities throughout America were taking up actively the sanatorium movement. Not four hours' journey to the south of Montreal over the border, at Saranac Lake in the Adirondacks, was the pioneer sanatorium colony of Dr. Trudeau doing a work of the first order. Within a very short time it was found that we could not travel along the then accepted lines. The Provincial Government, it is true, placed at our disposal a tract of 100 acres at Montagne Tremblante in the Laurentians. But to erect a sanatorium adequate for the number of early cases in the city was out of the question. Neither the city nor the Provincial Government was prepared to contribute to the building or to the cost of maintenance of such an institution. And while the English, or, more truly, Scotch charities supported by wealthy Montrealers, with scarce an exception, open their doors freely to French-Canadian patients, it was found impossible at that period to interest a sufficiently large body of these, or any individual donor, in the support of an institution which would mainly be occupied by French-Canadian patients, and to be successful would demand, in all likelihood, a staff largely French with some order of sisters as nurses. What, however, was the outstanding objection to the sanatorium system was the expense; a sanatorium of fifty beds serving only part of the population was

[1] The religious society which controls the Hôtel Dieu, the foremost French hospital, is coeval with the foundation of the city. Mademoiselle Mance and her nuns charged with the care of the sick were an integral part of the devoted band that landed with Maisonneuve in 1642.

useless. Such a sanatorium, if employed for cure, would care for little more than one hundred cases a year. The cost for these patients in other establishments on the North American continent averaged seven dollars (£1, 8s.) weekly. Even this imperfect scheme would require more than $36,000 a year; nor could we see whence so considerable an annual sum could be obtained. Here I may add that three years ago the endeavour to establish a sanatorium of the simplest type ("shack system") for educational purposes on the outskirts of the city failed to receive general support. We shall, I firmly believe, realise this eventually, but while the city fathers as a body gave us their blessing, the aldermen from the outlying wards and the surrounding municipalities effectually killed the scheme.

Educational Crusade.—There was at first, therefore, but one avenue open to us, that of an educational crusade. This was entered upon vigorously by the publication of numerous pamphlets in both languages, by lectures in the various districts of the city, and through the daily press, which from the first has afforded the most cordial co-operation. The schools and their teachers, French and English, have more particularly been approached, and here one of the most effective agents has been a catechism on tuberculosis, the cost of which was defrayed by the treasurer of the League, Mr. R. Archer. I may add that many thousands of copies of this catechism have been applied for by other cities throughout Canada. Another effective measure which has been copied elsewhere was the establishment of a Tuberculosis Sunday, on which leading physicians occupied the pulpits at the evening service in most of the Protestant churches of the city. This novel experience on their part was made easier by supplying each with a syllabus of data bearing upon the ravages of tuberculosis in Montreal and elsewhere, with headings of various subjects that might effectively be referred to bearing upon preventive measures and social hygiene. Two years ago this educational campaign culminated in a Tuberculosis and Health Exhibition opened by His Excellency, Earl Grey. Of this, perhaps the main feature was that it was the conjoint effort of the League and a large number of associations interested in the general welfare of the people—the Montreal branch of the National Association of Women, the Federation Nationale de St. Jean, the Ecole Menagère, the Provincial Board of Health, the Victorian Order of Nurses, Diet Dispensary, Red Cross, etc., etc. During the ten days it was open it was attended by some 60,000 people, including 25,000 pupils of the senior classes of the public schools, and some fifty lectures and illus

trated talks were delivered. One of the outcomes of this exhibition has been the establishment of a City Improvement League and a general increase in interest in civic matters. Hitherto Montreal, like most American cities, had almost hopelessly left civic matters in the hands of a not too pure body of city fathers.

The Anti-Tuberculosis Dispensary.—At a very early period this campaign in education brought to light the need for some agency to collect statistics and investigate the cases, details regarding which were constantly being brought to the notice of the committee. And within two years from the foundation of the League its enthusiastic first Secretary, Dr. Richer, succeeded in convincing his colleagues that a dispensary was a necessity, that it would cost very little, and that, working in close relationship with the City Health Department, it would secure a grasp upon the tuberculosis conditions in the city such as no other means afforded. His confidence proved well founded. It was not difficult to raise some $2000 a year by subscriptions. The House of Refuge, centrally situated, afforded two good-sized rooms as a home for the dispensary, at a very moderate rental; the city, which already granted $1000 a year for the educational propaganda, placed at the disposal of the League one of its health inspectors to report new cases, distribute cuspidors and literature, and advise regarding the surroundings of the patients, and their need for aid, financial or otherwise. From its opening in 1904 the dispensary showed itself an institution of the highest value. Very soon the whole time of the inspector was requisite. The number of patients attending and the other activities of which it was the centre increased rapidly year by year, until the accommodation provided was all too small.

Dr. Philip's Address to the Board of Trade at Montreal.—It was at this juncture, when the League was debating how it might expand, that at the invitation of the Canadian Association for the Prevention of Tuberculosis Dr. Philip, on his way to the International Congress at Washington, visited Montreal and some other cities of the Dominion. In Montreal arrangements were made that he should address the Board of Trade at mid-day, or, more accurately, during the lunch interval. It was a fortunate choice, for the memorable address he then delivered upon the Edinburgh system powerfully impressed one of our leading citizens who had already been approached on behalf of the dispensary, but, if I mistake not, while wishing with his sisters to establish some memorial for his father, had until then been inclined to find some other outcome for his charity. The result of Dr. Philip's speech was very

striking. Colonel Burland forthwith attended the Washington Congress, met and discussed methods with the various leading workers there, studied carefully the dispensary and its methods at Johns Hopkins Hospital in Baltimore and the Phipps Institute at Philadelphia, and on his return quietly purchased an old mansion in the heart of Montreal and proceeded to convert this into what, with the sanction of our late King, has become the Royal Edward Institute. When complete and fully equipped this was formally presented by him to the League on the remarkable occasion when, for the first time, an institution in the Greater Britain across the seas was opened by the Royal touch. Most fittingly Dr. Philip was present to see the results of his eloquent appeal made the year before. Well situated and amply provided with abundant air-space on every side, the Royal Edward Institute is an ideal centre for the anti-tuberculosis activities of the city.

Those activities, it is true, have not developed as yet in so many directions as in Edinburgh. As has been already indicated, the conditions in Montreal require very careful handling, and our first care is to keep all working together, or, more accurately, so to distribute the work as to ensure the hearty co-operation of all sections of the community. Unlike Ontario, where the Provincial Government subscribes $4000 towards the building of a sanatorium or tuberculosis hospital erected in any county, with, in addition, a grant of $4.50 (19s.) per week for each patient therein treated, the Government of Quebec Province has so far made no contributions for these purposes, although better things are hoped as the result of the recommendations to be framed by the Royal Commission on Tuberculosis, now sitting under the presidency of Dr. E. P. Lachapelle. Thus a sanatorium for poor patients is still lacking, although this year sees the establishment of two sanatoria for Montreal patients of moderate means at Ste. Agathe, some sixty miles distant, one erected by Mr. Lorne M'Gibbon and his friends at an estimated cost of $150,000, the other by the rapidly growing Jewish community of the city. In place of such the tendency is to encourage home treatment on the galleries with which most Montreal houses are provided, the Nurses of the Victorian Order here giving most effective help. In the hands of Drs. Harding and Campbell Howard the "class treatment," after the plan of Dr. Pratt of Boston, has indeed yielded better results than have been gained by sending patients to Ste. Agathe and other places in the Laurentians. Each class meets at the Institute once a week to report and compare notes; the members are given a cup of broth on arrival, and are encouraged to rest on the galleries before returning home.

The Work of the Catholic Sisters.—If this work for dispensary patients and home treatment is largely supported by the Protestant section of the community, and that without respect to creed,[1] coincidently the care of advanced cases is falling largely into the hands of the Roman Catholics. With the hearty support of the Archbishop the Sisters of Providence, who for years have conducted a hospital for incurables, now offer to care for as many tuberculous patients as the city is willing to send at the rate of $12 per month, and this irrespective of creed, so soon as they obtain assistance in building wards for their accommodation. With Dr. Newsholme we are convinced that the isolation of these advanced cases will accomplish more for the stamping out of the disease than any other mode of procedure. When it is known that the average cost of patients in the city hospitals is nearer $1.50 than $1 per diem, this generous offer of the good sisters immediately places Montreal in a more favourable position to cope with the disease than any other city in North America. The future thus is full of hope.

If I may repeat the burden of my address at the recent meeting of the Canadian Association for the Prevention of Tuberculosis, the matter of successful prevention of tuberculosis is now at base reduced to a matter of cost: reduce the cost to a minimum and rapidly the incidence of the disease must be reduced. Surely the time has come for some at least of our Protestant womanhood seeking a noble work to do in the world to follow the lead set by their Catholic sisters and band themselves together to care for the sufferers from tuberculosis.[2] It is not asked that they take a perpetual vow, nor is it necessary that they be under the dominance of a particular sect. The work to be done should be the dominating influence—it is God's work, and such as should fill their lives with generous and uplifting purpose.

"*To Lead the World Aright.*"—Thus with not a little faith I would conclude by quoting Dr. Philip's speech at the opening of the Royal Edward Institute—"Canada has a chance to lead the world aright. She

[1] The classes are maintained, the one by the congregation of Emmanuel Church (Congregational), the other by St. George's (Anglican). In both there is a large proportion of French Canadian members.

[2] It is here advisable to note that as distinguishing Canadian from British conditions, the "Workhouse" and the Workhouse Infirmary are unknown in Canada. There is thus wanting a fully developed scheme of Government provision for chronic indigent cases of incurable disease. Wherefore the various communities in Canada find themselves confronted with the problem how to deal with these cases. The helpless and hopeless case of tuberculosis is not as a matter of course cared for by the Government—but another example of the relatively slight headway made by Socialism in the New World.

has come in at a fortunate moment. In the past there has been a good deal of stumbling in the dark, and advance has been uncertain. Progress has been prevented by prejudice, misconception, and even self-interest. Canada, happily less disturbed by tradition and old institutions, can take the direct course."

J. G. ADAMI.

CHAPTER XVIII

THE ANTI-TUBERCULOSIS MOVEMENT IN SOUTH AUSTRALIA

Climatic Conditions—Death-Rate in South Australia—Legislative Measures—Notification—Powers of the Local Board of Health—Dairy Legislation—Slaughter-houses—Individual Effort—Recommendations to the Government—The Anti-Tuberculosis Dispensary—Inspectors of Tuberculous Patients—Influence of Dust—By-Law against Spitting—Sanatoria.

[The following remarks apply only to the State of South Australia, as regulations for the control of infectious disease vary in different States, on account of each having its own Health Act.]

THE health authorities of the State of South Australia have for some years been doing a great deal, but perhaps not as much as they might, to combat the ravages of tuberculosis.

Climatic Conditions.—Fortunately they are assisted by the climate, the atmosphere for the greater part of the year being dry and bright. Occasionally in midsummer it is very hot for several days at a stretch, but the extreme dryness makes the heat more endurable than in the Eastern States, where the atmosphere is moist. The climate is splendidly adapted to an abundance of open-air life, and the physician, treating a case of pulmonary tuberculosis, probably has less trouble in getting his directions as to fresh air carried out than has his confrère in severer climes. The abundance of sunshine, in conjunction with the comparative absence of overcrowding in the cities, is probably the reason why the death-rate from pulmonary tuberculosis in South Australia in 1907 was only 95 (for every 100,000 living), although tuberculosis is still by far the largest factor in the death-rate, killing more than all the other infectious diseases put together.

Legislative Measures.—As regards legal measures to control the spread of this disease, South Australia was one of the first States to make it compulsory on medical men to report every case coming under their notice to the Local Board of the district in

which the patient resides. An Act of Parliament to this effect was passed in 1898, and it came into force in 1899. The Adelaide Local Board of Health also pays fees to medical men, both for notification of change of address of a patient and for notification of death by that disease.

Unfortunately, many of the suburban and country Boards of Health do not go as far as that, but they are gradually awakening to the value of this procedure.

On notification the Local Board of Health has power to supervise the disinfection of the house either immediately upon the removal to another dwelling, or on the death of the patient. The expenses incurred are borne by the owner or occupier, but the Local Board may defray the whole or part, as it sees fit. In the metropolitan area, after notification, the case is followed up by systematic visitation on the part of a nurse specially trained to supervise and assist in carrying out the Board of Health regulations. These visits only cease on the recovery or death of the patient, or until such time as the nurse sees that there is no need for further supervision. There is no compulsory removal of a patient, and no interference with his liberty. This is unfortunate, because if each one were compelled to spend at least one month in a properly managed sanatorium, he would then be so educated that he not only could look after himself, but he would cease to be a danger to others.

Dairy Legislation.—To control any infection arising from the sale of milk, every person possessing even a single cow, and selling the milk therefrom, must obtain a licence from the Corporation, and every dairy, however small, so registered, is visited periodically by an inspector who sees that the Board of Health regulations are observed. If any animal looks otherwise than in good health it is subjected to the tuberculin test, and if it reacts is immediately slaughtered and its carcase destroyed. It is compulsory on owners to notify the Local Board of Health if any of their cows are suffering from any form of tuberculosis. If a case of tuberculosis is notified by a medical man to exist in any building used for the storage of milk, butter, cheese, or other articles of human food, the Board of Health may order the building to be closed, if there is reason to believe that these products may be contaminated.

Similar rules are observed at every slaughterhouse, all animals being inspected before they are killed, and, in addition, the meat is inspected before being offered for sale. Up to the present private slaughterhouses

have been allowed to exist, but public abattoirs are now being built on a thoroughly up-to-date scale, where all cattle intended for human consumption must be killed, and no other slaughteryards will be permitted. These regulations, of course, apply to the metropolitan area only.

Individual Effort.—The legal measures introduced to combat the disease are supplemented by individual effort. This was recently shown in a marked degree by a successful conference *re* tuberculosis initiated by a layman (Alderman W. Dollman), held at Unley, South Australia, in the latter part of 1909, and attended by representatives of all the Local Boards of Health in the metropolitan area. It was decided to place before the Government a number of resolutions, one being that power be given to Local Boards of Health to isolate any sufferer who neglects or fails to carry out the necessary precautions to prevent infection; another calling on the Government to undertake the duty of providing better means of combating the disease by increasing its subsidy to the existing public sanatorium; by establishing a fund for the maintenance of needy families whose breadwinners are compulsorily isolated or are being treated in sanatoria; by establishing a colony in the northern part of the State for the benefit of patients; by having all its buildings thoroughly disinfected and cleaned in all instances in which the said buildings are known to have been used by persons affected with tuberculosis; and last, but not least, by establishing a central dispensary on the lines of that in Edinburgh.

Anti-Tuberculosis Dispensary.—The functions of this latter were set out in detail in a paper read before the Congress by Dr. Reissmann, as follows:—A sign shall be displayed upon the dispensary indicating that here may be obtained by all patients, and by those suspected of disease, information, advice, examination, and treatment free of cost. Some patients will be assured that their complaint is not tuberculosis. These, if they are unable to obtain private medical attendance, will be referred to the Adelaide Hospital. On the other hand, all patients attending the out-patient department of the hospital who are found to be tuberculous will be referred to this dispensary. Those in the early stages will be sent for a time to the sanatorium, others may be visited at their homes, or be sent to the tuberculous wards of the Adelaide Hospital. Those patients who do not enter an institution will receive periodical visits from the dispensary nurse. If they live outside the city a nurse will visit them from the Local Board to which they have been notified by the city dispensary. To

those who need it will be given medicines, inhalers, sputum mugs, paper handkerchiefs, and receptacles to contain these when soiled.

Special short classes will be held at the city dispensary for the instruction of nurse inspectors who desire to take office under any of the local and country Boards of Health, and no person should be appointed an inspector of tuberculous patients who does not hold a certificate of competency from this dispensary. If this plan be adopted, all nurse inspectors will receive the same training, and the measures taken to prevent tuberculosis will be uniformly observed by all patients throughout the State.

All the foregoing resolutions of the Conference have been placed before the Government by means of a deputation to the Chief Secretary. How much the Government will do in carrying them out remains to be seen.

The Influence of Dust.—There is one factor in the spread of pulmonary tuberculosis which in South Australia is of considerable importance, and that is the prevalence of dust. During the occasional dust storms nothing much can be done to combat the evil, but to lessen the amount of dust arising from ordinary vehicular traffic the roads are either watered or covered with a dressing of oil. The latter method is sufficient for about a week, whereas the former in the summer has to be repeated daily. Cases of tuberculosis among sheep and cattle drovers are not uncommon, and a change of occupation has often very beneficial results.

There is a municipal by-law prohibiting spitting on the footpaths, etc., and notices to this effect are posted in the streets, tramcars, and other public places.

Sanatoria.—The sanatorium accommodation for Adelaide at present virtually consists of two sanatoria in the Mount Lofty Ranges, a few miles from the city, at an elevation of about 1000 feet. One of these is a private enterprise for patients who are in comfortable circumstances. The other is maintained by charitable bequests, assisted by subsidies from the Government and certain city and suburban Boards of Health. In return for which they have the right of nominating a limited number of patients for admission, who, however, must be in a sufficiently early stage of the disease to be likely to be benefited by treatment. For incurable cases there is a home with fifty beds, adjacent to, and worked as a department of, the Adelaide Hospital.

It is recognised in Australia, as elsewhere, that the most important factor in preventing the spread of this disease is the education of the

people. The non-observance of a few simple measures, both by those who are affected and those who are well, causes the mortality to remain unnecessarily high in spite of legislation, medical advice, and climatic conditions all tending to check it.

J. Ernest Good.

CHAPTER XIX

THE ANTI-TUBERCULOSIS MOVEMENT IN SOUTH AFRICA

THE tuberculosis problem in South Africa is complicated by questions of race and colour. Largely a native and coloured question, it is rapidly becoming one that affects the white races, with whom the natives come in contact in their capacity of domestic servants and labourers. The influx of patients from overseas, to whom our veld-highlands offered prospects of cure, has led to the establishment of numerous tuberculous centres. The servant class of these resorts has suffered severely owing to carelessness and ignorance of the nature of the disease, and they are now infecting the white races who have hitherto enjoyed a degree of immunity conferred by their more affluent social circumstances. This is borne out by the high tuberculosis mortality amongst the native and coloured population of some of these tuberculous Meccas, *e.g.* Beaufort West with an average of 14·3 per mille, Richmond with 11·5, and Cradock with 6·3 per mille. Equally high mortality returns obtain in other towns not health resorts, due to overcrowding, bad housing, and ignorance of the infectious nature of the disease. The importance of the housing problem and the destruction of tuberculous foci of infection are well illustrated by the remarkable fall in the death-rate from tubercle amongst the natives at Port Elizabeth, due to their removal to a location outside the municipality—a fall from 15·04 to 5·19 per mille. The labour centres, and especially the mines of the Transvaal, are unfortunately becoming distributing centres of tuberculosis. Thus it comes that the disease has spread to all parts of South Africa, Cape Colony, the oldest, largest, and most densely-populated State, being much more severely infected than the other colonies. The European tuberculosis mortality in Cape Colony has averaged during the last ten years 0·65 per mille higher than the mortality in England and Wales during that period, while the coloured and native death-rate averages 5·9 per mille higher.

The resistance to tuberculosis of the native (Bantu) and coloured (mixed) races has also some bearing on the question. It is decidedly

less than that of the European, judging from the more rapidly fatal course and the comparative ease with which infection occurs. This may be due in part to the more or less virgin soil these races present, but more likely perhaps to their intemperate habits and bad housing conditions.

In South Africa, as elsewhere, climate and altitude have been shown to have little effect on the incidence of the disease. This is evident from the irregular distribution of the highly-infected centres throughout the country.

The source of infection in a dry climate like this is mainly the dwelling-house or hut. The confirmed habit of promiscuous expectoration, ignorance of the elements of ventilation and of the infectious nature of the disease, and the presence of the ubiquitous house-fly constitute in many cases the steps towards implantation. The average hut or hovel provides ideal conditions for keeping the germ alive and favouring infection. Sunlight seldom or never reaches its interior, overcrowding is the rule, ventilation is unknown, and the dust of the sputum-laden mud floor is frequently disturbed by sweeping.

Inhalation of infected matter seems to be the commonest route of infection, but fly-infected food probably also plays a part. Infection has further been directly associated with dusty occupations in tuberculous localities.

The pulmonary type of disease largely predominates, but generalised miliary tuberculosis is becoming more common. Glandular disease occurs more frequently than meningeal, but *tabes mesenterica* accounts for a remarkably low percentage (6 per cent.) of the total tuberculosis mortality. Bovine tuberculosis is common only in Western Cape Colony, whilst the incidence of mesenteric disease is remarkably uniform throughout the country. I fully agree with Dr. Macvicar, who concludes that bovine tuberculosis has at present little to do with the production of human disease. The remarkable sequence of pulmonary tuberculosis on the prevalent pulmonary bilharziosis has recently been emphasised anew by Dr. Geo. Turner of Johannesburg.

Notification is compulsory in Cape Colony but quite ineffectual, as local authorities are not yet sufficiently alive to the necessity of destroying tuberculous foci of infection.

The Cape Colony Association for the Prevention of Tuberculosis is making steady progress. An active propaganda is slowly awakening an apathetic public; a small tuberculosis exhibition is being prepared

and will form part of a lecture campaign, a partial dispensary scheme is in operation in Cape Town, and in Durban (Natal) a municipal dispensary scheme has been initiated.

The campaign here lies largely in the future. The bacillus has gained a firm hold on the dark races, and indeed threatens them with extinction. The white races have at last come to realise this and also the danger to themselves, and are tardily bestirring themselves.

DAVID P. MARAIS.

CHAPTER XX

A NOTE ON TUBERCULOSIS IN INDIA

Bengal Asiatic Society—Pulmonary Tuberculosis in India—Calcutta—Bengal—Race and Sex Incidence—Age Incidence—Occupation—Incidence of Tubercle in Different Organs—Seasonal Prevalence—Propagation of the Disease.

It is rather more than fifteen years since I commenced the study of pulmonary tuberculosis as a student under Dr. R. W. Philip; a little later I had the honour of being one of the earliest Resident Physicians at the Royal Victoria Hospital, Edinburgh. During the interval that has elapsed, although I have been engaged in the investigation of the causation of more strictly tropical diseases, I have followed with interest the development of the movement for the eradication of pulmonary tuberculosis, originated in 1887 in a small way by Dr. Philip. It must be a source of justifiable pride to all of us who have taken part in this movement, in however humble a capacity, to see its world-wide extent at the present time. At the Washington Congress of 1908 Dr. Philip was presented with a map of Pennsylvania showing sixty-seven dispensaries marked on it, all on the lines of his dispensary in Edinburgh, and all founded within three years of the first.[1]

Bengal Asiatic Society.—In dealing with the question of tuberculosis in India my task has been considerably lightened by being able to refer to a most important discussion on this subject which took place in Calcutta last year before the Medical Section of the Bengal Asiatic Society. This discussion was organised by the secretary, Major Leonard Rogers, I.M.S., whose contribution towards it contained his valuable researches on the pathological and clinical aspects of the disease as met with in Bengal. The discussion was opened by Colonel G. F. A. Harris, I.M.S., and the chief medical authorities in Calcutta took part in it. As a result of the discussion, the following important resolution was unanimously carried:—

"The Medical Section of the Asiatic Society of Bengal, having discussed the subject of tuberculous disease in Bengal, and its wide prevalence, are of opinion that it is an extremely common cause of

great suffering and mortality, both among the European and Indian communities, and therefore venture to call the attention of the Government of India and the Local Government to the urgent necessity for providing a properly equipped sanatorium for the treatment of early pulmonary tuberculosis, such as has now been provided with most satisfactory results in nearly all civilised countries."[2]

It will be understood from a perusal of this resolution that the subject is a very important one for India, and will form one of the great problems which will require to be dealt with by the Sanitary Service. In India and in the tropics under the heading "Fever" a variety of different diseases are grouped. A classification of "Fevers" of the tropics, based on the results of scientific investigation, is being evolved gradually. Tuberculous disease undoubtedly accounts for a number of the cases classed under the general term "Fever."

Pulmonary Tuberculosis in India.—Amongst the causes of death recorded in India in 1908, the following figures show the mortality from tubercle of the lungs[3]:—

European Troops .	·23	per 1000 of average strength.
Native Troops .	·42	„ „ „
Prisoners (excluding Andamans) . .	3·76	„ „ „

The following table shows the admissions and deaths from tubercle of the lungs in the prisons of India (excluding Andamans) for ten years:—

Years.	Average Annual Strength.	Tuberculosis of the Lungs.			
		Actuals.		Ratios.	
		Admissions.	Deaths.	Admissions.	Deaths.
1899	98,723	770	305	7·8	3·09
1900	110,231	973	415	8·8	3·76
1901	105,020	898	372	8·6	3·54
1902	101,427	918	362	9·1	3·67
1903	88,680	769	821	8·7	3·17
1904	90,353	763	279	8·4	3·09
1905	91,917	803	293	8·7	3·19
1906	95,394	844	306	8·8	3·21
1907	93,264	704	256	7·5	2·74
1908	101,336	951	381	9·4	3·76

The Sanitary Commissioner with the Government of India,[3] in his valuable report remarks that, "In 1908 the admission rate on account

of tuberculosis of the lungs was very high—9·4 per 1000—and the death-rate, 3·76, was the highest since 1900."

Calcutta.—In Calcutta[4] the mortality from tuberculous disease is shown in the following table:—

Years.	Deaths from Tuberculous Disease.			
	Actuals.	Rate per 1000.		
		Males.	Females.	Total.
1905	2,052	1·9	3·3	2·4
1906	2,201	1·8	3·7	2·6
1907	2,241	2·0	3·7	2·6
1908	2,101	2·0	3·4	2·4

For England and Wales (1901-1905) the rate was 1·9 per 1000. For Bombay City the rate is 3·8 per 1000. As regards the relation of the disease to density of population in Calcutta, it is recorded that the disease is twice as common among the population living in huts as among those living in well-built houses. The average number of occupants per hut is 6·47, and per room in a hut 2·41. In houses the figures are 10·44 and 1·72 respectively. From this it will be seen that the population living in huts is crowded into a smaller space.

Bengal.—Turning next to the post-mortem examination evidence it will be found that this reveals a terrible prevalence of tuberculous disease in the natives of Bengal. Thus the records[5] of the Medical College Hospital, Calcutta, from September 1886 (after Koch's discovery of the tubercle bacillus) to September 1908 show that 18·3 per cent. of the total deaths were due to tuberculous disease, and in addition 7·2 per cent. show the stigmata of old lesions in the lungs, making the total 25 per cent. A noteworthy fact is the comparative rarity of surgical tuberculosis in Bengal, only 3·15 per cent. of the total deaths coming under this heading. Rogers[5] is of opinion that this is associated with "the infinitely less frequency of the disease in Indian cattle as compared with those in Europe."

Race and Sex Incidence

Tuberculous disease is rather more frequent in Mahomedans than in Hindus, but what is most striking is the much higher incidence of the disease among females. This is shown in the table given above for

Calcutta. The figures probably underestimate the mortality, because the female population of Calcutta is small, and if the number of females equalled that of males the number of deaths returned from this disease would increase. Further, it is seen that the death-rate among females of the Mahomedan race is higher than among female Hindus—5·8 and 3 per 1000. Post-mortem evidence, also, supports this fact, which is an extremely interesting and important one. It is explained by the habits of the females of India, who, as is well known, lead a much more indoor life than the males, particularly Mahomedan women, who live in crowded and badly-ventilated zenanas. These facts indicate the important part played by fresh air in the prevention of this disease. It is noteworthy, also, that post-mortem evidence shows that old healed tuberculous lesions of the lungs are found less frequently in females than in males, further indicating that, in the absence of fresh air, the healing process does not occur.

Age Incidence

Tuberculous disease is met with at all periods. In females the incidence between 20-30 is very high. Post-mortem evidence[5] shows that 61·5 per cent. of deaths took place between 20-40. It is interesting to note that the number of cases of old healed tubercle observed post mortem is much higher after 40 years. These healed lesions in the lungs are of the greatest interest and importance from the point of view of the prevention and cure of the disease. They furnish evidence in India that if the case can be detected sufficiently early and modern methods of treatment adopted, a healing of the lesion may be brought about, and not only will the patient himself be restored to health, but he will cease to be a source of infection to his neighbours.

Occupation

At the Medical College Hospital, Calcutta, out of 666 cases Harris[6] records that 34·5 followed no occupation, 19·2 were of the cooli class, 19·2 were of the clerical class; of the miscellaneous classes the highest incidence is amongst the sweepers. At the European General Hospital, Calcutta, Pilgrim[7] states that out of 651 males above the age of 15 suffering from tuberculosis, 160 belonged to the loafer class, 95 were seamen, 111 engaged in clerical pursuits, 61 were employed on railways,

42 were engineers and mechanics, 21 were employed in printing presses. The remaining 161 were divided up without any marked incidence amongst all the many other miscellaneous occupations.

Incidence of Tuberculosis in Different Organs

Rogers [5] analysed the lesions found in 220 consecutive cases in the medical post-mortem records of the last ten years and compares them with a similar series of 275 tuberculous cases in 1000 consecutive post mortems given by Osler. The following table shows the result:—

	Pulmonary Tuberculosis.	Intestinal.	Laryngeal.	Spleen.	Liver.	Kidney.	General Tuberculosis.	Empyema.	Pericarditis.	Tuberculous Peritonitis.	Perforation.	Meningitis.
Calcutta cases.	96·4	65·9	9·1	15·5	14·6	12·3	18·2	5·5	5·5	11·4	2·3	2·5
Osler's cases.	98·9	23·9	...	8·4	4·4	11·6	...	...	1·4	13·1	...	8·4

These figures bring out several points of much interest and importance. The greater frequency of intestinal lesions, mostly secondary to those in the lungs (65·9 per cent. against 23·9 per cent.), and the lower incidence of secondary laryngeal complications (9·1 per cent. against 18·30 per cent. given by Osler and 50 per cent. by Kidd) in the Calcutta series are explained probably by the climatic differences. In the tropics intestinal troubles are common, and so the resistance to infection is lowered, whilst, on the other hand, laryngeal disturbance is not so common as in colder climates. The greater frequency of the comparatively very rare lesion, tuberculous pericarditis, is very striking, particularly as other forms of pericarditis are seldom met with in India. The intestinal lesions are of particular interest in the tropics, owing to the frequency of dysentery and the importance of a correct differential diagnosis. A point of importance in distinguishing the two conditions is that, in tuberculosis, the lesion nearly always involves both the small and large intestines; in only a few cases is the large bowel alone affected, and in these cases it is nearly always confined to the cæcum and vermiform appendix. In some cases true dysenteric lesions will be found along with tuberculous ulceration of the intestine.

Seasonal Prevalence

In Calcutta the period from the middle of March to the middle of June is hot and comparatively dry; from June to September is the rainy season; from September to December is the post monsoon period; from December to the middle of March is the cold season, and the climatic conditions during this latter period are very pleasant. It is found from post-mortem evidence that 60 per cent. of the deaths from tuberculous disease in Calcutta take place in the hot and rainy seasons—April to October. During this period the climatic conditions are depressing, and tend to lower the resisting powers.

Propagation of the Disease

The conditions favouring the spread of tuberculous disease appear to be particularly suitable. Thus Pilgrim[7] states regarding the prevalence of the disease in Calcutta: "The alarming feature is the absence of cleanly arrangements in the houses of Indians, even in many good ones. I mean that the houses are not kept clean nor comparatively free from dust, and the people do not realise the danger arising from expectoration, everywhere left to dry and disseminate. I have on several occasions seen sputum from tuberculous cases on the floor, on the walls, and everywhere, and nothing that I could say brought home to the people, usually well educated and respectable, the danger of this custom." From this description it will be readily understood that all the conditions for the spread of tuberculosis are present. Further, as pointed out, in the crowded zenanas with insufficient light and air tuberculosis is rife amongst the Mahomedan women.

E. D. W. Greig.

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CHAPTER XXI

THE ANTI-TUBERCULOSIS MOVEMENT IN THE UNITED STATES

FEDERAL MEASURES.—Government Employees — The Army and Navy Medical Services—Navy Sanatorium—Army Sanatorium—United States Public Health and Marine Hospital Service — Immigrants — Seamen — Fort Stanton—The Negroes—The American Indians—Federal Penal Institutions.

STATE MEASURES.—State Sanatoria—State Dispensaries—State Hospitals — State Penal Institutions — State Insane Hospitals — Public Schools—Education—Notification—Registration — Anti-Spitting Ordinances—Outlying Provinces—Work Accomplished in 1909.

MUNICIPAL MEASURES.—The Dispensary—Hospitals for Tuberculosis—Open-Air Schools.

MEASURES SUPPORTED BY PRIVATE INDIVIDUALS. — National Association for the Study and Prevention of Tuberculosis—Press Service and Bureau of Publicity —Foreign Residents of the United States—Cost of Sanatorium Maintenance —State Societies—New York State Charities Aid Association—Fraternal Organisations—Labour Unions—Life Insurance Companies—The American Red Cross—Women's Clubs and Organisation—Sanatorium Construction—Railway Carriages—Journals on Tuberculosis.

GENERAL SUMMARY.—The Results Obtained.

Historical.—While America has had many earlier students of tuberculosis, prominent among whom may be mentioned Austin Flint and Alfred Loomis, the modern struggle against tuberculosis in America really dates from 1884, the year in which the Adirondack Cottage Sanatorium was founded at Saranac Lake, a small mountain village forty miles from a railroad, by Dr. Edward L. Trudeau. For many years the opening wedge in the various local campaigns has been the erection of a sanatorium, for it was deemed wisest to arouse public interest in the prevention of tuberculosis by demonstrating that the disease could be permanently arrested or cured. In the earlier part of the campaign, therefore, the sanatorium was the prominent feature.

In 1892 Dr. Lawrence F. Flick, whose work in Philadelphia had demonstrated that tuberculosis is a house disease, brought about the formation of the first anti-tuberculosis society in America, The Pennsylvania State Society for the Prevention of Tuberculosis.

The next advance in the anti-tuberculosis movement was undertaken in New York City by Dr. Hermann M. Biggs, who in 1891 posted

anti-spitting ordinances in the street railway cars, and in 1894 the city had adopted a law to enforce notification and registration. It should be added that the State of Michigan passed a similar law in 1893.

The Maryland State Tuberculosis Exhibit, held in 1903 under the auspices of the Johns Hopkins University in Baltimore, was the first introduction in America of a new method of instructing the public, a method which, since that time, has been used in nearly every State in the Union. At this exhibition a meeting was held which resulted in a second meeting, where in 1904 the National Association for the Study and Prevention of Tuberculosis was organised, with Dr. Trudeau as its first president.

The problem which the United States faces to-day may be stated briefly as follows:—There are constantly within its confines about 685,000 tuberculous patients, of whom about 150,000 die annually. Expressed in dollars and cents this means, allowing $500.00 as an average yearly wage of the tuberculous working man, the incurrence of a yearly loss of $114,000,000. To combat this loss the (1) Federal, (2) the State, and (3) the Municipal Governments are actively engaged, while (4) many measures supported by public contributions are springing up on all sides.

Federal Measures

The Central or Federal Government of the United States maintains to-day three separate medical boards—the Army and the Navy Medical Boards, the Public Health, and Marine Hospital Service—each entirely distinct and under a separate surgeon-general. The constitution of the United States allows these authorities jurisdiction only in interstate affairs, and while they are able to control the health of the immigrants and of the Indians (as public charges), they have no control over the negroes, whose utter disregard for hygiene makes them a source of great public danger, which must be combated by the individual States. Insurance of the health of working men has found no place in the federal measures against tuberculosis.

Government Employees.—Active measures are taken to prevent the spread of tuberculosis among all Government employees, and the following rules, first promulgated in 1906, are rigidly enforced:—

"All persons in Government employ are positively forbidden to spit upon the floors. Rooms, hallways, corridors, and lavatories shall be freely aired and effectually cleaned at least once a day and not during working hours. Spittoons shall receive a daily cleansing with very hot water, and

when placed ready for use must contain a small quantity of water. Dust must be removed as completely as possible by means of dampened cloths or mops. It should never be needlessly stirred up by a broom or duster, as this practice only spreads the dust and germs. Floors of tiling, brick, or stone must be frequently scoured with soap and water. The senior clerks in charge of workrooms will take measures to secure during working hours the admission of as much fresh air and sunshine as the conditions will permit. The use of individual drinking glasses is recommended. Persons in Government employ who suffer from pulmonary tuberculosis shall, when possible, be separated from others while at work. Such persons will not be permitted to use the public spittoons, but must provide themselves with individual sputum receivers, preferably of easily destructible material, and carry these with them on arrival and on departure. They will be held strictly responsible for the disposal and destruction of their own sputum, so that no other person's health may be endangered therefrom. Such persons must provide their own drinking glasses, soap, and towels, and shall not use those provided for the general use. Plainly printed notices, reading as follows:— 'Do not spit on the floor; to do so may spread disease,' shall be prominently posted in rooms, hallways, corridors, and lavatories of public buildings."

The Army and Navy Medical Services.—The tuberculosis death-rate in the army is stated to be 47·20 per 10,000, twice that for the British army, while the tuberculosis incidence in the navy is greater than those of Germany and Great Britain. The cause of this higher rate may be similar to that which produces a higher rate in the general population in the United States; the applicant for the United States forces may for several reasons be less robust than those abroad, or the medical examination for admission may be more lax in the United States for the foregoing reasons (Rixey). Both services maintain sanatoriums.

Navy Sanatorium.—In 1908 the Navy Department established its sanatorium at the site of New Fort Lyon, an old abandoned military reservation, near Las Animas, Colorado. All tuberculous officers and enlisted men of the Navy and Marine Corps are transferred to this sanatorium as soon as tuberculosis is diagnosed. It has a capacity of 154 beds.

Army Sanatorium.—Situated in the south-western part of New Mexico, Fort Bayard, abandoned in 1899 by troops of the line, was then organised into a hospital for the segregation of the tuberculous (constituting the beneficiaries) from the other inmates of the Soldiers' Home in Washington. Tuberculous soldiers, as well as tuberculous officers and enlisted men of the Navy and Marine Corps (1903-1907) and some tuberculous civilians attached to the army and a few others, were admitted from the first. The beneficiaries (really pensioners) are

free to leave and to return at their pleasure, but usually do return in the greatest numbers when too ill to work. All patients with pulmonary tuberculosis in the army, regardless of their condition, are admitted, and many who first fall ill at a remote station in the tropics are admitted in a hopeless condition. Nine medical officers, five of whom were formerly patients, are on duty at the sanatorium. The results of treatment have been published in detail and are excellent. For the maintenance of the hospital, the enlisted men, who, while under treatment, receive their full wage, pay 50 cents a day to the Subsistence Department of the Army. The Soldiers' Home pays $5 a week for the care, maintenance, and laundry of each beneficiary, and, in case he receives no pension, out of this fund one dollar a month is given him for tobacco. Patients with surgical tuberculosis are also received when not hopeless nor confined to bed. The capacity of the sanatorium is 400 beds.

United States Public Health and Marine Hospital Service.—This is the only department of the Federal Government which deals with the health of the citizen, and unfortunately its sphere of action is too limited. It deals directly with all matters concerning the health of immigrants, Government employees, seamen (merchant marine), prisoners in federal penal institutions, and domestic animals, maintains a sanatorium, and publishes at frequent intervals Public Health Reports and bulletins from the Hygienic Laboratory, both of which devote many pages of great value to the practical and scientific study of tuberculosis. This service has also maintained since 1898 separate wards for the tuberculous in all its hospitals.

Immigrants. — When the great number of immigrants (about 1,000,000 annually), and the fact that many go at once to the tenements situated in the congested areas of the large cities, are considered, it is readily seen that measures must be taken to protect the citizen, both from disease and from the necessity of caring for those immigrants who may speedily become public charges. For this reason all immigrants with communicable forms of tuberculosis (pulmonary, gastro-intestinal, genito-urinary) are excluded or placed under bond not to become public charges. Tubercle bacilli must be found in the secretions, but where marked clinical signs are present the immigrant may be debarred on the ground that he may quickly become a public charge.

Seamen.—Whenever a tuberculous seaman applies for treatment at a marine hospital or dispensary, the master or agent of the ship in which he last sailed is notified, and, if possible, the patient's former

quarters are disinfected (1902). As many of these patients, especially deep-water sailors, have no homes, no fixed place of abode, the Government has established (1899) a free sanatorium, known as Fort Stanton.

Fort Stanton.—This sanatorium, established by the Public Health and Marine Hospital Service in 1899, on the site of an abandoned army post in New Mexico, admits tuberculous patients in all stages, houses them chiefly in tents, and is a potent factor in the federal anti-tuberculosis campaign. The majority so improve in the sanatorium that they are able to become self-supporting after having been educated to live so as to be of no source of danger to others. The results obtained are most satisfactory. Its capacity is 250 beds.

The Negroes.—This same service has published one or more bulletins from the Public Health Reports relating to the prevention of tuberculosis among the negroes by the formation of anti-tuberculosis leagues among them, using oftentimes the Church as the opening fulcrum. Several such societies have been formed.

The American Indians.—The morbidity and mortality among the American Indians from all forms of tuberculosis exceed greatly those among the whites, and even the very high rates among the American negroes. The death-rate from pulmonary tuberculosis per 10,000 among the whites is approximately 17, among the negroes 40, while among the Indians it is 79. In 1909 among 181,000 Indians there were 1159 deaths from pulmonary tuberculosis (28 per cent. of the total deaths), while there were 2633 existing cases, and 2427 cases of other forms of tuberculosis. The disease, which is still increasing, is most prevalent in the northern and north-western United States, but nearly every tribe is affected, and the disease parallels more or less closely the degree of civilisation. An attempt at registration of all cases among the Indians is being made.

The Office of Indian Affairs, under the Department of the Interior, made, in conjunction with the Smithsonian Institution, an exhaustive study of tuberculosis among the Indians. This work has resulted in an increase of nearly 40 per cent. in the appropriation for physicians and medical supplies, has brought out the danger to the Indians of changing from an outdoor to an indoor life, emphasised the unhygienic conditions of the Indians' homes, the Indians' inherited need of fresh air, the need of the erection of proper dormitories with adequate porch facilities where suspected cases may sleep out of doors, and demonstrated the necessity for closer surveillance of the health of the children. But

the problem is a difficult one, as the reservations cover a vast territory and as the conditions of life among the numerous tribes are so varied. Consequently no uniform method of procedure would prove of value, and each local community is being studied systematically in order that measures peculiarly fitted to it may be adopted.

To-day the struggle is for better nourishment, more sanitary conditions in schoolrooms, dormitories, etc., complete sterilisation of dishes, new methods of house cleaning, fumigation of schools and books, the establishment of a travelling tuberculosis exhibit, of methods for individual physical development, of the encouragement of baseball, football, and other out-of-door games, and of camps for tuberculous patients.

Special camps and sanatoria are maintained at Fort Spokane (Washington), Fort Lapawi (Idaho), Laguna (New Mexico), Chemawa (Oregon), Fort Apache and Phœnix (Arizona) for the treatment of patients in the incipient stage. While superstition in regard to death in a building, restlessness, ignorance, and many other factors unknown among the whites render it difficult to help Indians under control in such institutions, the results are constantly becoming more encouraging.

The Indian Office has also prepared a pamphlet to be given and taught to every school child and adult who can read among the Indians, telling in the simplest way the facts he should know about tuberculosis, and showing him how he can modify his home conditions to prevent the spread of the disease. The value of such instruction of children (which is being rapidly appreciated throughout the whole United States for all races) can be seen in this case, when it is known that the Indian Office is trying to provide school facilities for all Indian children, and endeavouring to have them all attend the schools. This work is already exerting an influence.

An expert photographer, in the employ of the Indian Office, spends his entire time photographing the unsanitary conditions existing in the Indian camps and homes, which favour the spread of tuberculosis, and preparing for all schools and agencies exhibits of photographs and stereoscopic slides to show these points as well as the methods of prevention. A lecture has been prepared to accompany the different sets of slides. In addition to this, "living" pictures illustrating the same points will be shown on the reservations to the Indians summoned together from their scattered homes.

The Office also maintains a number of "field matrons" who instruct the Indians in their homes regarding sanitary housekeeping and make

numerous and repeated visits to homes where tuberculosis exists. They really do the work of visiting nurses, and their influence in persuading the tuberculous Indians to go to the sanatorium or hospital should be far reaching.

Federal Penal Institutions.—Measures have been taken in the United States Penitentiary at Atlanta to control and prevent tuberculosis among the prisoners. A tent system was inaugurated in 1905 and a farm in 1906. The federal penitentiary at Fort Leavenworth, Kansas, has a model building set apart for its tuberculous prisoners, where they receive the latest scientific treatment for their disease. The Bilibid prison in the Philippine Islands has a special prison hospital for 200 patients, the only one in the world devoted entirely to tuberculosis.

State Measures

Federal authorities have no jurisdiction over purely State affairs, a fact which must be borne clearly in mind, as it has influenced greatly the anti-tuberculosis campaign in the United States. The State alone can deal legally with the tuberculosis situation in its confines, and before any effective work can be accomplished, it has been found necessary to impress upon the citizens the grave importance of such work. It is a curious fact that indifference in regard to the disease, equalling in many instances that of the Oriental, can be broken down only by intimate contact with its dread results. For this reason many States have established State sanatoria as a preliminary step in the struggle. While at first this was probably necessary to arouse enthusiasm, more recently other methods have been employed, most potent among them being the exhibit of the National Association, and a series of public meetings at which the leaders of the people in the section have made vigorous addresses. A frequent outcome of such a campaign has been the appointment of a tuberculosis commission to study the problem in the State. Twelve or more States have done this. In the majority of States it is still deemed advisable to build a State sanatorium, but the name is no longer exactly applicable, for the requirements are very different from those of the early or private sanatoria. Here, not only healing and arrest of disease must be considered, but also prevention. The State sanatorium, with this idea in view, now admits patients who are able to be up and about, irrespective of the stage of their disease.

State Sanatoria.—Massachusetts established the first State sana-

torium in 1898, while to-day twenty-one other States have sanatoria in operation and eight more are in course of construction.

The following States have State sanatoria now in operation :—New Hampshire, Massachusetts (has four), Rhode Island, New York, Pennsylvania, New Jersey, Maryland, Virginia, North Carolina, Florida, Ohio, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Arkansas, Connecticut (three institutions). In Maine, Vermont, and Delaware State sanatoria are conducted under private auspices with State aid. This totals twenty-one States with twenty-six institutions.

These States have made provision for State sanatoria, and in cases where the sign ‡ follows, building has been begun :—Pennsylvania (two institutions), Georgia, Alabama, Indiana ‡, North Dakota, South Dakota, Oregon ‡—a total of seven States with eight institutions. Every State east of the Mississippi, except Illinois, West Virginia, Kentucky, Tennessee, South Carolina, and Mississippi, have provided institutions for the tuberculous.

The idea, however, that while the sanatorium is the main factor in the treatment of tuberculosis it is of minor importance in prevention when compared to other agencies, is rapidly spreading over the entire country.

State Dispensaries.—The dispensary plan is being vigorously pushed by the State of Pennsylvania, about $5,000,000 having been appropriated for this purpose. This money has been used to establish and maintain 115 dispensaries in every county throughout the State, often in communities where it seemed impossible otherwise to start dispensaries. So far no other State has followed Pennsylvania's lead.

State Hospitals. — State hospitals for patients in advanced stages are now building in Massachusetts and Connecticut. These States are constructing two or three hospitals in different localities, sufficiently large to care for all such patients in the confines of the State who are not provided for. Five States (Illinois, New York, Ohio, Minnesota, Iowa) have recently passed laws empowering the county authorities to levy taxes to enable them to build and to maintain county hospitals for advanced cases.

State Penal Institutions.—The recognition of the importance of tuberculosis among prisoners is due almost entirely to the efforts of Dr. J. B. Ransom, Physician to Clinton Prison, New York, situated on the eastern boundaries of the Adirondack Mountains.[1] Dr. Ransom

[1] Many of the following facts are taken from Dr. Ransom's interesting paper on "The Progress of the Anti-Tuberculosis Work in Penal Institutions of the United States," *Journal of the Outdoor Life*, 1910, vii. 125 (May).

has pointed out that 60 to 75 per cent. of the deaths that occurred in the New York State prisons in 1889 were due to tuberculosis, and in other States the conditions were even worse. When these facts were considered, together with the knowledge that 100,000 prisoners are discharged annually in the United States, of whom about 15,000 are tuberculous, the great danger to the general population is apparent. At this time isolation was considered of no importance, and not until 1892 was Dr. Ransom able to have a special wing of the prison set aside for the isolation and treatment of the tuberculous prisoners, the first step taken in America to guard against a very important source of infection. A special isolation ward was erected at Clinton Prison in 1893, and more recently (1901) a second special ward accommodating in all 150 patients, and now tuberculous prisoners are transferred here from the other State prisons in New York. As a result of this work the number of deaths from tuberculosis in the New York State prisons has decreased from 304 to 95, with approximately no decrease in prison population.

Meanwhile another experiment was proving successful in Texas, where the Wynne Farm, a State institution under the guidance of Dr. Fowler, was demonstrating that tuberculous prisoners could be successfully treated by light farm work. In 1907 Massachusetts founded a camp and hospital for 100 tuberculous prisoners near Rutland, and Connecticut, Colorado, Delaware, Georgia, Maryland, Indiana, Illinois, Michigan, Maine, Missouri, New Mexico, New York (Elmira Reformatory), South Carolina, Virginia, and others have established hospitals or farms or set aside wards for such cases.

State Asylums.—The isolation of the tuberculous insane was first carried out in Minnesota in 1894. Its importance has been clearly demonstrated by the fact that 5 per cent. of all the insane have tuberculosis, and in some asylums a much larger percentage. Twenty-one States have inaugurated segregation, and in some, special pavilions have been erected for the treatment of such patients.

Public Schools.—Many States (New Mexico, Iowa, etc.) exclude tuberculous children and teachers from the schools, requiring in some instances a negative sputum examination for tubercle bacilli, which is performed free of charge by the State authorities, before readmission. In Tennessee the Board of Education has requested that instruction about the nature and prevention of tuberculosis be given in all schools, and has issued circulars for this purpose, while in New Jersey and West Virginia wall cards giving such instruction, to which the atten-

tion of the children is called, are hung in every schoolroom. The importance of such a movement cannot be over-estimated when it is considered that out of 2,000,000 school children (census 1900) nearly 100,000 will die before reaching the age of 18 years, or about 6400 annually. If each child who dies of tuberculosis receives on an average six years of schooling, the loss to the country would amount each year to $1,152,000. At present only 6 per cent. of these children receive instruction in regard to tuberculosis.

Education.—Few if any States have not issued one or more pamphlets regarding the prevention and treatment of tuberculosis since Maine published the first, *The Prevention of Consumption*, in 1889, but few (Massachusetts, North Carolina, Porto Rico [territory]) so far have passed laws similar to that enacted by Michigan in 1905, requiring that "there shall be taught in every year in every public school in Michigan the principal modes by which each of the dangerous contagious diseases is spread and the best method for the restriction and prevention of each such disease." Michigan, to further the spirit of this law, issues a series of Teachers' Sanitary Bulletins, full of instructive advice about tuberculosis, etc.

States making provision of this sort include California, New Jersey, Kansas, New York, Rhode Island, Iowa, Minnesota, Delaware, and Texas (and Porto Rico). Ten States have appropriated nearly $100,000 to be spent in the educational campaign.

Notification.—Notification to the State Board of Health, first required by law in Michigan (1893), is now practised in many States, but so far has been rigorously enforced in few. It is felt in some States that it is a hardship to require a busy practitioner to fill out an intricate blank form, and to obviate this difficulty several States provide a small fee (25 cents to $1) for each blank. The law in New York State, patterned largely after the Maryland law, requires reports by physicians and others of the name, etc., of every person known to have tuberculosis; provides for free sputum examination, with a prompt report of the result to the applicant by the health officers; the protection of records from the public; disinfection of premises under the direction of the health officer, who can prohibit occupancy until his order is complied with; prohibits carelessness of the tuberculous patient under penalty of a fine; requires instruction of the patient in order to protect his family and associates, as well as a full report of such procedures; provides a penalty upon physicians who fail to perform these duties or who make false reports, and requires

reporting the recovery of the patient, who is then relieved from further liability under the Act.

Registration.—Many States require registration of vital statistics, but owing to the large number of negroes this has been neglected in nearly every southern State. Several States which require notification and registration of tuberculosis have passed strict laws guarding the privacy of such records.

Anti-Spitting Ordinances.—Several States (New Hampshire, Pennsylvania, New Jersey, Kansas, Connecticut, Virginia, etc.) have passed such laws. One of the briefest and yet most comprehensive is that of Virginia (1906), which follows:—

"An Act prohibiting expectorating or spitting in public places, buildings, theatres, steamboats, railways, and street cars, and other public conveyances, and requiring a sufficient number of spittoons or cuspidors to be provided in smoking compartments and smoking cars when so requested, and also requiring the posting of copies of this Act.

"Be it resolved by the General Assembly of Virginia:

"Section 1. That no person shall spit, expectorate, or deposit any sputum, saliva, mucus, or any form of saliva or sputum upon the floor, stairway, or upon any part of any theatre, public hall, or building, or upon the floor or any part of any railroad car or street car or steamboat, or upon the floor or any part of any car of interurban or suburban railway, or of any other public conveyance in the State of Virginia, or upon any sidewalk abutting on any public street, alley or lane of any public town or city in the State of Virginia; and it is hereby made the duty of the owner or lessee of every theatre, public hall, or building in the State of Virginia to provide every such theatre, public hall, or building with a sufficient number of spittoons or cuspidors.

"Section 2. It is further provided that every railroad or steamboat company shall provide in each smoking compartment or smoking car, when so requested, as many cuspidors or spittoons as may be necessary for the convenience of passengers.

"Section 3. Any person violating any provision of this law shall, upon conviction, be fined a sum not less than one nor more than five dollars, and in default of payment be imprisoned in the city or county jail for not more than five days.

"Section 4. It is further provided that printed copies of this Act shall be posted conspicuously in all public places, buildings, theatres, railway, and street cars."

The chief value of such laws has been to educate the public, a point which will be brought out more clearly under municipal measures, as few have been so far rigorously enforced.

It is of interest to note that some States (New York, etc.) not only forbid careless spitting, but provide sputum cups, disinfectants, paper napkins, and waterproof bags for the needy patients.

Outlying Provinces.—The agitation against tuberculosis has begun here also. In Hawaii notification is required and fumigation performed on request, and in Honolulu a hospital for far advanced cases was opened in 1901, where such patients are admitted from all over the territory.

In Porto Rico a sanatorium and hospital has been erected and opened, laws passed providing for dispensaries in seven towns and for the education of school children about tuberculosis. An extensive and successful educational campaign has been carried out.

In the Philippine Islands $20,000 was appropriated in 1909 for tuberculosis work, and a small camp near Manila and a sanatorium in the hills twenty miles from the city were erected. A Philippine Anti-Tuberculosis Association has just been formed. This work is under the able direction of Dr. Victor G. Heiser, Director of Public Health, under the control of the United States Public Health and Marine Hospital Service.

Work Accomplished in 1909.—The following table, showing the amount of expenditures, the number of pieces of literature distributed, the number of patients treated in ten States most active in anti-tuberculosis work, is of great interest:—

State.	Expenditures.	Literature, Pieces Distributed.	Patients Treated.
New York . .	$1,669,179.76	4,997,600	41,779
Pennsylvania . .	1,515,664.02	251,300	24,410
Massachusetts . .	1,059,123.53	217,605	10,645
Illinois . .	202,820.53	254,500	4,826
Maryland . . .	195,691.07	29,500	5,829
Ohio	245,502.17	127,000	3,197
New Jersey. . .	211,660.62	287,500	2,159
Colorado . . .	566,205.17	37,000	3,229
California . . .	254,707.14	107,075	1,900
Connecticut . .	220,190.98	13,500	1,141

Municipal Measures

Inasmuch as the incidence of tuberculosis varies directly with overcrowding and poverty, which occur chiefly in cities, it seems fitting that the struggle against the disease should be waged first and most vigorously in municipalities. In America the anti-tuberculosis campaign always starts in the cities and gradually spreads to the villages and outlying districts. The leading American cities in anti-tuberculosis work, taking into account not only the amount spent, but also the work done in every line, are New York, Boston, Chicago, Philadelphia, Baltimore, St. Louis, Pittsburg, Cincinnati, Rochester and Denver. (See also

Chapter XXIII. by Bowditch on Boston, and Chapter XXIV. by White on Pittsburg.)

The Dispensary.—The Edinburgh anti-tuberculosis scheme represents an ideal to which, so far, few American cities have attained. The free tuberculosis dispensary, about which the whole scheme revolves, is probably to-day the first step taken in a municipal war on tuberculosis, and this is as it should be. There are to-day 286 dispensaries in active service, an increase of 64 for the past year. Many of the larger cities have a number of dispensaries, and in not a few instances these are conducted by the municipal board of health.

Municipal Education.—The many methods used in various cities for education of the public are often very ingenious, *e.g.* instruction of school children by special nurses (the most important), lectures, sermons, posters, handbills, the reverse of street railway transfer coupons, stereopticon pictures at nights on top of a building near a public square, continuous phonographic lectures, etc. In only eleven cities—Washington, D.C.; Dallas, Texas; Richmond, Va.; Poughkeepsie, N.Y.; Detroit, Mich.; Malden, Mass.; Salem, Mass.; Saginaw, Mich. Knoxville, Tenn.; Pittsburg, Pa.; and New York City—is special instruction given, or special text-books used in the public schools.

Municipal Hospitals for Tuberculosis.—Few American cities, except New York, Boston, Philadelphia, Pittsburg, and Chicago, have under their control all the institutional agencies of the Edinburgh system, but thirty-three cities in all have in one place or another beds for far advanced cases. Special hospitals for these patients have been erected in Boston, Chicago, Indianapolis, Memphis, New York, Paterson, Philadelphia, Pittsburg, and Providence. In Atlanta and Minneapolis special hospitals are maintained independent of municipal aid, as well as in New York, Philadelphia, Boston, and Chicago. In New York State many of the smaller cities are uniting with the counties in building such hospitals.

Many general municipal hospitals have set aside wards for the care of tuberculous patients in advanced stages, but these are usually connected with the poorhouse, as in Boston, Philadelphia, New York, etc.

Open-Air Schools.—The question of open-air schools for tuberculous children is arousing widespread interest since the first school was established in Providence in 1908. At present New York City has twenty such schools, while Boston, Pittsburg, Cincinnati, Chicago, Hartford, Brookline, and Rochester have similar institutions. Many others are projected.

Measures Supported by Private Individuals

National Association for the Study and Prevention of Tuberculosis.—Foremost among such measures must come the National Association for the Study and Prevention of Tuberculosis.

The Association, founded in 1904, is composed of 2270 physicians and laymen. Its main object is to acquaint every man, woman and child in the United States with the etiology and prevention of tuberculosis, and to promote scientific and sociological investigation.

The Sixth International Congress at Washington was conducted by the Association, which is the American representative of the International Anti-Tuberculosis Association.

An annual meeting is held in Washington in May of each year, and the *Transactions* of the Association, as well as a copy of the *Journal of the Outdoor Life*, is sent to every member. The Association depends upon membership fees (annual $5, life $200) and voluntary contributions for funds with which to carry on its work.

Press Service and Bureau of Publicity.—For two years the National Association has maintained, under the energetic charge of Mr. Philip P. Jacobs, of the Executive Office, a press service of fortnightly bulletins to nearly 6000 newspapers in all parts of the United States, while in addition nearly 5000 weekly bulletins are distributed through the Western Newspaper Union and the American Press Association to the smaller papers in the United States.

Some idea of the subjects mentioned in this service may be gained from the following:—"Millions Educated on Consumption: One-eighth of Church-goers Heard Health Gospel on Tuberculosis Sunday"; "Prevention of Tuberculosis as an Investment: Fraternal Organisations and Labour Unions Unite to Save Members"; "Public Funds Big Aid in Tuberculosis Fight: Percentage of Official Appropriations Rapidly Increasing"; "Great Lack in Beds: Will Take Forty-five Years at Present Rate to Care for all Consumptives"; "Poor Consumptives Cause Vast Loss: Lack of Hospital Beds Costs Country over a Billion Dollars"; "Millions Spent in Tuberculosis Crusade: Survey of Year's Work Gives Interesting Figures," etc.

An editorial of 1000 words is furnished nearly every month to some 200 leading papers of the country through the International News Syndicate, while four syndicates, the Associated Press, the United Press Association, the Publishers' Press, and the International News Syndicate, which control practically the entire telegraphic news service of the country, have heartily co-operated to distribute special items, not of a

suitable nature to be sent out in regular bulletin form. It is estimated that fully 6,000,000 readers were reached fortnightly by the bulletins and dispatches.

The first Tuberculosis Sunday in the United States was a great success. This plan was an endeavour to have as many clergymen as possible devote a part of some service on 24th April 1910 to the statement of the problem of tuberculosis and its prevention. Endorsed by President Taft, approved by the governors of sixteen States, seven of whom, as well as thirty-one mayors of the larger cities, issued formal proclamations calling for the observance of this day in their respective States and municipalities, its success was assured. Nearly 40,000 sermons were preached, over 4,000,000 church-goers—one-eighth of the 33,000,000 listed communicants of the churches in the United States—listened to them, while at least 25,000,000 persons were reached by the 20,000 newspapers, journals, and magazines which gave publicity to the day.

Foreign Residents of the United States.—The mortality among the Chinese inhabitants of the United States is greatly above the average, and at the request of several prominent Chinese students a special bulletin of information and advice, endeavouring to change their traditional habits of neglecting their health, was prepared and sent out to the 600 students in the United States. This bulletin, translated at the University of Nanking, has been widely circulated in China, and has apparently been the means of initiating there a national anti-tuberculosis movement, as plans for an extensive educational campaign have been prepared. Special work has also been done among the Hungarians by distribution of Kothy's work in this language.

Cost of Sanatorium Maintenance.—This matter has been made the subject of an investigation which is nearing completion. The detailed analysis of the operating expenses *per capita per diem* under thirty different items of thirty sanatoria in various parts of the United States has been completed and the institutions classified according to capacity, length of residence of patients and geographical location, and other available data. A preliminary report states that the average cost per patient *per diem* is $1669, food representing one-third, salaries and wages nearly another third, while fuel, oil, and lights about one-eighth of the total cost. The cost was higher in the west than in the east. Only 35 per cent. of the cost was paid by the patients, the remainder being made up from other sources.

State Societies.—The Pennsylvania Society for the Prevention of

Tuberculosis was the first of its kind in America. There are at this time thirty-five other State associations of a similar nature, and several, such as Massachusetts, Indiana, Ohio, Vermont, Iowa, and Connecticut, have State commissions or State committees of medical societies which really perform many of the functions of a State society or else allot the work to the State Board of Health. In New Hampshire the State branch of the Red Cross Society fulfils this duty. It is of great interest to note that only five States—South Dakota, Utah, Nevada, Idaho, and Wyoming—have no anti-tuberculosis organisations whatever.

New York State Charities Aid Association.—In some States, as has been noted, commissions take the place of State associations, but in New York State the State Charities Aid Association has united with the State Board of Health to conduct a vigorous campaign. During the past year their slogan has been "No Uncared-for Tuberculous in 1915," a prophecy which gives every promise of fulfilment. The main object at present is to urge cities and villages in the State to procure a tuberculosis nurse and dispensary and hospital provisions. Five cities have all three, eleven have two of the three, and eight have one of the three. A second object is to urge the counties to build apart from the poor-houses a hospital for advanced stages. Eight counties have already made appropriations for such hospitals, and fourteen have appointed committees to consider the question.

Fraternal Organisations.—One of the most hopeful signs in the American anti-tuberculosis campaign is the fact that the fraternal and labour organisations have awakened to the importance of the work. In one society, the Modern Woodmen, the loss from tuberculosis from 1891 to 1907 has been computed at 13·9 per cent. of the total insurance loss, which in figures amounts to $9,065,000. The Associated Fraternities of America,[1] with a beneficiary membership of 7,000,000, have a total insurance loss of $75,000,000 annually, of which over $10,000,000 is due to tuberculosis alone. As much of this loss is preventable, some estimate even 50 per cent., active endeavours are being made to reduce it through an educational campaign and the erection of sanatoria. By this means over 3,000,000 men and women have been made familiar with the dangers and methods of prevention of tuberculosis by means of official papers, lectures, and literature expressly prepared for them.

Within two years the following fraternal organisations have joined in the anti-tuberculosis campaign:—Brotherhood of American Yeomen, Order

[1] See excellent article by Dr. A. L. Craig, in *Western Review*, 1909, vol. xv. No. 3, p. 5.

of Eagles, Improved Order of Redmen, Modern Woodmen of America, Knights of Pythias, Royal Arcanum, Workmen's Circle, Knights of Columbus, Independent Order of Foresters of America, Independent Order of Odd Fellows, and Benevolent and Protective Order of Elks. In most cases they have decided to erect institutions, and at present sanatoria are in operation in North Carolina, New Mexico, Colorado and New York, where the patients in nearly every instance receive free treatment.

Labour Unions.—The international labour unions have also been alive to the necessity of caring for their tuberculous members. The International Typographical Union, the International Photo-Engravers Union of N. A., the International Printing Pressmen and Assistants Union, and the International Boot and Shoe Workers Union have all begun work, the first and second with a sanatorium, and the third with conducting a unique educational campaign by means of which every one of its 23,000 members will hear one or more ten-minute lectures on the nature and prevention of tuberculosis. Literature is distributed and plans for home treatment devised. Furthermore, each of the members of this same union devoted during one week in May 1910 one day's wage for the anti-tuberculosis work of the union. Besides defraying the expense of the educational campaign already mentioned, $100,000 will be used to establish a sanatorium in Tennessee.

The labour organisations of Philadelphia, consisting of 75,000 men and women, have planned to erect a sanatorium and to provide for lectures and the distribution of literature. Each member will be assessed one cent a week to defray expenses.

The Central Federation of Labour of Albany, N.Y., erected a pavilion in 1908 in which any member of the federation with tuberculosis is treated free.

Since 1905 the working men of Connecticut have been active in the anti-tuberculosis crusade, and it was through their efforts that the Wildwood Sanatorium at Hartford was reopened.

The Associated Bill Posters of the United States have voted to donate to the National Association the vacant space on the bill-boards of the United States, and further offered to post up educational material on tuberculosis. This contribution is estimated to exceed $1,000,000. The Poster Printers Association later offered to print such posters free of charge, but so far paper enough for only 30,000 posters has been donated.

Life Insurance Companies.—After a careful study of the problem

of insurance against tuberculosis, F. L. Hoffman, of the Prudential Life Insurance Company, advised against such insurance. More recently the Metropolitan Life Insurance Company has decided to erect a sanatorium for its tuberculous employees. It has inaugurated in forty cities a visiting nurse service, employing the nurses of the regular visiting associations, for the policy-holders who are sick at home from tuberculosis or other diseases. Up to this time 160,000 visits to 32,000 patients have been made. The present insurance laws will not allow the company to erect a sanatorium for its sick policy-holders, but it is hoped that these may be altered. A pamphlet, "A War upon Consumption," has been printed in ten languages and 4,000,000 distributed. Two other pamphlets, one giving a list of all the anti-tuberculosis agencies in the United States, the second giving details for living and sleeping in the open air, have been prepared and thousands given away. A series of 100 tuberculosis exhibits have been prepared, and will be shown at country fairs and other places. This company has 9,000,000 industrial policy-holders, with 16,000 deaths from tuberculosis annually. If this number of deaths can be reduced to 5000, the present outlay would be more than made up.

The American Red Cross.—This society, with President Taft at its head, has been very active in the anti-tuberculosis campaign. Hundreds of thousands of dollars have been raised by the sale of the Christmas Stamps ($400,000 in 1909), and the funds donated to the establishment and maintenance of sanatoria, day camps, tuberculosis classes, visiting nurses, dispensaries, educational campaigns, material aid, etc., etc. Local work received 87½ per cent. of the gross receipts from the sale of these stamps. The State campaign in New Hampshire is conducted by the State branch of this society.

Women's Clubs and Organisations.—The Health Department of the General Federation of Women's Clubs, with a membership of 800,000, with 2000 clubs, in every State of the Union, has as one of its objects to raise the national standard of health. Under Mrs. R. P. Williams and Mrs. S. S. Crockett this department has, after a study of tuberculosis, extending over two years, decided upon a platform with two planks, "education and execution." The fact that they have raised annually for the anti-tuberculosis work $500,000, besides millions that are secured through their efforts in State and municipal appropriations, is proof of the "execution."

The Public Health Educational Committee of the American Medical Association, composed largely of women, the Mothers' Congress, the

Young Women's Christian Association are all at work, and there is no State in the Union in which some work by women has not been done.

Sanatorium Construction.—The reduced cost of sanatorium construction, made possible by the introduction of the "shack idea" by Dr. H. M. King, is of great importance in the anti-tuberculosis struggle. Many institutions are adopting this plan, which has been admirably discussed by Klebs (*Tuberculosis*, by American Authors, New York, 1910, p. 640) and by Carrington (*l.c.*). King, in a recent address, stated that a complete sanatorium for fifty patients could be built and equipped for $38,000, or $760 a bed. (Administration building and infirmary, furnished, $20,000; detached kitchen, dining-room and equipment, $6000; sleeping quarters, dressing- and bath-rooms, furnished, $7000; ground and outbuildings, $5000.)

Many special inexpensive porches, tents for roofs, open-air sleeping verandahs have been described and put into use.

Railway Carriages.—The common drinking glass or cup formerly often found in American railway coaches will soon be completely abolished. Six States have forbidden its use since Kansas passed the first law in 1909. Vacuum cleaning systems are employed by several railway companies, and sleeping coaches are provided in many instances with special basins to be used when cleansing the teeth. All cars are fumigated when necessary, and sleeping cars which run to a tuberculosis health resort at the end of each trip. Blankets, which cannot be washed so often, are covered with a sheet when used and disinfected with the car. Many States have passed anti-spitting ordinances which include railway carriages.

Journals on Tuberculosis.—While there exists in America no scientific journal devoting itself to tuberculosis, several sanatoriums publish monthly papers, which, however, are chiefly of local interest. One journal, however, *The Journal of the Outdoor Life*, New York City, devotes itself exclusively to tuberculosis and its allied problems, publishing only articles any intelligent layman can easily understand; while a second, *The Survey*, dealing only with sociological problems, devotes a certain amount of its space to tuberculosis.

General Summary

The following table prepared by Mr. P. J. Jacobs, to whom the writer is indebted for much information, will convey at a glance what has been accomplished in one year—1909 :—

Class.	Amount Spent.	Copies of Literature Distributed.	No. of Patients Treated.
Sanatoria	$5,292,289.77	...	38,758
Associations . . .	975,889.56	8,399,629	16,968
Dispensaries . . .	640,474.64	...	61,586
Municipal Work . .	1,111,967.53	1,056,780	...

During the legislative season of 1909 forty-three States and territorial legislatures were in session, and twenty-eight considered 101 and passed sixty-four laws pertaining to tuberculosis, carrying with them appropriations of about $4,000,000. Municipal appropriations of $3,976,500 have also been made. Approximately 50 per cent. of the total expenditures for the prevention of tuberculosis were made from public resources during 1909, while during 1910 the figure will probably rise to 75 per cent. The struggle against tuberculosis is largely a matter of dollars and cents. It has cost about $250 to cure an incipient case or to care for a far advanced case until death, who in all probability would infect at least two other persons. If we consider that each life is worth to the State about $1500, it is readily seen that the loss annually through tuberculosis in the United States amounts to about one billion dollars.

The growth of anti-tuberculosis institutions in the past year has been very gratifying, as the following table will show:—

Year.	Sanatoria and Hospitals.	Associations.	Dispensaries.
Before 1905	115	24	19
During 1905	15	13	5
„ 1906	17	25	11
„ 1907	35	49	51
„ 1908	71	120	88
„ 1909	133	163	91
Total, Jan. 1, 1910	386	394	265

The number of institutions has doubled but the average capacity is only two-thirds of what it was, showing the popularity of the small local tuberculosis hospital.

There are at present 22,720 beds for tuberculous patients in the United States, of which 7000 were established in 1909. Of these beds approximately 60 per cent. are set apart for incipient, 15 per cent. for moderately advanced, and 25 per cent. for advanced cases.

They were distributed in part as follows:—New York, 5476; Massachusetts, 2403; Pennsylvania, 2347; Colorado, 1489; and New Mexico, 1104.

During 1909, 38,758 tuberculous patients were treated in sanatoria and hospitals on an average 101 days, or in all for 3,200,000 days of treatment. About one-half were discharged improved, and a large per cent. of early cases were discharged with their disease apparently cured. During this year the 394 associations, with an average membership of 266, held over 6000 meetings, with an average attendance of 583, aided in some way 16,998 patients and contributed nearly $1,000,000. Within the same period of time the 265 dispensaries treated 61,586 patients, who made 606,741 visits; employed nearly 350 visiting nurses; and expended on an average about $2500 a year.

In addition to the tuberculosis exhibits owned by State and local boards of health and by the National Association, local and State associations own thirty-nine others.

While much has been done, much yet remains to be accomplished. When it is considered that only 10,000 patients out of 300,000, too poor to pay for sanatorium or hospital treatment, can be treated free, it is readily seen that the anti-tuberculosis work is but begun. In Alabama, Idaho, Montana, Nevada, and Wyoming, with a combined population of over 5,000,000, the destitute cases can procure treatment only in jails or asylums, and in most cases not even there. In nine other States and territories (Alaska, Delaware, Florida, Kansas, Minnesota, South Carolina, South Dakota, Vermont, and West Virginia), with a combined population of over 7,000,000, less than fifty beds each are provided for this class; in many States not one in fifty of the poor patients can find a bed, and only in New York and Massachusetts is the number great enough to accommodate one in ten. When it is considered that 100 per cent. more deaths from tuberculosis occur among the poor than among the well-to-do, and that 65 per cent. of the tuberculous in the United States are too poor to pay for proper treatment, the conditions that exist to-day may be grasped.

The Results Obtained.—The United States covers a vast area, the anti-tuberculosis campaign is of recent origin in its confines, and unfortunately too markedly limited to certain localities for it to produce as yet any effect upon the general tuberculosis mortality. Even in New York, Pennsylvania, and Massachusetts the efficient crusade is all but too young to show its influences. But the time will surely come, and that probably in the life of the next generation, when tuberculosis will

occupy among diseases the position that smallpox does to-day, when only a few cases will occur and those due to the ignorance and stupidity of misguided individuals.

LAWRASON BROWN.[1]

[1] The writer wishes to express his thanks to Dr. Livingston Farrand, Executive Secretary, National Association for the Study and Prevention of Tuberculosis; Mr. P. J. Jacobs, Assistant Executive Secretary; Surgeon-General Robert M. O'Reilly, U.S. Army; Surgeon-General P. M. Rixey, U.S. Navy (Retired); Surgeon-General Walter Wyman, United States Public Health and Marine Hospital Service; Dr. Jos. A. Murphy, Medical Supervisor, United States Indian Service; Dr. W. C. Braisted, Chief of Bureau of Medicine and Surgery, Navy Department; Dr. R. N. Hickman, Chief Quarantine Division, United States Department of Agriculture; Dr. B. V. Woodward, Acting Chief Quarantine Division, United States Department of Agriculture; Mr. C. F. Hauke, of the Indian Office; Dr. J. B. Ransom, Physician to Clinton Prison, Dannemora, New York. Mr. Warwick S. Carpenter, Editor, *Journal of the Outdoor Life;* D. A. L. Craig, Medical Director, Old Colony Life Insurance Company; Dr. Lee Fraenkel, Medical Director, Metropolitan Life Insurance Company; and to Major Geo. M. Bushnell, Army Sanatorium, Fort Bayard, New Mexico, whose kindness has made it possible to collect the facts necessary for this article.

CHAPTER XXII

ADMINISTRATIVE MEASURES FOR THE CONTROL OF TUBERCULOSIS IN NEW YORK CITY

The World-Movement—The Edinburgh System—Problem in New York City—Clinics or Dispensaries—Central Hospital Admission Bureau—Day Camps—Open-Air Schools—Seashore Hospitals—Tuberculosis Preventorium for Children—Free Hospitals for Advanced Cases of Tuberculosis—Hospitals with Accommodation at Small Cost—Sanatoria for Hopeful Cases—Industrial Colonies for Arrested Cases—The Future.

The World-Movement

The world-wide campaign in recent years directed toward the prevention of tuberculosis has resulted in the institution of administrative measures for the control of this disease, more or less comprehensive and effective, in almost every large city of Great Britain and its colonies, and in the United States. The scope of the various schemes adopted in these places, however, vary vastly as to completeness and to the efficiency with which they are enforced. Unfortunately, in many cities in our own country at least, not much more has been done than to institute an educational campaign and to enact certain sanitary rules, regulations or ordinances, which are often not subsequently enforced, largely because of the lack of facilities, on the part of the authorities, for such enforcement.

The Edinburgh System

I think it may be fairly said that at the present time in Edinburgh and New York more comprehensive and satisfactory plans are actually in operation than in any other cities, although in recent years several of the larger towns of England have put into effect very complete measures. So far as I can learn, to Dr. R. W. Philip and to Edinburgh belongs the great credit of having very early appreciated the significance to the whole tuberculosis movement of the special tuberculosis dispensary, and of having really initiated the movement for the control of this disease by the establishment of a special institution in that city.

It was a long time before the example of Dr. Philip in this respect was followed. Commencing with this special dispensary, and working with untiring energy and unbounded enthusiasm, directed by an unusually far-seeing and intelligent conception of the significance and scope of the work, Dr. Philip and his co-workers gradually elaborated a comprehensive scheme covering all the phases of the problem. In this work their voluntary efforts have in recent years been supplemented by the co-operation of the sanitary authorities, who have provided for notification and registration, the disinfection of premises, and the other necessary preventive measures.

Problem in New York City

In New York, as I have previously pointed out, the procedure has been quite different, but the resulting plan, which is now in effect, is not unlike that of Edinburgh. In New York, of course, the problem is a much greater one than in Edinburgh, and is, I believe, a far greater one than any sanitary authorities have to meet anywhere else in the world, for the Board of Health of New York City has absolute jurisdiction over all sanitary matters in the city, with nearly five millions of inhabitants, while in London, which is the only city larger in size than New York, the supervision is divided among a number of sanitary authorities who are limited in their activities by the regulations which may be established by the Local Government Board of England.

In New York, as we have had a free hand to do what we felt should be done, with only such limitations as were imposed by the funds available for carrying on the work, we have instituted what we have regarded as the best plan for meeting the indications. In discussing the administrative measures for the control of tuberculosis I shall, therefore, largely confine my description to certain of the provisions which have been adopted there.

I shall not attempt a discussion of certain of the administrative measures concerning which there is now a substantial agreement, such as notification, registration, sputum examination, disinfection, etc., but shall confine myself to a discussion, particularly, of the variety of institutions for the care of tuberculous persons, which are important or essential to the success of the work.

There should be available in every great city, in any comprehensive scheme for the administrative control of tuberculosis, a number of kinds of institutions for the care of tuberculous persons as follows:—

Clinics or Dispensaries

I regard special tuberculosis clinics or dispensaries as constituting the initial step and a fundamental part of any successful scheme for the prevention of this disease. As I have said before, the importance of this was first recognised in Edinburgh. In any great city there should be a considerable number of dispensaries conveniently located in every district of the city, so that they are readily accessible to patients. At the present time, in New York, a very complete and well co-ordinated system of special tuberculosis dispensaries exists. It is more complete, I believe, than is to be found in any other city in the world. These dispensaries, in the borough of Manhattan, are all under the general supervision of the New York Association of Tuberculosis Clinics, which is an incorporated organisation. It has on the board of managers a representative of each dispensary. In the other boroughs of the city the special clinics are all conducted by the Department of Health and are under its sole direction. The borough of Manhattan comprises about one-half of the population of the entire city. The Department of Health has, in the borough of Manhattan, direct supervision of three dispensaries, and the Board of Trustees of Bellevue and Allied Hospitals, which is a co-ordinate city department, has the supervision of three others. The remainder in the borough of Manhattan are conducted by private organisations, associations or hospitals, as, for example, Roosevelt Hospital, Presbyterian Hospital, Mount Sinai Hospital, the German Hospital, etc.

The borough of Manhattan is divided into nineteen districts, and each district has a special tuberculosis dispensary situated in it. Certain conditions must be complied with to obtain membership in the Association of Tuberculosis Clinics and to have a district assigned. These include the provision of adequate space for the care of patients, assignment of competent physicians, compliance with certain methods of administration, history-taking, etc., and the provision of trained nurses to visit, in their homes, all cases which come under its care in its district. Only those cases of tuberculosis living in the respective districts are treated at each of these dispensaries. Any patient appearing at any dispensary from outside its district is, after physical examination (if found to be suffering from tuberculosis), reported to the Department of Health and referred to the district in which he or she lives. Thus each dispensary is made directly responsible for the supervision of all home cases in its district, needless duplication of

labour is avoided, and concentration of work is rendered possible. Each dispensary, through its visiting nurses, is able to keep constantly in close touch with all the patients in its district. If a patient moves from one district to another, the history cards are transferred to the district to which the patient has moved. A number of dispensaries, not under the direct supervision of the city departments, provide their own visiting nurses. About one hundred and sixty nurses for the home visiting are furnished by the city. To each district is assigned a corps of nurses (with one head nurse in charge), depending in number upon the size of the district and the number of tuberculous patients located in it.

Connected with a number of dispensaries, including those of the Department of Health, there are auxiliaries composed of ladies interested in this work. They supplement the work of the sanitary authorities by providing those things (needed by tuberculous patients and their families), which the sanitary authorities are unable to furnish, such as better living apartments, additional beds, clothing and food, assistance in the support of the family in the absence of the bread-winner, who may be in a hospital or sanatorium, etc. These auxiliaries have given invaluable assistance in many cases, and are almost indispensable to the proper conduct of the work.

In the other boroughs of the city dispensaries are maintained by the Department of Health under similar conditions. During the year 1910 more than 77,000 separate visits were made to those of the Department of Health, and the nurses made more than 241,000 visits to the homes of patients, to give instruction, to leave circulars, obtain data as to the condition of the patient and of the family, the social status and financial income, the sanitary condition of the premises, the health of the other members of the family, the character of the light and ventilation, the amount of air space for each person, the precautions being observed, the possible need for any further interference on the part of the authorities, the necessity for relief in the way of additional food, clothing, beds, etc., or for the provision of more sanitary apartments, or for assistance in nursing, cleaning, housework, etc. The nurses make monthly and, where necessary, more frequent visits.

Every tuberculous patient discharged from a hospital or sanatorium, on returning home, is reported to the dispensary in his district, and comes directly under the supervision of the nurses. Nurses, also, assist in bringing the apparently healthy children in tuberculous families to the dispensary for examination. Special classes for tuberculous children have

been established. These are distinctly for tuberculous children, and their work differs from that which is done in all dispensaries in connection with the examination of children from families in which one or more cases of tuberculosis exist.

Central Hospital Admission Bureau

In a great city like New York, where a large number of institutions are maintained, directly or indirectly, at the city's expense for the care of tuberculous patients, a central hospital admission bureau is necessary. Through this all admissions and discharges to institutions for tuberculous patients pass, and the assignment of cases to the institutions best fitted to meet their special requirements is made. This bureau in New York is administered in connection with three of the city departments, which come into relation with tuberculous patients in some way. These are the Department of Charities, the Department of Bellevue and Allied Hospitals, and the Department of Health. Each of these departments has the supervision of one or more institutions which care for tuberculous patients. The Admission Bureau is under the charge of, and is administered by, the Department of Health. Cases of tuberculosis applying for admission to a hospital or sanatorium, as well as all cases which are referred by dispensaries scattered throughout the city for admission to such an institution, apply at the Admission Bureau, and are assigned to a proper institution. A notification of a proposed discharge from an institution must be made to the Admission Bureau in advance of the discharge, and the Admission Bureau in turn notifies the district dispensary of the proposed return of the patient to his or her home. A nurse is then sent to the address given by the patient, to which he or she expects to return, and an investigation is made to determine the suitability of the conditions. If they are found to be unsuitable for any reason, and the patient is in an infectious stage of the disease and insists upon discharge from the hospital, he or she is then transferred to the Riverside Hospital of the Department of Health, where the retention can be enforced. At the present time there are nearly four thousand beds available in public and private institutions for tuberculous persons in New York City.

Day Camps

Day camps for the care of patients who for any reason are not able to obtain admission to institutions, or who are compelled for any cause

to remain at home, have considerable value. In New York, in place of day camps, discarded ferry boats are employed. Four of these are maintained by the city and are moored at different convenient points on the river front. Tuberculous cases from the neighbourhood spend the day, or it may be the night, on one of these ferry boats. They are supplied with milk and eggs in the middle of the morning and in the middle of the afternoon, and a full meal at midday. One open-air roof camp of the same character is also maintained in connection with the Vanderbilt Clinic.

Open-Air Schools

Open-air schools of two types should be provided—*First*, for children who have open tuberculosis; and *second*, for anæmic and debilitated children, or those who give a tuberculin reaction but have no clinical symptoms of tuberculosis or definite ascertainable lesion. In New York open-air schools for tuberculous children have been conducted on ferry boats, and open-air schools for anæmic and debilitated children are being provided by the Board of Education. The latter authorities are also providing for open-air schools for crippled non-tuberculous children.

Seashore Hospitals

Seashore hospitals for tuberculous disease of the bones, joints, and glands in children. Such an institution is extremely desirable, or, possibly, where this can be arranged, a similar institution at a high altitude for treatment by the direct rays of the sun, after the method of Rollier at Leysin. A small seashore hospital for this class of cases has been established in New York, and the results obtained have been most encouraging. Plans are now under consideration by the city authorities for the extension of this work.

Tuberculosis Preventorium for Children

A proper institution located in the country for the care of children (especially those from tuberculous families) who are likely to develop tuberculosis, or who already give a tuberculin reaction but have no definite lesions, is of the greatest value. Such an institution has been established in New York City, and, while it is a private incorporated institution managed by a board of trustees and is partly maintained by

private contributions, still it receives a definite *per capita* allowance from the city for the care of poor children who are sent to it from the tuberculosis clinics of the city. The purpose of such an institution is, naturally, to improve the general health of the children—to increase their resistance and thus to protect them from the development of tuberculous disease or from the extension of any existing lesion, while at the same time measures are being taken in the homes from which they come to obviate, as far as possible, the dangers of subsequent infection. The Garden and Playground Association in New York deals with a somewhat similar class in another way within the city limits.

Free Hospitals for Advanced Cases of Tuberculosis

Two classes of public free hospital should be available, as is the case in New York. *First*, a hospital conducted directly by the sanitary authorities, and intended, primarily, for advanced and dangerously infective cases and those which are compulsorily removed and retained. It is, of course, evident that the point of view of the sanitary authorities and the institutional authorities, with reference to the inmates of an institution, so far as a communicable disease is concerned, must be quite different. The managers of an institution, naturally, desire to dismiss at once from the institution any patient who is vicious or insubordinate, or who fails promptly to comply with the rules of the institution, or one who is for any reason particularly undesirable. From the sanitary standpoint, such cases are the ones which are the most serious menace to others and must be provided with institutional care at all costs. Riverside Hospital was first designated by the sanitary authorities in New York particularly for cases of this kind. There are now available in this institution three hundred and fifty beds, and accommodation for one hundred and fifty more will be completed within a few months. *Second*, hospitals for advanced hospital cases. These are really homes in which the advanced cases should be made as comfortable as possible until they die. The New York municipal authorities provide, either in their own institution or by subsidy, for the care of more than two thousand five hundred advanced cases.

Hospitals with Accommodation at Small Cost

It is extremely desirable, in my opinion, that hospitals should be available for those patients who are able to pay a small sum for their

care and who are unwilling to enter a charitable institution. While limited accommodation of this kind is to be obtained in New York, it is totally inadequate, and I believe always will be inadequate, unless it is provided by the municipal authorities. Many patients will readily pay five dollars or ten dollars a week, which, perhaps, would not be sufficient to cover the cost of their maintenance in a proper institution. The balance must be either provided by the authorities or by private voluntary contributions.

Sanatoria for Hopeful Cases

The importance of sanatoriums for the care of early cases of tuberculosis was one of the first needs recognised, and both public and private sanatoriums have been widely established. In any administrative scheme both varieties are important. There are available for different types of tuberculous cases in New York City municipal, State, semi-public, and private sanatoriums. The municipal and State sanatoriums are entirely free; the semi-public sanatoriums are either free to selected cases or the charges are below the cost of maintenance, *i.e.* five to ten dollars per week; at the private institutions the charges are much higher.

The sanitary authorities have built an institution, which now has accommodation for four hundred patients, which is situated at Otisville, New York, about seventy-five miles from New York City, in a delightful hilly country at an elevation of about 1200 feet. At this institution it is intended eventually to provide for one thousand patients. The municipal authorities have also provided for another institution situated in one of the outlying boroughs, but within the city limits, which is partly completed, and which, when completed, is intended to provide for one thousand more patients.

The New York State Sanatorium for incipient tuberculosis, with three hundred and twenty beds, is situated in the Adirondack Mountains, 350 miles from New York City. The City of New York has a definite quota of beds assigned to it in this sanatorium (about one-half of the capacity of the institution), and the city pays for the care of each patient fifty cents *per diem*; the remainder of the cost of maintenance is provided by the State through annual appropriations. Only very early favourable cases are accepted in this institution.

We, in New York, have come to feel more and more strongly that the sanatorium should be employed in a much broader way than has

been usually the case. It should really furnish the solution of the institutional care of all cases of tuberculosis, excepting the advanced, febrile, hopeless cases. When the municipal sanatorium at Otisville was first opened, only early favourable cases were sent there, but gradually we have let down the bars, and now any case of tuberculosis which in the judgment of the admitting physician is in such physical condition as to be capable of making any considerable degree of improvement may be accepted. Thus, only about one-third of the patients are really early cases.

Experience with us has shown that satisfactory buildings for sanatorium purposes can be constructed at much lower cost than is the case for hospitals, and the cost of subsequent maintenance of patients in a sanatorium is also less than in a hospital, while the maximum benefit derived is far greater than in the latter institutions. There is, therefore, every reason to develop the sanatorium at the expense of the hospital.

Industrial Colonies for Arrested Cases

As in the case of tuberculosis dispensaries, Dr. Philip was one of the first to meet a widely recognised demand by the establishment of a farm colony for arrested cases of tuberculosis. It seems to me that the care of these cases constitutes one of the most important questions in the whole problem of the prevention of tuberculosis, and it has been thus far almost untouched. It is, of course, an extremely difficult problem to solve. Under the conditions in which a large proportion of the labouring classes in New York live, the return to their homes of arrested cases means, sooner or later, a recurrence of the disease. A large percentage of cases, as the result of the education, training, and advice which they receive, find some kind of occupation out of doors and outside of the city, but too often the conditions under which they live are unfavourable, and they are unsuited to the work which they obtain. A still larger number of persons are compelled to return to New York to their former occupations and environment.

It has been a policy of the management of the New York Municipal Sanatorium since its inception to administer the institution as largely as possible through arrested cases. Work is provided for a considerable number, and experiments are now being undertaken to build proper houses for such employees and their families, and to actually supervise all the conditions of the life of these ex-patients and their families, even as if they were still inmates of the institution. The great difficulty,

however, of course arises from the relatively small number of the positions open. What is needed is an industrial colony where proper occupations can be provided under proper conditions and with proper living quarters, where arrested cases can earn a livelihood and maintain their health. I believe such an industrial colony, once established, could be made self-supporting, but a large fund would be required for the erection of sanitary workshops and houses and the conduction of the business of such a colony. The future will probably see the solution of this.

The Future

Where such a comprehensive scheme as has been outlined in part above can be made effective, in my judgment there is every reason to look forward for a steady and continuous reduction in the morbidity and mortality rate from this disease, but the extinction of tuberculosis will only be achieved when many, as yet, unsolved social and economic problems have also been satisfactorily met.

Hermann M. Biggs.

CHAPTER XXIII

THE MOVEMENT IN THE STATE OF MASSACHUSETTS

The Sharon Sanatorium — The Sanatorium Movement — State Commission — Medical Activity—Social Organisation—Provision for Children—Institutions for Advanced Cases—Boston Tuberculosis Hospital—The Boston Association.

The Sharon Sanatorium

The first decided step in the anti-tuberculosis movement in Massachusetts and in New England was made in 1891, when the Sharon Sanatorium was opened for the reception of women with symptoms of pulmonary disease. Begun as an experiment by the author of this article, with the aid of wealthy charitable people of Boston and in pursuance of the teachings of the late Dr. Henry Ingersoll Bowditch, who believed that much could be done for the cure of early cases of tuberculosis by hygienic methods, the institution has grown in its twenty years of existence from a nucleus for housing nine people to buildings capable of holding twenty-four patients. From necessity and for purposes of closer observation the sanatorium has been left comparatively small and for several years was quite unique. Although following the general principles taught by Brehmer and Dettweiler in Europe, and by Trudeau in America, it differed from their institutions in its situation at a comparatively low altitude (about 250 feet above sea-level). This proximity to the seacoast, and exposure to the changeable, harsh, inclement New England climate, had been thought, previous to that time, to be distinctly unfavourable to the treatment of tuberculous disease. As it is a charitable institution, for nineteen years the price of board was only five dollars a week, exclusive of laundry. Recently, however, owing to the greatly increased cost of living, the directors have felt obliged to raise the charge to ten dollars a week, which still leaves a large annual deficit which has to be obtained from the public. This latter fact, therefore, still keeps it within the limits of a medical charity.

The project was naturally at first regarded with scepticism, both by the medical profession and by the laity; but the results shown in the following years, often surprising even to those who had favoured the plan, were sufficiently convincing to encourage others to adopt similar methods. The astonishing growth of the anti-tuberculosis movement in the past few years is sufficient proof of the correctness of view held by those who began the campaign.

The result of this experiment and of later experiments of a similar nature, has been to remove the victims of this disease in great measure out of the realm of utter hopelessness into one bright with the prospect not only of alleviation but even of cure.

The Sanatorium Movement

The sanatorium movement in Massachusetts and elsewhere was beneficial in more ways than one, for it not only taught that tuberculosis could be arrested in a large number of cases by comparatively simple means, but also emphasised the importance of attacking the disease in all its phases. Its educational effect upon the community at large as to the value of hygienic living as a means of prevention as well as a cure of disease can hardly be over-estimated.

The fact that at one time in its history the belief in this method temporarily waned, owing to the ill-judged and extravagant statements and claims of over-zealous people, was in itself a potent cause for the growing belief in after years that in order to eradicate the disease or to get it under such control that its mortality should be lessened, additional means must be found for treating every kind of case, whether incipient, advanced, or even suspected, not only in sanatoria, but in hospitals for far advanced cases, in dispensaries, in the homes of the poor, open-air schools, in day and night camps, in short by every method known to modern science.

In June 1895, four and a half years after the establishment of the Sharon Sanatorium, a bill was approved in the Massachusetts Legislature for the establishment of a so-called "Massachusetts Hospital for Tuberculous Patients." This bill was introduced by philanthropic people among the laity and a few medical men, the first instance in America of the formation of a State institution for the poor afflicted with tuberculosis. The sum of one hundred and fifty thousand dollars (£30,000) was appropriated for the purpose. A Board of Trustees was appointed; a section of land in the village of Rutland,

situated on the central hills of Massachusetts, having an elevation of about 1100 feet, was then selected, and buildings were erected. At first there had been no intention of establishing anything more than a hospital or home for all classes of pulmonary tuberculosis, but the trustees wisely decided later to change the character of the institution to that of a sanatorium for the early and more hopeful cases. As stated in one of the earlier reports, they based their decision largely upon the results which had already been obtained at the small institution at Sharon. The sanatorium was not formally opened, however, until three years later, in October 1898. In 1900, after two years of existence, the name was changed to that of the "Massachusetts State Sanatorium."

The buildings, made on the pavilion ward plan, were capable at first of holding 175 patients. Later the capacity was increased to the number of nearly 400 beds. The price of board was first fixed at $3.50 a week, but subsequently was raised to $4, at which point it has remained up to the present time, the large annual deficit being supplied by the State.

At the outset it was thought best to put the medical directorship into the hands of those who had made a special study of sanatorium methods, and for this purpose two specialists from Boston were appointed to make weekly visits to the sanatorium, the chief part of the work being done by resident assistants. This plan was in force for about seven years, when a medical superintendent was appointed, upon whom, with his assistants, the care of the patients should devolve, and the former attending physicians retired.

In 1898 Dr. Millet was successfully treating cases of tuberculosis among the poor by building small balconies upon the houses, thus encouraging among the working classes the habit of sleeping in the open air. This movement was probably the first to establish the custom which is now so commonly used throughout the country, even in large cities. The frequent success in arresting the progress of tuberculous disease by this means, without compelling working people dependent upon their own exertions to give up their occupations, is already a matter of history, and marks one of the most important forward steps in the treatment of tuberculosis.

During the ten years following the establishment of the Sharon Sanatorium in Massachusetts the interest of the public was slowly but surely becoming aroused to the idea of successfully combating

tuberculosis. The newspaper press took up the subject with zeal, and the belief that there was hope of eradicating the disease, or of at least keeping it under control, began to spread like a prairie fire through the State and gradually over the country.

State Commission

Following the foundation of the State Sanatorium at Rutland, the Legislature of 1907, in consequence of popular demand and the recommendation of a Commission appointed by Governor Guild in 1905, appropriated £60,000, later £3000 more, for the establishment of three hospitals, to hold 150 patients each, in the western, north-eastern, and south-eastern parts of the State. These hospitals, which were opened within the last year, are devoted to the care of more advanced cases than those received at Rutland, and for which there has been up to recent times a lamentable need of proper care. At time of writing they are in complete working order, and, including the Rutland Sanatorium, are now all under the supervision of the Massachusetts State Commission. They and the Rutland Sanatorium offer about 850 beds for incipient and advanced cases of pulmonary tuberculosis. When we include the accommodations for tuberculous patients in prisons, insane asylums, special wards in general hospitals and in private institutions, we find that there are about 2400 beds for all such patients in the State, a number greatly out of proportion to the necessities of the case. With the rapid increase of such institutions in our cities and towns, however, this unfavourable proportion will soon change for the better.

The Massachusetts State Commission is now in close connection with the State Board of Health, the State anti-tuberculosis work being carried on by these two departments. By a recent Act of the Legislature fifteen District Medical Inspectors were appointed to work under the supervision of the Board of Health. It is the duty of these physicians to make a careful study in each district of the conditions under which people are living and working. They must see that laws are enforced, and act as a direct means of communication between the people and the State Board of Health.

The Commission was given power "to disseminate information in regard to the disease," and this is being done as far as is possible on a very small appropriation. They are in communication with the National Association for the Study and Prevention of Tuberculosis

by means of bulletins which are distributed to nearly two hundred newspapers throughout the State. Circulars of information, reports and pamphlets in regard to the disease, are kept on hand at the office of the Commission, ready to be sent throughout the State to all who may apply for them. The Board of Education, the local associations and Boards of Health are also in constant communication with the State Commission in matters pertaining to the subject of tuberculosis.

Medical Activity

It is interesting to note the increased activity among the medical profession throughout the State. Chiefly through the activity of Dr. Arthur T. Cabot, of Boston, when President of the Massachusetts Medical Society a few years ago, a number of "Associated Committees of the Massachusetts Medical Society for the Prevention and Control of Tuberculosis" were formed. These associated committees, of which there is one for each medical district in the State, consist of two hundred acting physicians from all the large cities and towns in Massachusetts. Yearly reports from each committee keep all acquainted with what is being done throughout the State. This method of affiliation with the parent society differs from that of other States in which the State Tuberculosis Association, if there is any, is independent of the State Medical Association. The advantage of the Massachusetts method would seem to be that if application comes to the headquarters of the State Association in Boston for information the matter is referred back to the local committees, and thus keeps each committee man in touch with local needs.

Social Organisation

Throughout the State the various social organisations, like the associated charities, the social service departments and others, are in close touch with these associated committees; for while their work is by no means confined to tuberculosis, they come in constant contact with the disease, and their work is all consistent with the methods adopted by the medical associations.

The public is fully aroused in the State to the great importance of active co-operation throughout all classes of society in the anti-tuberculosis work. Women's clubs are formed for the special purpose of promulgating the modern ideas as to what must be done to combat the disease. The churches throughout the State are beginning to

take part. The work of the Emmanuel and Arlington Street Churches in Boston, the first to establish the "Tuberculosis Classes," under Dr. Pratt and Dr. Wood, are examples which show vividly what can be done in teaching poor people how to cure and how to prevent tuberculous disease. These classes are composed of the tuberculous poor in the church parish. They report at regular times to the physician, and are visited in their homes and given instruction by volunteer visitors as to proper methods of care of themselves.

Manufacturers are gradually awakening to the fact that they, from motives of economy as well as humanity, must take active steps to teach their employees the laws of hygiene, to prohibit spitting on the floors, to procure proper methods of ventilation, and to see that those of their employees who are already afflicted shall be properly cared for in their homes, and that those who are suspected of possibly having tuberculosis shall be under the supervision of some medical authority.

It is a most promising and surprising fact to notice the diminution of the habit of spitting in the street cars since the notices prohibiting such action have been placed there. The steam railways are now following their example with gratifying results, although there is still much to be desired as far as smoking-cars are concerned.

In the year 1905 there were twenty-two anti-tuberculosis associations in Massachusetts, and at the time of writing the number has increased to one hundred and fifty, a most impressive and gratifying proof of the interest which the laity as well as the medical men are taking in the subject.

Provision for Children

Following the teachings of medical men that pulmonary tuberculosis could be prevented and cured by hygienic measures, it came to be recognised that the same methods should be adopted in other forms of tuberculosis, especially bone disease. In accordance with this idea the Hospital School for Crippled Children was founded by the State in Canton, Mass., a healthy country town not far from Boston and adjoining the town of Sharon. The hospital was opened in 1908, and accommodates 120 patients, and the results obtained there are most gratifying.

Several years previous to the foundation of this Hospital School the surgeons attached to the Children's Hospital and the House of the Good Samaritan in Boston (both private institutions supported by the public) believed that greater stress should be placed upon hygienic treatment

in the cases of tubercular bone disease. In both of these institutions, therefore, special accommodation was made for carrying out this idea.

The present House of the Good Samaritan is situated in the immediate suburbs of Boston, and now has all modern arrangements for out-of-door treatment of cases by means of large balconies attached to the building. This hospital has accommodation for twenty-five cases of surgical tuberculosis, and it also receives other forms of tuberculous disease as well as chronic diseases of other nature.

The Children's Hospital has had its Convalescent Home in Wellesley, Mass., not far from Boston, and the House of the Good Samaritan a farmhouse in the country as a Convalescent Home. At the Wellesley establishment, with a capacity for seventy-five patients, about one-half of whom have surgical tuberculosis, it was found that these cases, when placed in "shacks" and made to live practically all the time in the open air, did vastly better than those living in more confined quarters, an experience which agrees entirely with the results of similar treatment in pulmonary disease.

Other institutions in Massachusetts for the treatment of surgical tuberculous disease are the Peabody Home for Crippled and Deformed Children in Hyde Park, Mass., with a capacity of thirty to forty beds; the Baldwinsville Home at Baldwinsville, Mass., a small private institution; the Lowell Island Seashore Home, which is open for two months in the summer for a limited number of children. The larger general hospitals in Boston, notably the Massachusetts General and the Carney Hospitals with their orthopædic departments, receive a limited number of cases of surgical tuberculosis. The City of Boston, therefore, is fairly well supplied with institutions of this special nature.

Institutions for Advanced Cases

In conjunction with the three State hospitals lately established, other institutions for the reception of far-advanced patients should be mentioned. First in importance is the Department of the State Almshouse at Tewksbury, Mass., this special department having been authorised by the Legislature in 1898 and an appropriation of $100,000 made to build a hospital for 100 patients. The next year the sum of $10,000 was added for heating, lighting, and furnishing. In 1905, 1906, and 1907 "shacks" were added to this department, the capacity being thus increased to 154, and later by putting beds in the sun-rooms 166 patients were accommodated.

Since that time a further appropriation of $20,000 has been made for an additional wing with a capacity of fifty beds. In 1909 still another appropriation of $20,000 was made for a wing for fifty beds, which is not yet finished, so that the total capacity in this department will soon be 266 beds.

An additional appropriation of $20,000 was also made to build a similar hospital for women at Tewksbury, with a capacity of forty beds and situated half a mile from the main group. This was opened in 1907, and has been filled ever since. This institution will have therefore a total capacity of 306 beds.

There are a few private hospitals for advanced consumptives, notably the so-called "Cullis Home for Consumptives" and the "Free Home for Consumptives," both situated in Boston. The "Channing Home," also founded for the reception of these cases, is another small private institution which receives other forms of chronic disease also. The Holy Ghost Hospital in Cambridge, adjoining Boston, is also devoted to the care of the same class. These all being of small capacity, and utterly inadequate to the demands for beds, a movement was started in 1901 for the foundation of a Boston Tuberculosis Hospital by a number of people, physicians and laymen. Previous to that time the Long Island Hospital, in Boston Harbour, was the only municipal institution which devoted a certain number of beds in a special ward to this class of case.

The Boston Tuberlulosis Hospital

No active measures were taken by the municipal Government until 1906, although $250,000 had been appropriated for the purpose of building a hospital for the tuberculous poor of Boston in 1901. An unpaid Board of Trustees consisting of seven members was finally appointed by the Mayor, and active work was begun after the purchase of a large piece of land, containing fifty-eight acres, in Mattapan. Dorchester, one of the immediate suburbs of Boston. The trustees sought to build up a comprehensive organisation which should so coordinate all factors in the work, public and private, as to effectively deal with all phases of the problem. As a consequence of this plan the Boston Board of Health, the various hospitals for the care of advanced disease, sanatoria, special tuberculosis clinics, convalescent homes, and many other agencies such as the volunteer associations, associated charities (over sixteen hundred different societies), churches,

women's clubs, labour unions, etc., have co-operated in the development of this plan of campaign.

The Mattapan Hospital will consist, when finished, of:—

(*a*) A series of large two-storey pavilion wards capable of holding four hundred beds. Up to the present lack of sufficient appropriation has prevented the completion of this building. This part is intended for the far-advanced cases existing among the indigent class, and will be devoted to those who are practically hopeless cases.

(*b*) The Sanatorium Day-Camp is intended for the moderately advanced or ambulatory cases, who can visit the hospital between the hours of 9 A.M. and 5 P.M., and return to their homes at night. This plan has been in full operation for over a year, and is based upon the method adopted three years before by the Boston Society for the Study and Prevention of Tuberculosis, who established a "Day-Camp" on Parker Hill, in the immediate vicinity of Boston. This building is 150 feet long by 36 feet wide, of rough wood construction, open towards the south. It has a kitchen capable of furnishing food for five hundred patients, and two hundred can be accommodated now in this single institution and taught sanatorium methods by their daily routine.

(*c*) Cottage wards are similar to the "lean-to's" used at sanatoria, and when erected will be used for patients who have no homes or who cannot otherwise have proper accommodation at night. The plan for the care of patients in these day-camps includes also provision for graduated work on the farm, a very important feature of the work.

(*d*) *The Out-Patient Department.*—In conjunction with the Mattapan buildings, the Out-Patient Dispensary Department, situated in the heart of the city, is of the greatest importance. From lack of space in this article a detailed account of this department is impossible. Suffice it here to say that this Dispensary Department of the Tuberculosis Hospital is planned upon the basis made by Philip of Edinburgh, who was the first to establish a dispensary department for tuberculosis twenty-three years ago in his own city, being followed later by Calmette of France and by E. O. Otis of Boston. This special form of anti-tuberculosis work in Massachusetts owes a great debt to Dr. Philip, whose admirable addresses, given in various cities of the United States and under the auspices of the International Congress on Tuberculosis held in Washington in the autumn of 1908,[1] placed vividly before the

[1] "The Anti-Tuberculosis Programme: Co-ordination of Preventive Measures," *Transactions of the Sixth International Congress*, 1908, R. W. Philip, M.A., M.D., F.R.S.E., F.R.C.P.E., Edinburgh.

community the great importance of the results of his twenty-one years' experience in Edinburgh.

Besides the twelve visiting physicians there are twenty-five nurses on duty at the Out-Patient Department, four of whom are in attendance there every morning. Each nurse is also assigned to a definite section of the city, and her duty is not only to care for the tuberculous poor whose cases are already reported, but to ferret out others which may exist and need attention. No more admirable or efficient work exists than is done in this department.

(*f*) Co-operation with the State Sanatorium for After Care. This is a very important addition to the work of the Boston Tuberculosis Hospital, by which arrangements are made with the Rutland Sanatorium to refer all patients sent there by the Boston Dispensary and the Out-Patient Department of the Hospital back to those institutions. Supervision of these patients is thus continued, and endeavour is made to procure suitable work for them and to keep in touch with them as far as is possible in after years.

The Boston Association

The Boston Association for the Relief and Control of Tuberculosis was founded in 1903. It had its origin in a self-appointed committee which had been specially active in 1900-1, and had had later much to do with the movement to appropriate $150,000 for the Boston Consumptives' Hospital. From this was finally organised the Association which has since been actively engaged in furthering every method possible for fighting the disease among the poor of Boston.

Largely through the efforts of Mr. Alexander M. Wilson, the Secretary of the Association, the first "Day-Camp" in America was established in Boston on Parker Hill in 1905, the work there being afterwards transferred to the Mattapan Hospital. Recently a Day School for Tuberculous Children, originally placed at Parker Hill, has been moved to Franklin Park, in the immediate suburbs of Boston, and has been put under the care of the Boston Tuberculosis Hospital. This school has at present 107 pupils.

The Boston Association, supported by public contribution, is in touch with all other associations in the city, and is a constant factor in the anti-tuberculosis movement.

From the foregoing pages we may get a fair idea of the work which Massachusetts is doing for the suppression of tuberculosis. The means

of accomplishing this are as yet far from perfect, but one of the most encouraging features is shown in the steady fall in percentage of the death-rate from tuberculosis in our State in comparatively recent years. From 1880 to 1890 the death-rate from pulmonary tuberculosis per 10,000 was 28 per cent., from 1890 to 1900 it averaged 23 per cent., and during the last ten years it has fallen to 16 per cent. This remarkable fact cannot be attributed to one cause alone. The increased attention to cleanliness, however, improved hygienic conditions, and a more careful supervision of suspected cases are large factors, doubtless, in the decline of the death-rate. This gives us reason to believe that in due course of time, not in this nor probably in the next generation, tuberculosis may be robbed of its terrors.

VINCENT Y. BOWDITCH.

CHAPTER XXIV

THE MOVEMENT IN PITTSBURGH

Origin of the Movement—Adoption of the Edinburgh System—Tuberculosis Commission Established by Law—Powers of the Commission—City Canvass—Tuberculosis League Work—The Hospital and the Dispensary—Educational Work—Talks to School Children—Extent of the Field Covered—Hospitals—State and City Institutions — Night Camps — Maternity Ward—Open-Air Schools—Farm Colony—A Problem for Statesmen.

Origin of the Movement

Up to January 1906 practically no step had been taken in the effort to reduce the incidence of mortality from tuberculosis in the city of Pittsburgh, U.S.A. At this time a group of business men banded themselves in a unique organisation to effect some struggle against this infection. In this group there was no medical man. Nearly all of the members had become interested in the subject through intimate contact with the disease in their own families, and, as they found later, had suffered from careless or wrong advice in the care of the sick ones. Having organised as a Board of Trustees under the presidency of Mr. Otis H. Childs, they accepted of Mr. Wm. M'Conway the offer of his former residence and four acres of ground as a hospital. This property by good fortune lay in the midst of the city on high ground.

After progressing thus far they decided to import a medical director who would be given charge of the active work of the organisation. The importation of a director was decided upon in order to start on a fair and broad basis without medical entanglements. The choice of a director happened to fall upon the author of this paper. What follows in this article will be the recital of what has been accomplished by a voluntary organisation of business men in an untouched city in a period of three years.

Adoption of the Edinburgh System

In my early conference with this group of men I found that their desire was to move Pittsburgh from the position of a negative factor

in this phase of public health work, to accomplish this in a business-like way, and to give the director a free hand in the development of the different factors of an organisation necessary to accomplish this purpose. For some years I had been familiar with the plan which has been inaugurated, successfully operated, and preached by him in whose honour this book is prepared. This plan may be briefly stated as the correlation of all factors active in the tuberculosis crusade in some centralised system for the municipality or district in which these factors are operative, or, to emphasise the other end of the scheme, the municipal or regional supremacy in tuberculosis work through a centralised correlated system of all operative factors. The great common sense of this plan at once impressed me, and its application to Pittsburgh appeared a great opportunity. The more I have laboured in this field the more I am impressed with the fact that in this idea lies the secret of successful control of this sickness, and it is a great pleasure to do honour to Dr. R. W. Philip, who first suggested it and has so perfectly developed and operated it in Edinburgh.

The progress of the plan in Pittsburgh has been beset with many difficulties. It was not long before a second organisation of health and charity groups was formed; such an organisation, in fact, followed before the first one had begun operations. Some time later the State of Pennsylvania through its health department commenced work on a most gigantic scale by a system of dispensaries throughout the State. One of these was located in Pittsburgh. About the same time the municipal Board of Health awoke to some activity. Thus before the first year's efforts were over there were four agencies at work in a field which up to this time was untrodden. The State maintained a large dispensary with four or five doctors and eight nurses, and was a distributing station for large quantities of eggs and milk. The municipality fumigated houses, published some standard educational pamphlets, and maintained at the poor farm about twenty beds for advanced cases. The second charity organisation, after its first act of importing a travelling exhibit and giving two weeks of education, subsided, but still remained in existence. The charity organisation of business men opened their hospital and started their construction work of correlation on the Edinburgh plan.

The first step was an amalgamation of the two voluntary organisations. By adding five new members from the quiescent anti-tuberculosis society to the Board of Trustees of the Pittsburgh Sanatorium (the business men's association) this was readily accomplished. The

new organisation was known as the Tuberculosis League. The new members of the board, carefully chosen from the membership of the other society, were the Rabbi of the Jewish Church, the Bishop of the Roman Catholic Church, the owner of two of the large newspapers of the city, and two active business men. This left the municipal and State activities, and one voluntary organisation, the Tuberculosis League.

Tuberculosis Commission Established by Law

Although the State health commissioner was interviewed twice with the hope of establishing for the city a correlated system of work, he could not be persuaded to relinquish in the least the independent system which he had established. The city, however, was willing to do all in its power to fumigate and to furnish literature for distribution. Finally, it was possible to secure through the municipal Government the establishment of a Tuberculosis Commission as a part of the municipal board of health. On this commission were appointed representatives of the Tuberculosis League, the State representative for the district, and the head of the municipal bureau of infectious diseases.

The by-law establishing the commission was as follows:—

"Creating and establishing in the Bureau of Health, under the Department of Public Safety, the Division of Tuberculosis Inspection and Relief, prescribing the powers and duties thereof, how the same shall be controlled and exercised, and the number of employees and their salaries.

"Section I. Be it ordained and enacted by the City of Pittsburgh in Select and Common Councils assembled, and it is hereby ordained and enacted by the authority of the same,

"That there shall be and is hereby created and established in the Bureau of Health, under the Department of Public Safety, a separate division to be known as the Division of Tuberculosis Inspection and Relief.

"Section II. That said division shall be under the superintendence and direction of a commission consisting of the Superintendent of the Bureau of Health and four competent and skilled citizens who shall be appointed by the Director of the Department of Public Safety for terms of seven years and serve without remuneration, and which commission shall be designated as the Tuberculosis Commission of Pittsburgh. Said commission shall adopt such rules and regulations as they may see fit, not inconsistent with any general law or ordinance, and shall elect one of their number as president and one as secretary. Vacancies occurring in said commission shall be filled by appointment of the Director of the Department of Public Safety for the full term.

"Section III. That said commission shall prepare and keep accurate record of all cases of tuberculosis existing in the municipality in such form

and detail as said commission shall prescribe; inspect all dwellings, tenements, shops, factories, and other places where cases of tuberculosis exist; ascertain the cause of infection and provide for the disinfection and cleansing of the same, and report to the proper department cases needing charitable relief; establishing dispensary stations; prepare and disseminate information as to the cause, treatment, and relief of tuberculosis; and generally do such work and adopt such measures as will tend to control and eradicate the infection.

"Section IV. That said division shall have attached thereto one clerk, at a salary of one hundred and twenty-five ($125) dollars per month, and five trained nurses, clothed with police power, at salaries of seventy-five ($75) dollars per month, all of whom shall be appointed by the Director of the Department of Public Safety.

"Section V. That it shall be the duty of the Director of the Department of Public Safety to provide suitable accommodation in connection with the Bureau of Health for the use and occupancy of said division.

"Section VI. That any ordinance or part of ordinance conflicting with the provisions of this ordinance be, and the same is, hereby repealed, so far as the same affects this ordinance."

Powers of the Commission

The nurses have police power, the commission is unpaid, and as now appointed the organisation has represented on it the State, the city, and the tuberculosis charity. The commission, which exists for seven years, has its policy thus insured from interruption. While the State law provides for registration and sequestration of tuberculosis cases dangerous to public health, it must not be thought that this commission can accomplish anything by roughshod methods. It must by gentleness, guidance, and tact steer the way, which it is hoped will eventually result in what is best for the municipality—a tuberculosis management centralised with permanent policy in the Department of Public Health, a registration there of every case in the municipality, its source of danger, and the assurance that each case is being properly handled, whether by State, city, or charity means. In the Health Department there was thus secured a centralised governing body for tuberculosis. This made possible the proper correlation and distribution of the city's work, and utilised all forces—the charity, the municipality, and the State.

City Canvass

As the first work of this commission, and as a preliminary step to distribution of labour, it utilised all its nursing and office force to obtain

a statistical basis of the tuberculous sick of the city—in other words, to secure a stocktaking in order to determine the extent of the task before it. In pursuance of this idea they began a house-to-house canvass of two-thirds of the city. This was accomplished by the nurses with police authority, choosing the sections of greater poverty. The nurses objected to canvassing the wealthier parts of the city because of the opposition encountered there, so that the work in this quarter had to be abandoned. All suspected cases were reported to the health office. From here was sent a letter to the physician or the dispensary supervising the case explaining the plan and asking for verification or refutal of the diagnosis. This at first aroused some criticism, but as the law was behind the effort the criticism subsided. This method had an excellent educational influence both on physicians and on the public, and put the burden of proof and report upon the physician. In this way about 5000 cases were reported in ten months; 73 per cent. of these were poor or destitute, or in need of aid or education, or both. These figures were utilised, and by means of them has been secured an appropriation for a municipal hospital for tuberculosis.

The canvass has just been finished. The next move of the commission will be the apportionment of the dispensary work among the different dispensaries by dividing the city into districts, and the attempt to have, through the health authorities, some uniform system governing all this work. It is hoped that eventually a scheme of division will be arrived at by which the State, city, and charity will each have its part of the municipality with correlated dispensary and hospital system, and that these will unite for uniform management and correlation in the commission of the health department.

One of the most unfortunate occurrences of this attempt has just now to be faced. The municipal administration has changed, and the co-operation of the authorities in the new regime is very uncertain. I will refer to this feature in a later paragraph in discussing the value in this field of work of a man backed by his office.

Tuberculosis League Work

While the Tuberculosis League was attempting to bring about this broad field of correlation it was at the same time building up a comprehensive scheme of charitable forces, combining hospital, dispensary, farm colony, educational and preventive branches of this work.

The Hospital and the Dispensary

These two departments differ in no way from the same departments in Edinburgh and in many other cities. They are under a central management, are situated on the same property in the midst of the city, and have steadily increased in usefulness. The hospital has forty beds for advanced cases and forty beds for early cases. The hospital is just erecting a building for children with bone and gland tuberculosis, and an open-air school, which has been given by the Hebrew Benevolent Society in honour of Mr. Abraham Lippman, and a small building to be paid for by the College Women's Club for patients of more fortunate monetary possessions.

The dispensary building was erected by a group of fifteen young women, called the Dispensary Aid Society, who now collect all moneys necessary for this branch of the work. It has attached to it two visiting nurses and seven physicians, and now takes care of about a thousand cases a year.

Educational Work

(*Provided for by the Dispensary Aid Society*)

During the last few years in this country tuberculosis education has assumed many different phases. It has usually taken the form of attempts to reach adults. It has ranged all the way from spasmodic lectures to the brass band and the phonograph. As an effective plan of educational work, adult teaching has many difficulties from the side of both teacher and of audience. In the main the adult population has its mind fully made up on most subjects, except on those about which it knows nothing. Such a subject in this latter case they either ignore or approach with the willingness to believe as much as they wish, or, in the case of a small minority, they are ready to accept the teaching from those who know a fair amount about it.

Teachers in the tuberculosis field, however, present the greatest difficulty. They are usually physicians who do this work in part from an altruistic standpoint, in part as help towards their introduction to a city; and when the calls for work that mean money come, they grow lukewarm about the charity work. Most of these teachers, too, are voluntary assistants, and as a rule relax in enthusiasm in their work very quickly. Their enthusiasm lasts for one or two lectures and then as new interests grow up suddenly wanes. I have not known of

a persistent and consistent voluntary educational campaign carried out with equal and equitable character for more than a single year.

At the commencement of the tuberculosis work in Pittsburgh two and a half years ago the necessity was felt for placing the educational activities upon some permanent and effectual basis with as little possible outlay as was compatible with efficiency, and with better results for expended effort than had been accomplished before. With these objects in view it was reasoned that several of the difficulties to be contended with in making the former kind of educational work effective were to be found in the necessity for providing halls, lecturers and audiences. To overcome these it was felt that some place should be sought in which the hall was accessible without special preparation and charge, and that it should be filled with an audience which was there for some other purpose. It was also felt that the teacher's time should be paid for and controlled, and that the audience should vary from day to day, and be of a sufficiently impressionable character to retain the material which was offered its members. In seeking to do this the only place which fulfilled all conditions was the school, and this seemed the only reasonable place to carry on the work. The school is the seat of all the education which we seek to give the embryo citizens. There seemed no good reason why the tuberculosis education in company with all other hygienic laws should not be incorporated in the regular educational life of the child. As this idea developed it was seen to hold all the possibilities of reaching the adults through the children, for the parents and relatives will listen to a child's chatter when they will not listen to that of a voluntary teacher. It seemed possible also through the children to reach every home in the municipality.

In carrying out the project there was a peculiar condition to contend with in the city of Pittsburgh. It was necessary to see not only the central Board of Education which controlled the high schools, but also over fifty public school boards which had to do with local public schools, the Bishop of the Catholic Church, the superintendent of each of the separate schools, and the governors of the different private schools in the city. The accomplishment of this meant months of hard labour to gain permission from groups of people who, in the main, had no knowledge of the effort we were trying to make, nor any conception of its value. These interviews with boards of control were in themselves of great educational value. By persistently working with them it was found possible at last to gain an entrance into every school

in the city, with the exception of two. The choice of someone to do this work is of the first importance. One has to be well educated, conversant in a practical way with tuberculosis work, and so versatile as to speak entertainingly to groups of people from the kindergarten class to those who teach in the schools.

The teacher provided by the Tuberculosis League first met the teachers of the school along with the janitor, and talked over with them the general plan of the work. These meetings were held immediately after the school hours of the day. She pointed out the possibilities of the janitor's aid and the ways in which the teacher could help in this crusade. She presented each teacher with a carefully prepared pamphlet, arranged especially for teachers with the object of educating them to present the lessons contained therein to the school children in the different classes. There were problems on tuberculosis for the arithmetic class, reading on tuberculosis for the reading class, and lessons on tuberculosis in the public hygiene class, etc. It was then arranged that she go next day from room to room in the school giving fifteen-minute talks to the children, from the kindergarten to the highest grade. The plan of entering each room separately has many advantages. In the first place it forms a pleasant break in the school day of the child, who is more likely to accept the lesson interjected suddenly into his sometimes monotonous life. The talks to the different grades have to be varied according to the age of the children, and in part according to the social status of the children in the school.

Following these talks to the children, the outline of which is given later in this article, many of the teachers gather a mothers' meeting for the locality, and the Tuberculosis League teacher returns to take up the question with the mothers. Since this often resolves itself into a question class, in which the mothers conduct the questioning of the teacher, it is a factor of permanent educational value. To make the talk to the children of greater value the teacher presents each pupil with a little pictorial pamphlet, which has just been prepared, covering the whole ground of hygienic laws, especially those relating to tuberculosis. This little pamphlet, which is simple, pictorial, and attractive, the child is asked to take home and talk about at the gatherings of the family. It contains the simple laws governing the control and prevention of tuberculosis, some simple laws of hygiene, and also a list of the city dispensaries that do tuberculosis work. When it can be arranged with the teacher or principal at some time following the Tuberculosis League

teacher's talk to the children, the children are asked to write an essay on what they have heard at this lecture.

Having finished one, the teacher carries out the same plan in the next school, arranging her work so as to cover the whole school ground in the shortest possible time. It takes about a year and a half to cover the whole school ground, but by the time this has been done one may be reasonably sure that the work has been thorough, and that the lessons have reached the greatest possible number of people.

The following is the outline of the talks given to the children :—

1. Brief History on Tuberculosis.
2. Prevalence.
3. The Cause of Tuberculosis.
4. The Prevention of Tuberculosis.
5. The Cure of Tuberculosis.

THE CAUSE :

1. A germ which is spread chiefly by the spit of patients and those having tuberculosis. Many do not know they have the disease.
2. A weak body in which the germ thrives.

How the germs are scattered from spit :

1. By shoes.
2. „ skirts.
3. „ dusty air, especially in houses.
4. „ soiled handkerchiefs.
5. „ drinking cups.
6. „ careless coughing with open mouth.
7. „ flies.

How acquired by the body :

1. By breathing them into the lungs.
2. „ taking them into the stomach with food, by biting the nails, putting fingers, money, pencils, and other objects into the mouth.
3. „ inheritance.

How the body is made weak so that the germs have a chance to develop :

1. By living in impure air.
2. „ over-heated houses.
3. „ lack of sunlight.
4. „ unwholesome food.
5. „ impure water.
6. „ lack of exercise.
7. „ late bed hours.
8. „ neglected colds and other ailments—tonsils, adenoids.
9. „ dissipation.
10. „ careless personal habits, mouth breathing, stooped shoulders, swallowing mucus, uncleanliness, especially neglected teeth.

THE PREVENTION:

1. Destroy the germ.
2. Build up the body.

To destroy the germ:

1. Spit in the gutter if on the street; here the sun and air may kill the germs.
2. If you use a spittoon disinfect it with carbolic or lye—always keep water in it.
3. The best thing is to use rags or paper and burn them.
4. Patients should use spit cups that can be burned.

To build up the body:

1. Fresh air night and day.
2. Sunlight.
3. Good plain food, eaten slowly.
4. Good pure water.
5. Rest—early bed hours.
6. Exercise in the fresh air.
7. Cleanliness.
8. Cheerfulness.

THE CURE:

The same as Prevention, except the exercise.
Take no medicine unless advised by a good physician.
All persons who are sick should be under the care of a good physician.

This work, of course, to be of permanent value, must be of a persistent nature, and yet it seems possible in this way to gain a thoroughly educated municipality in a shorter time and with less expense than in any other manner.

The Tuberculosis League teacher has kept a carefully tabulated record of each school building, its principal, its enrolment, its janitor, the mothers and others that have been talked to, the literature distributed to the teachers, the pupils, the mothers, the janitors and others, with remarks about the school building, the number of rooms, how the floors are kept, how the sweeping and dusting is done, how ventilated, what the light and water supply is, the drinking facilities, with remarks on recess and general hygienic conditions. These reports have been kept in the same systematic way that all our book-keeping has been done, and form a mass of material which we hope, now that the work has been completely covered, to tabulate and put in such form as can readily be understood by all.

The report for the past year has been as follows:—

Number of schools visited . . .	68
„ „ teachers hearing talks . .	653
„ „ pupils hearing talks . . .	17,711
„ „ parents hearing talks . . .	350
„ „ others hearing talks . . .	36
Total . . .	18,818

Number of pamphlets distributed . . .	25,638

A month's report condensed is as follows :—

Number of schools visited . . .	9
„ „ teachers hearing lecture . .	34
„ „ pupils hearing lectures . .	1,493
„ „ parents hearing lecture . .	30
„ „ others hearing lecture . .	5
„ „ pamphlets distributed . .	3,012

We feel that after two years of this work nearly all the possibilities opened in Pittsburgh to arouse an interest in tuberculosis have been more or less traceable to this school work. We place it far ahead of the other lectures that have been given to adults and audiences specially gathered.

There is another body of people which gathers weekly, and in which it is possible to reach both adults and children. I refer to the churches, and I feel that in the churches rests the possibility of the greatest educational factor of our civilisation, not only on questions of public health, but on all questions of public good. We have met the ministers of all the different denominations in consultation over this problem, and have sent a member of the Tuberculosis League staff on a persistent educational campaign through their churches. As a result of this we had a day about Christmas set apart and called "Tuberculosis Sunday," in which a great many of the ministers devoted their talks, and the congregations their gifts, to the furtherance of this work.

Hospitals

Tuberculosis and the general hospital forms another serious feature of the municipal aspect of this disease. The general hospital, as a rule, will not admit tuberculosis cases diagnosed as such; consequently it does not feel under the necessity of carrying out the ordinarily accepted method of controlling its spread. Two great problems are presented by this fact. First, almost daily general hospitals admit tuberculous cases for operative work, child delivery, and through mistaken diagnosis. This is doubtless the explanation of the frequent incidence of tuberculosis and the great mortality from this sickness in the nurses and physicians whose duty attracts them to hospital work. In order to meet this the Tuberculosis League for the past year has been providing burnable sputum cups for the use of all patients in two of the largest

hospitals in Pittsburgh. Second, the nurses in these institutions receive no instruction, save that of a didactic character, in the care of a disease which kills one-seventh of city dwellers. The consequence is that it is a rarity for a private family afflicted with this disease to secure a nurse who understands the least thing about it. It would be infinitely better for hospitals to frankly say "We take tuberculous cases," and to make proper provision for caring for such cases, and for teaching those in training the methods of such care.

In an attempt to reach the nurses' problem we have had satisfactory results. We have started a post-graduate training school for nurses, giving them a six months' course in tuberculosis nursing, district nursing, and educational work. The successful completion of the course is to be rewarded by a diploma. Over sixty applications were received during the first month following the announcement of this course.

State and City Institutions

The next problem to be solved had to do with orphan asylums, asylums, and the institutions where the wards of the municipality and the wards of the State have almost no provision against this disease. In the asylums it has been found that tuberculosis is rife. Little can be done with an insane tuberculous patient, as they cannot understand the teaching, and the only thing to do with them, as a rule, is to segregate them and put them under proper supervision. The first duty is to clean up existing conditions, and then to carefully examine and segregate all incoming patients to these institutions.

At a recent conference on the care of dependent children we presented a paper on their care and supervision, holding that they are properly the wards of the city, and that it is the city's business to care properly for them in the matter of tuberculosis. After the paper, two of the heads of these institutions came to us and asked if we would undertake to look over their children, to segregate them, and to tell them how to take up the problem. This work is now under way, and will be reported on at some future date.

Night Camps

For the past eight months we have utilised some of the beds at our disposition in the hospital for patients who were at work throughout the day. These patients were either those who could not give up work, or

those who had their disease arrested in hospital and had returned to work, or who had no proper means of taking care of themselves at home. The night camp forms a valuable means of conserving the work done in the restoration of the health of patients by keeping them under proper conditions.

Maternity Ward

One of the most powerful features of tuberculosis organisations is a maternity department. The maternity period of a tuberculous woman's life is the chief time of relapse. If the prenatal period is spent under proper conditions properly supervised for mother and child, not only will relapse be less frequent, but the child will be protected from infection and two lives may be preserved. The hospital has opened a small maternity ward for tuberculous mothers, the results of which have been unusually encouraging.

Open-Air Schools

Two years ago we opened a children's ward at the hospital. This was soon converted into an open-air school, with the double object of providing education for the children who were compelled through a long period of sickness to remain out of school, and of providing an object-lesson in school ventilation, which it is hoped will spread into each school district — the same treatment which develops strong resistant bodies, makes tuberculous children well, and also keeps other children in health. The school has been a great boon to the children in other than educational ways, for with the little daily interest they have made greater progress towards health than before any such provision was made. Each child is allowed school hours dependent upon its health. We have been fortunate in having the interest and conjoined work in this field of the Civic Club. Through their tuberculosis committee they provide a school teacher, who takes charge of the teaching work, at fifty dollars a month. In this connection we are constantly at work, by conference and otherwise, in urging the inauguration in each school district of an open-air room or separate building for the sickly children of that district.

Farm Colony

A farm colony has been opened which will do the double duty of providing fresh food supplies and possibilities of labour for those who

have advanced far enough in cure to enable them to work a varying number of hours, and thus perfect their cure. The farm colony, extremely valuable in itself, can only reach its fullest usefulness, as shown by Dr. Philip, as part of a correlated system. The funds for the farm work are raised by the Farmington Society.

This raises one point of expedience, that of individual interest, which I am convinced must be emphasised in this work. The Tuberculosis League has endeavoured to arouse wherever possible interest in this field, and to give to each new interested group some special branch of the work which may be mothered by it as a child of its own creation, the one demand being that it conform to the general plan and strive, by the conservation of its energies in avoidance of overlapping, for the one great goal, the maximum reduction of the amount of tuberculosis for the city of Pittsburgh. Names of those actively working have always been suppressed in the newspapers and before the public in the interest of the progress of the organisation and the work itself.

It will be seen from the above account of the energies of the Tuberculosis League that the central thought has been the elicitation of all factors that could be utilised in this campaign, to have all these operative at the same time in some uniform plan, centralised in the health department of the city, and to finally corporate these in the everyday municipal life. The progress of this work is likely to be much hampered by any attempt at a revolution. It would seem wise to inaugurate only such factors as can readily be incorporated in the daily life of the community without deviating too much from the regular routine.

A Problem for Statesmen

Probably the most difficult problem in this field of endeavour is the correlation of the three great factors at work—the State, the municipality, and charity. The voluntary organisation which starts out with this object in view soon runs against insurmountable difficulties. Almost invariably the State and the municipality will not work in conjunction with a charity, so that an independent correlated system can progress but a limited distance. For some months I have been convinced that the solution of this problem can be reached only when we have in our public health offices honest fearless men who will take this view of this great question, and use the dignity and power of their office to call together and confer with all agencies interested, not only in this field but in all fields of health work, and with them divide

and correlate the labour, so that no overlapping is possible and that all branches are taken care of in a uniform system, centralising in the municipal and State health office. The tuberculosis question, the pneumonia question, the infant mortality question, the venereal question, are all public health questions to be handled in this way, and only when we see the common sense of putting in charge of our health departments big men who will organise and utilise all forces—State, municipal, and charity—in some business-like and common-sense way, will we see great reduction of loss from these sources. The State should have some uniform correlated plan for registration and control, and should provide for the division of the State without autonomy in health matters, and should aid those divisions to which autonomy is given by example, advice, coercion, and in some cases with funds to carry on this work. The municipality should provide for the carrying out of the State plan for the municipality in a correlated system by hospitals for advanced cases, working colonies, dispensaries, education, open-air schools, house inspection, and tenement control. The destitute patient should be provided for by public taxation, and when dangerous he should be segregated. Public charity should conform to the municipal plan, doing the share of work allotted to it, and providing for that great mass of temporarily disabled tuberculous people, not destitute, but able to earn a good wage and support themselves and dependants if well, who need but temporary relief to be again re-established in society. Private enterprise will take care of the more fortunate class with sufficient money to provide for the period of illness.

Wm. Charles White.

CHAPTER XXV

THE MOVEMENT IN GERMANY, AUSTRIA, AND HUNGARY

Want of Co-ordination—Notification—Sources of Statistical Error—Prevalence of Tuberculosis in Germany, Austria, and Hungary — Sanatoria — Compulsory Insurance for Illness—The German Central Anti-Tuberculosis Committee—Results of Sanatorium Treatment—Sanatoria in Austria—In Hungary—Anti-Tuberculosis Dispensaries—Hospitals for Advanced Cases—Tuberculin Depôts —Farm Colonies—Day Camps—Night Camps—Establishments for Children—Anti-Tuberculosis Work and Authorities—The Future.

Want of Co-ordination

Distance almost as much as time has hindered the spread of truth regarding tuberculosis, and it is astonishing to see how each nation has gone its own way in this as in so many other affairs, which were better treated in common, for the benefit of the poor and diseased. Take Germany, Austria, and Hungary, three closely connected countries, yet how different their methods of dealing with tuberculosis—sanatoria in Germany, dispensaries in Austria, and nothing in Hungary; this was the position not so many years ago. The reason is the ignorance in each country of similar foreign institutions, and the want of proper statistics at home.

Notification

Our knowledge of the incidence of tuberculosis depends on notification. Unlike Scotland and England, where compulsory notification of pulmonary tuberculosis has been introduced in certain areas, authorities in Germany, Austria, and Hungary could not be induced to demand more than notification of deaths from this disease, arguing that cases should not be notified unless the sanitary authorities were able to deal effectively with them. With Biggs[1] and others we fail to see the validity of this argument, as other events, such as

[1] Biggs, Hermann M., "Combating Tuberculosis, Care of Consumptives," Fourteenth International Congress on Hygiene, Berlin, 1908.

marriages, etc., are notified without necessarily calling for further action by the authorities. "The educational value of notification to both the physician and patient is of no little importance, even if notified cases receive no other attention than a circular of advice from the authorities." Notification of every case can alone tell us the real incidence of this disease.

It is not an exaggeration to assert that the anti-tuberculosis movement in Germany is based on the statistical fact that every third person dying between the ages of 15 to 60 dies from tuberculosis. It would be more successful were we able to tell the general public, local authorities, and charitable institutions the exact number of cases in their midst.

Even notifications of death from pulmonary tuberculosis are unreliable where certificates may be written out by persons other than doctors, as is the case in some parts of Germany. According to Teleky[1] certification of death from tuberculosis in Austria, though exclusively done by doctors, is not uniformly carried out.

Sources of Statistical Error

These are not the only pitfalls of comparative statistics on tuberculosis, as in some countries pulmonary tuberculosis is differentiated from that of other organs, while in others (Austria) these cases are grouped together. It is unnecessary to indicate the disastrous effect of such summary procedure, as it is well known how often the diagnosis of intestinal tuberculosis, tuberculous meningitis, etc., is erroneous. There is the further danger of cases of death from tuberculosis being registered as inflammatory diseases of the lungs, especially where notification is followed by compulsory disinfection or where the doctor or the family have reasons for concealing the real cause of death. It is therefore necessary to consider the number of deaths from other diseases of the lungs, with the exception of pneumonia—because of its frequency and easy diagnosis. In this group Austria altered the statistics in 1895 by adopting "pneumonia" instead of "inflammatory diseases of the lungs." It is to be hoped that the "International Anti-Tuberculosis Association" will succeed in introducing a uniform system of statistics in which "tuberculosis of the lungs," "tuberculosis of other organs," "miliary tuberculosis," "pneumonia," and "other

[1] Teleky, Ludwig, "Die Sterblichkeit an Tuberculose in Osterreich, 1873-1906," Sixth International Congress on Tuberculosis, Vienna, 1907.

diseases of the lungs" will be separately grouped. It is also desirable that cases among children and adults, men and women, should be differentiated.

Prevalence of Tuberculosis

But however incomplete and unsatisfactory the published statistics there can be no doubt that tuberculosis is more frequent in Hungary and Austria than in Germany and England. There died during the last twelve years

in England 17·9 per 10,000 per annum from tuberculosis,
in Germany 21·1 „ „ „
in Austria 33·8 „ „ „
and in Hungary 37·6 „ „ „

The mortality from tuberculosis in Hungary is thus more than double that in England, and, what is still more important, in Hungary it has not decreased during the last ten years, whereas there has been a remarkable fall in the death-rate from tuberculosis in the other three countries, especially in Germany. It is interesting to notice that there are periodic oscillations in the mortality curve, almost corresponding with each other in the different countries, and occurring mostly every five years; the regularity of this fluctuation is most striking in Austria, where the curve reached its highest points in 1895, 1900, and 1905.

The scantiness of statistics precludes further details, and does not permit me to compare the mortality from pulmonary tuberculosis in children and in adults. This is the more to be regretted, as Austria has made special provision for tuberculous children, while Germany has provided for adults, so that if our campaign against tuberculosis has been really effective, the mortality curve ought to have fallen in the one country for children and in the other more for the adult population. According to Kirchner[1] the children in Prussia do not share in the steady decrease of mortality from tuberculosis, and to judge from the charts in Kaup's pamphlet on tuberculosis[2] it would appear that in England also the death-rate from tuberculosis in children has fallen much less than that in adults. The question if these differences are really the result of anti-tuberculosis methods adopted in different countries must remain unanswered.

[1] Kirchner, M., *Die Tuberkulose und die Schule*, 1906.
[2] Kaup, J., *Betrachtungen über die Bekämpfung der Tuberkulose, etc.*, Berlin, 1910.

Sanatoria

Unlike England and France, Germany, Austria, and Hungary began combating tuberculosis by building sanatoria instead of establishing dispensaries. Ruppertsheim in Germany, St. Endre in Hungary, and Alland in Austria were the first public sanatoria erected (1895-1898), after Brehmer in Görbersdorf (1854) and his patient and fellow-worker Dettweiler in Falkenstein (1876) had proved the disease to be curable. Since then the number of sanatoria for the rich as for the poor have steadily increased, and, with the exception of the United States, nowhere as rapidly as in Germany. Germany possesses at present 97 public sanatoria for the poorer classes, *i.e.* almost five times more than Austria (12), and Hungary (7) together, the number of beds available for needy consumptives in Germany (11,000) exceeding still more that of Austria and Hungary together. The number of sanatoria for the well-to-do must be regarded as sufficient in all three countries. The points Germany has scored in the sanatorium movement are almost entirely due to the Insurance Acts.

Compulsory Insurance for Illness

Promised by Imperial message in November 1881, compulsory insurance for illness was introduced in Germany in 1883. Together with the amendments of 1900 and 1903 it provides free treatment, medicine, and other remedies for any sick workman or employee earning less than £100 a year. Inability to work entitles the worker to receive for 26 weeks at the longest a sick allowance amounting to half the average daily wage. In case of death dependants also receive a certain sum. The necessary funds are raised by weekly contributions varying from 3d. to 1s., of which two-thirds must be paid by the workman and one-third by the employers. These contributions are paid into one of the 23,232 local or guild banks. The great number (1907, 12,945,242) of insured persons—men and women—have made the maintenance of so many sanatoria possible, but their erection was mainly undertaken by friendly societies, or by the Invalidity Insurance Banks (Landesversicherungs-Anstalten), of which there are at present 41 in Germany. They are based on the Invalidity Insurance Act of 1899, by which the employers and the employees are each compelled to pay one-third of the invalidity-allowance in weekly contributions varying from 1½d. to 5d., while the State advances the

other third. This pension becomes available in case of old age (over 70 years) and in case of permanent inability for work, and amounts on the average to £7, 10s. a year. In order to avoid or to postpone invalidity among the 14,958,118 insured persons the Invalidity Insurance Banks may make the insured undergo special treatment at the cost of the banks — a most valuable right, which is very often made use of, so that most of these Invalidity Insurance Banks erected sanatoria of their own, or lent capital at low interest for their construction. While the insured is staying in a sanatorium those dependent on him are also provided for, either by the Invalidity Insurance Banks themselves, or by the Local Insurance Banks. To illustrate the importance of these different banks it may be said that in the year 1907 the Local Insurance Banks paid £15,000,000[1] and the Invalidity Insurance Banks £78,000,000. As one-fifth of all cases of invalidity are due to pulmonary tuberculosis, and one-third to diseases of the throat and lungs, it will be easily understood how much it is the interest of these banks to cure, to postpone, or to prevent these diseases, not only among their own 25,000,000 clients, but also among the whole population, any of whom may one day become a client, or when suffering from these diseases may infect the actual clients of the insurance banks. It seems only natural that these banks, as well as the friendly societies, began with the humanitarian side of anti-tuberculosis work by trying to cure patients in sanatoria.

The German Central Anti-Tuberculosis Committee

For this purpose a special society was founded in 1895, under the presidency of the Chancellor of the Empire, the "German Central Committee for the Erection of Sanatoria for Tuberculous Patients," later called "The German Central Anti-Tuberculosis Committee," which now numbers over 1500 members. It is mainly due to the ample means and activity of this Committee that Germany to-day possesses 97 public sanatoria with 11,000 beds for early cases, and two establishments where patients in different stages of the disease are being received. For the well-to-do there are 34 private sanatoria with 1972 beds. The average sanatorium cure lasting three months, 52,000 patients can thus be treated yearly.[2] It is astonishing how by thoughtful pecuniary help and scientific activity this German Central

[1] *Statistisches Jahrbuch des Deutschen Reichs*, Berlin, 1909.

[2] Nietner, *Der Stand der Tuberkulosebekämpfung im Frühjahre*, 1910, Berlin, 1910.

Committee has succeeded in making friendly societies, invalidity and illness insurance banks, as well as counties, municipalities, and private persons erect sanatoria for the poor. Although it is impossible to give a detailed account of the extensive activity of this Committee, it may be mentioned that once a year it arranges for a meeting of sanatorium doctors, where actual questions are discussed and personal experiences exchanged.

Although most of the German sanatoria have been erected within a relatively short time, each has an individuality of its own, its character depending on the available funds, its owner if private person, municipality, or insurance bank, and on the ability and skill of its physician-in-chief.

Results of Sanatorium Treatment

According to the resolution adopted by the Sixth International Conference on Tuberculosis at Vienna in 1907, the 41 Invalidity Insurance Banks in Germany have now accepted the Turban-Gerhardt classification, and the Imperial Insurance Board has undertaken to work up the statistics of sanatorium cures paid for by the Invalidity Insurance Banks. Although it is to be regretted that a classification based exclusively on anatomical changes in the lungs should have been chosen rather than R. W. Philip's classification, where both the local and the systemic disturbances are taken into account, it will be very interesting to see if the average ultimate results of the 41 Invalidity Insurance Banks will be as good as those of the Invalidity Insurance Bank "Baden," which shows that five years after treatment 85 per cent. of Stage I. patients are able to work, 65 per cent. of Stage II., and 21 per cent. of Stage III.

The immediate results for the year 1909 have been published quite recently by the Imperial Insurance Board.[1] The number of patients admitted to sanatoria on behalf of the 41 Invalidity Insurance Banks during the year 1909 was 42,232; 69 per cent. of all the patients left the sanatorium fit for work.

Sanatoria in Austria

The state of things in Austria is different, there being only two

[1] *Reichs-Versicherungsamt, Anwendung der Turban-Gerhardt'schen Studien-Einteilung*, p. 1-15, Berlin, 1910.

or three large sanatoria, and three small sanatoria for Jews, all of which are charitable institutions erected by private initiative. The cause of this is evident. Austria has got no Invalidity Insurance Bill, and therefore no rich insurance banks interested in the cure or prevention of tuberculosis among the working classes.

It would be erroneous, however, to conclude from this fact that Austria has not fully realised the danger and the possibility of its prevention. As early as 1844 a little establishment with 18 beds had been erected in Gleichenberg by the Count of Wickenburg—the Pilgrim Hospital for poor patients suffering from chest diseases; in 1871 Wölfler had founded the first association for the nursing of poor patients suffering from chest diseases, an association which up to 1906 had sent 2397 patients to several watering-places, especially to Roznau; and long before Germany had thought of providing sanatoria for the poor, von Schrötter of Vienna had in 1883 emphasised the necessity of building sanatoria for early cases.

Here the first modern sanatorium was opened in 1898 at Alland, near Baden; it lies 425 m. above sea-level, and is surrounded by wooded hills which reach a height of 680 m. The establishment gives the impression of a large farm, with its great kitchen-garden, potato-fields, and vast stables for 60 cows, etc. It cost altogether £72,000, raised exclusively by private charity. There is a staff of 5 doctors, 15 nurses, and 61 attendants for the 228 patients. Tuberculin is used, and patients suffering from larynx affections are treated with direct sun radiation, an invention of the physician-in-chief Dr. Sorgo.

Sanatoria in Hungary

The development of the sanatorium movement is similar in Hungary, where there are three large sanatoria: Queen Elizabeth Sanatorium at Pozsony, with over 200 beds, the Archduke Joe Sanatorium at Gyula, and the Workmen Sanatorium at Hunyad, with 100 beds each; three smaller sanatoria, one opened in 1898 at St. Endre with 25 beds, two others for printers and railway employees, and also four hospital sanatoria. Like the Austrian sanatoria, those of Hungary differ from those of Germany in accepting advanced cases. Whereas in some Austrian and Hungarian sanatoria nearly one-half of the patients are in Stage III. (Turban), the German sanatoria admitted in 1909 only 4744 patients in Stage III., that is not more than 13 per cent. of all

the patients. This difference is due to two factors—first, to the German Invalidity Insurance Bill, which allows the Invalidity Insurance Banks to pay for sanatorium treatment for such patients as are curable; secondly, to the competition between sanatoria to publish the best statistical results. It is to be expected, however, that the uniform classification (Turban-Gerhardt) generally adopted since 1909 will induce most sanatoria to admit more advanced cases.

Anti-Tuberculosis Dispensaries

The great interest in the erection of sanatoria in the eighties resulted in other anti-tuberculosis institutions being neglected in Germany, so that the first Anti-Tuberculosis Dispensary (Edinburgh, 1887) received little notice until the Prussian Education Board drew attention to the useful working of the Lille Tuberculosis Dispensary founded by Calmette in 1901.

Since then 320 dispensaries have been established in Germany, to which must be added 14 out-patient departments for tuberculous patients in different towns, and 537 inquiring offices for patients in the Grand Duchy of Baden. These dispensaries have been established and maintained by private associations, counties, municipalities, invalidity or illness insurance banks, and other organisations.

The various German dispensaries differ greatly from each other, the only common characteristic feature being that patients are not treated but only examined, and even this in many is only on the special request of a practitioner. This difference from the English original has arisen from the fact that in Germany almost every member of the lower classes has got the right to free medical treatment either from the illness insurance doctor, or from the poor-law doctor. As these physicians are paid for every consultation either by the insurance banks or by the poor-law authorities, the dispensaries must avoid anything that looks like competition, as any friction between the dispensary and practitioners would hinder useful working. For this reason many dispensaries, especially in the country, do not engage a special physician as dispensary doctor, but allow all the practitioners of the district to act as such. To judge from the various reports, the doctors are paid for anything they do at the dispensary, be it a clinical examination, sputum examination, or a written certificate.

The dispensary nurse looks after the patients and their families at home, suggests arrangements for the prevention of infection, and sends

other members of the family to the doctor for examination. She indicates the means of admission to a sanatorium, provides beds, milk, etc., and has withal to avoid the impression of giving alms, to avoid the curiosity of the patient's neighbours, and last, but not least, has to direct a staff of lady nurses who help her. It is evident that persons equally apt in all these various tasks are not abundant, and that only the very best trained nurse is suited for dispensary work.

In most German dispensaries the county physician, the mayor, or some other prominent person has disposal of the funds, engages the doctor and nurse, and keeps in close touch with the three chief supporters of dispensaries—the illness and invalidity insurance banks, the poor-law authorities, and the charitable associations. Whereas sanatoria are mostly supported by the invalidity insurance banks, dispensaries are chiefly maintained by the illness insurance banks. In many districts these contribute for each of their members 1 to 3 Pfennige to the dispensary fund; in other districts the counties do the same for the total population; and the poor-law authorities also contribute to the maintenance of dispensaries.

Some invalidity insurance banks have taken a special interest in the erection and maintenance of dispensaries, as, for instance, the Invalidity Insurance Bank "Rheinprovinz" in Düsseldorf. The effect of this has been that its district possesses more dispensaries than any other province, and it is instructive to consider the means by which this result has been obtained in the various counties of this province.[1]

(1) County Kreuznach. Here there is a special County Anti-Tuberculosis Association with a working committee of 7 ladies and gentlemen; every municipality of the county has got a dispensary of its own, of which there are at present 61. Sixty-two ladies have been gratuitously trained by the county physician, and are working gratuitously. In villages where there is only one practitioner he acts as the dispensary doctor, and where there are several physicians, each of them acts as doctor to his own patients. Every practitioner sends in the names and addresses of tuberculous patients. The presidents of all these 61 dispensaries are county councillors. The central dispensary decides if a patient is to be sent to a sanatorium, a tuberculosis hospital, a day camp, or if he is to receive money, milk, or fuel, and if rooms are to be disinfected or altered, etc.

[1] Schmittmann, *Die Einrichtung zentraler Auskunfts und Fürsorgestellen, etc., im Bezirk der Landes-Versicherungsamt*, Düsseldorf, 1909.

(2) County Soligen. Here, too, each municipality has a dispensary of its own, erected and maintained chiefly by the "Emperor William-Augusta-Victoria Foundation" (capital £50,000), a private charitable institution presided over by the county councillor. All the four physicians practising in the county act as dispensary doctors, each assisted by dispensary nurses, and by an alderman as trustee. The central dispensary in Opladen has engaged as head nurse a former medical corps sergeant, specially trained in disinfecting and in nursing tuberculous patients. He also keeps the other dispensaries in close contact with the central one. The dispensaries may give away milk, meat, or victuals, beds, and other useful things, but no money; if possible they pay only one-third and make the poor-law authorities, illness insurance banks, and other organisations pay the remaining two-thirds.

(3) In the County Montjoie anti-tuberculosis work is characterised by secrecy, the consulting-rooms of the four doctors being at the general dispensary, where all diseases are treated, and the four nurses have to visit other than tuberculous patients. These and similar measures have been taken in order to conceal the real nature of the disease from the neighbours of patients. The doctors get 2s. to 4s. for every examination.

As for the nine other counties belonging to the district of the Invalidity Insurance Bank "Rheinprovinz," we must refer to the excellent study published by Schmittmann.[1] But this sketch of the organisation of the work in three counties will suffice to show how the dispensaries are being everywhere adapted to local circumstances, and to demonstrate how widely the various dispensaries differ from each other, especially in the country.

Town dispensaries show a greater uniformity, although here, too, individuality and character of the president, doctors, and nurses decide whether help and money be simply thrown away or rightly spent. As typical dispensaries may be mentioned the establishments erected in Berlin by Secretary Puetter,[2] and controlled by the Berlin Central Committee for Anti-Tuberculosis Dispensaries. The chief feature of these dispensaries is the close co-operation with municipality, invalidity and illness insurance banks, private associations, charitable institutions, poor-law authorities, school doctors, sanatoria, tuberculosis hospitals, day camps, seaside hospitals, and any other institutions that may be of use

[1] Schmittmann, *l.c.*

[2] Puetter, E., *Die Auskunft und Fuersorgestellen in B. Fraenkel; Der Stand der Tuberkulosebekaempfung in Deutschland*, pp. 215-230, Berlin, 1905.

in the campaign. Every home is visited by the nurse, and, if necessary, by the doctor; every member of the patient's family is examined medically either by his private doctor, his insurance or poor-law doctor, or if the patient should have no right to free medical treatment, by the dispensary doctor; the latter also examines those patients sent to the dispensary by other doctors. The main purpose of these dispensaries is to obtain, if necessary, for the patient admittance to one of the above institutions, to make him sleep in one room or at least in a bed by himself, to teach him how to be careful in his habits, to help him to pay his rent or for a nurse, and to give in case of need, milk, provisions, fuel, clothes, etc.

The chief aim of dispensaries being not to cure early cases but to protect endangered persons against infection, children ought to be looked after with special care. This maxim has been thoroughly understood by the Austrian Anti-Tuberculosis League—the "Viribus Unitis" association for the helping of the tuberculous—which from 1903 has directed its efforts to the establishment of dispensaries and to the care of children.

The first Austrian dispensary opened at Vienna in 1905 must be looked at as a most happy combination of dispensary and children's home. While the activity of the dispensary is pretty much the same as in Germany, the children's home receives children in danger of being infected with tuberculosis, and those who require to be looked after during the day, in order to allow another member of the family to earn a livelihood to support the patient. The first group of children spend day and night at the home, whereas the other children are kept at the home only during the day. There are now 40 available beds distributed over 6 bedrooms; and in a special department 5 or 6 babies may be received. Dispensary and children's home have 1 doctor, 6 nurses, and 1 clerk. The children are fed and taught at the home.

Another dispensary opened in 1906 at Laibach has also a children's home, whereas the other 29 Austrian dispensaries differ from those of Germany in that patients are not only examined but treated. In Hungary the State has established two large dispensaries, one in Budapest, and another in Algyogy, both opened in 1908; besides these there are 4 other dispensaries in Hungary due to the initiative of illness insurance banks or of charitable institutions.

Hospitals for Advanced Cases

The contact of healthy individuals with tuberculous patients is best prevented by removing the patient, rather than by making the endangered persons live in special places, such as day or night camps, or in children's homes. This preventive measure is not yet popular in Germany, although prominent authorities like Leube (Wuerzburg)[1] have recommended it warmly, and although the first tuberculosis hospital was established by an invalidity insurance bank in 1900 at Lichenberg near Berlin. In Germany hospitals for special diseases, so common in England, are practically unknown, so that tuberculosis hospitals are a novel idea. Further, German hospitals, unlike English, are not based on private charity, but are erected and maintained chiefly by municipalities, counties, accidents insurance banks, and other organisations. This fact and the circumstance that the German public has not yet been educated to look upon the nursing of hopeless cases as a duty of charity, and as a rational measure of preventing disease, have made it impossible to raise sufficient private and public funds for the erection of hospitals for advanced cases. But even where these have been erected by insurance banks, some of which recognised the great importance of such institutions, there has sometimes been failure, as the patients would not remain there. The reason for this is to be found in the regulations of the Invalid Insurance Bill, which only allows the invalidity insurance banks to treat tuberculous patients in hospitals on payment of the invalidity allowance. As the patient's family profits from this money while he remains at home, and as he may be useful in looking after children, going errands, etc., it is evident that for these very material reasons families will not always use their influence to induce the patient to live in a hospital. If those dependent on patients with advanced disease were provided for by law, as are the dependants of early cases treated in sanatoria, the difficulties in popularising such hospitals in Germany would soon be overcome.

Notwithstanding these unfavourable circumstances the Invalidity Insurance Bank "Rheinprovinz" at Düsseldorf has established and successfully maintained a relatively great number of tuberculosis hospitals. In its district 28 of these institutions have been established, either as special buildings, or as specially adapted departments of other hospitals. The number of patients applying for admittance

[1] Leube, v., *Spezialkrankenhaus fuer Tuberkuloese, etc., in Fraenkel, B.; Der Stand der Tuberkulosebekaempfung in Deutschland*, Berlin, 1905.

into these hospitals is steadily increasing. While on the 1st of January 1905 only 50 patients were being nursed, this number had risen to 128 on the 1st of January 1909.

Tuberculin Depôts

As tuberculin is used in the majority of German sanatoria, and as the usual sanatorium cure of 10 to 12 weeks is not long enough to complete the special treatment, tuberculin depôts have been established in several places, where this treatment may be continued. The number of physicians who are against the therapeutic use of tuberculin is very small, and the results of these tuberculin depôts are very encouraging, as tuberculin, if wisely administered, may be given without interfering with the patient's occupation.

Farm Colonies

Post-sanatorium care in another form is represented by 16 convalescent homes representing 700 beds; one of them, at Sannum in Oldenburg, is a colony where the patients are doing garden and farm work. In other places like Stuebecksborn in Hanover colonies have proved an utter failure because very few of those leaving a sanatorium could be induced to enter such a colony. The majority imagined themselves cured and wanted to provide for their families, or else the good fare in the sanatorium had made them unappreciative of the value of a colony, where food and work were of necessity more similar to home conditions. One difference in the management of the successful colony at Sannum and the unlucky Stuebecksborn is worth mentioning here. In Stuebecksborn the convalescents were paid for their work, while in Sannum they earned no money. This difference is essential, and accounts in part for the failure of the former. Gardening or farming is necessary for the recovery of health in convalescents, for which they ought not to be paid.

In Austria, where 5 convalescent homes are available, these difficulties are apparently more easily overcome, as in Austrian sanatoria the patients are more frequently kept working than in those of Germany.

Day Camps

In addition to hospitals and colonies there are camps for convalescents, where they may spend the day in the woods. These day

camps, of which there are at present in Germany 94, in Austria 5, and in Hungary 3, ought to be situated in the immediate neighbourhood of towns and villages, and connected with them by railway or by electric cars. The cost of erection is relatively low, and in Germany is mostly paid by private charitable associations, whereas their maintenance is guaranteed by the illness insurance and also by the invalidity insurance banks. The patients receive their sick allowance, full board at the camp, and free fare to and from the camp. They arrive in the morning, are given milk and bread, then rest for a couple of hours in deck-chairs wrapped up in woollen blankets. There is also an open shed where the chairs can be put out on rainy days. One or twice a week the patients take a warm bath in the morning. Soon after midday they have a meal consisting of soup, meat, vegetables, milk and bread. After the meal most of them rest again till 3.30 P.M., when again milk and buttered rolls are given. The afternoon is passed walking, reading, playing, or gardening. Between 6 and 7 P.M., before leaving the camp, they are given supper consisting of milk and sandwiches, or milk and fried potatoes and cold meat alternatively.

Night Camps

Some of these camps (in Germany 26) have also night accommodation. Such day and night camps are especially useful for convalescents living so far away that they could not possibly make the journey twice a day. These camps resemble convalescent homes with these differences that only part of their clients stay over night, that they are constructed and managed on much simpler lines than convalescent homes, and that usually a doctor only comes once or twice a week to the camp for a couple of hours. Another institution popular in the United States has hitherto been unknown in Germany, Austria, and Hungary, *i.e.* night camps where patients go only for the night.

As the anti-tuberculosis problem is to a large extent a housing question, and as the disadvantages of poor conditions assert themselves much more at night than during the day, it is logical to provide for accommodation for the night. In Germany, Austria, and Hungary, where the principal meal is usually at midday, and where the people get home from work very late in the evening, the management of such night camps would be very economical, and the extensive woods make it possible to erect such night camps within easy reach of almost every town.

Establishments for Children

Long before doctors, hygienists, and economists started the modern warfare against tuberculosis throughout the whole civilised world, private charity had already effectively begun to help tuberculous children. To Great Britain [1] belongs the credit of having established not only the first Anti-Tuberculosis Dispensary (Edinburgh, 1887), but also the first hospital for children suffering from tuberculosis, founded at Margate as early as 1796. Austria was the first to follow, erecting in 1852 a sanatorium for tuberculous children at Vienna, and then in 1873 the seaside hospital for children at Grado. In Germany it was Beneke who popularised the erection of special hospitals at the seaside for children, after he had seen the excellent results obtained at Margate. Thanks to his initiative 3 seaside sanatoria for tuberculous children were opened in Germany in 1874 at Kolberg, Elman-Salze, and Norderney. Since then the number of such establishments has steadily increased, and the modern anti-tuberculosis movement gave these endeavours a new impulse. At present there are in Germany 107 hospitals and sanatoria with nearly 10,000 beds for tuberculous or weakly children, and in Austria altogether 15 infirmaries with about 20,000 beds; it has been mentioned that two big Austrian dispensaries are connected with homes for tuberculous children.

The day camps have become of importance in the fight against tuberculosis among children because half the camps receive children, either alone, or with women. In some of these camps the children have lessons. Of these open-air schools there are at present in Germany 12, with accommodation for over 1000 children. The first open-air school was erected by the municipality of Charlottenburg in 1905.

The day camps are not exclusively reserved for tuberculous children, but it is evident that any institution to strengthen the general health of children is of value in the fight against tuberculosis—such are school baths, holiday homes and colonies, milk kitchens, and school doctors and dentists.

Anti-Tuberculosis Work and Authorities

The quick and extensive development of the anti-tuberculosis movement in Germany, Austria, and Hungary would have been impos-

[1] Confer Häberlin, "Die Kinderseehospize Europas und ihre Resultate," *Medizinische Klinik*, 1909, Nos. 23-25.

sible had not the different Governments lent powerful aid. The German State spends £5000 yearly for this purpose, Hungary £8000, while Austria has given a sum of £80,000, the interest of which is being used. In Germany and Austria these sums have been augmented by several specially licensed lotteries.

A considerable amount of this money is put into the hands of three anti-tuberculosis societies—The German Central Anti-Tuberculosis Committee in Berlin (first secretary, Professor Dr. Nietner) ; The "Viribus Unitis" Association for the Assistance of Tuberculous Patients in Austria at Vienna (president, Dr. Hans Count Larisch ; first secretary, Dr. Ludwig Teleky); and The Hungarian Sanatorium Association at Budapest (president, Ludwig Count Batthyany ; first secretary, Privatdocent Koeniglicher Rat Dr. Franz Tauszk).[1]

Almost all the ministries of the three countries have taken the opportunity of furthering the anti-tuberculosis movement within their sphere of influence, either by recommending the erection of sanatoria, tuberculosis wards in common hospitals, dispensaries, or by advising hygienic measures in schools, railways and other public places, or by compiling statistics, and introducing preventive measures into the army and navy.

The Future

Looking at the enormous number of anti-tuberculosis establishments in Germany, Austria, and Hungary, one might be induced to think that now everything has been done, and that especially in Germany almost nothing has been left for the future. But even here some classes of patients, the advanced cases, and the whole middle class who belong to no insurance bank, are not yet sufficiently provided for, hopeful cases must be dismissed too early for want of means, and too many only begin to look for help too late.

One of the best means of popularising the work is by tuberculosis exhibitions, stationary and travelling ones, of which 10 exist at present in Germany. Public lectures, enlivened by the demonstration of instructive lantern slides, and the many cinematographs in almost every town, might be useful.

Another important point to be taken into consideration is the concentration of anti-tuberculosis work. The great number of associa-

[1] I am greatly indebted to the courtesy and kindness of all these gentlemen for the gracious loan of reports and books from which the greater part of the data given above have been reproduced.

tions interested in the campaign against tuberculosis—in Germany not less than 300—have certainly obtained results, but here and there one gets the impression that by concentration still more could be done. In every place there ought to be a centre for the whole anti-tuberculosis work, and this centre should be the dispensary, from which the patients are sent if necessary, either to a camp, to a sanatorium, to a colony, or to a hospital; and these various institutions ought to co-operate still more with each other and with the general practitioners. This ideal state of things is realised in the Edinburgh Anti-Tuberculosis Scheme of Dr. R. W. Philip. If every town and village were within easy reach of such a co-operative anti-tuberculosis system, the question asked by Edward VII. of Great Britain, "If preventable, why not prevented?" might soon become without object.

W. Fornet.

CHAPTER XXVI

THE MOVEMENT IN RUSSIA [1]

Incidence in Russia—Tuberculosis Increasing—Pulmonary Tuberculosis—Death-Rates in Russian Cities Compared with Western Europe — The Rural Districts—Social Conditions of the Peasantry—Evils of the Factory Settlements—The Movement in Russia—Sanatoria—Interest of Alexander III.—The Association of Russian Doctors—Russian Anti-Tuberculosis Association—Government Opposition—Association for the Protection of Public Health—Action of the Russian Home Office—Anti-Tuberculosis Associations—The Political Movement—The All-Russian League.

Incidence in Russia

Russia, unfortunately, takes a foremost place amongst European nations in regard to the occurrence of tuberculosis; the Report of 1907 on the General Health of the Population gives the number of tuberculous patients as 545,070, *i.e.* about 36·6 cases in every 10,000 inhabitants. In view of our incomplete medical statistics, and of the frequent impossibility of collecting statistical data amongst the various nomadic tribes (Kirghiz, Kalmucks, etc.) and amongst the half wild races of the Caucasus, Central Asia and Siberia, the foregoing figures must fall far short of the actual numbers. The total yearly deaths from tuberculosis in Russia reach 450,000, and since Leyden and Dittweiler calculate the death-rate among tuberculous patients to be $\frac{1}{6}$-$\frac{1}{7}$ of the total number, it follows that the number of tuberculous cases in Russia must approach some two and a half millions.

This figure, viz. two and a half millions, colossal as it may appear, is not out of proportion considering that the total Russian population amounts to 150 millions, and further in view of the fact that Germany, with her more favourable economic conditions and her superior organisation against the disease, shows 800,000 cases of tuberculosis.

Tuberculosis Increasing

Apart from the enormous number of tuberculous patients, Russia presents the more saddening spectacle of a yearly increase in the

[1] Translation by Colonel R. L. A. Pennington.

number of patients. The following are the registered figures of tuberculosis for the thirteen years up to 1907:—

Year.	Number.	In every 10,000 Inhabitants.
1895	258,832	21·1
1896	278,573	22·3
1897	280,874	22·8
1898	297,236	23·1
1899	293,131	25·4
1900	341,267	25·6
1901	376,078	27·7
1902	409,546	29·7
1903	416,687	29·8
1904	424,525	29·8
1905	443,441	30·7
1906	483,370	32·9
1907	545,070	36·4

It will be seen that the increase of the number of cases is independent of the growth of the population, since the percentage of cases shows continual increase; in 1895 there were 21·1 cases in 10,000 inhabitants, in the year 1907 the number of cases per 10,000 had increased to 36·4.

In Finland the same state of affairs exists. It must of course be taken into account that the registration of disease becomes yearly more complete, and also that there is improvement in diagnosis.

The following localities are the centres where the disease is most pronounced:—The Moscow industrial districts and the North-West Governments; the Baku, Tiflis, and Black Sea Governments in the Caucasus; the Irkutsk Government in Siberia, and the Caspian Sea Provinces in Central Asia.

Pulmonary Tuberculosis

In Russia we have no differential statistics of the number of deaths from various forms of tuberculosis. Assuming, however, that the percentage of deaths from pulmonary tuberculosis is the same in Russia as in Finland, in which latter country the death-rate from that disease is 27·3 in 10,000 (average of twenty years up to 1905[1]), it may be calculated that in Russia pulmonary tuberculosis accounts for no less than 410,000 deaths; this figure would naturally be much greater if all forms of the disease were included in it. Allowing for a considerably higher level of civilisation and economic conditions in Finland than in Russia, it may reasonably be assumed that the above figure

[1] Richard Sievers, *La lutte contre la Tuberculose en Finlande*, 1909.

falls short of probability, for without exaggeration it may be said that in Russia no fewer than 450,000 die yearly of tuberculosis.

Death-Rate in Russian Cities

The statistics of our larger towns are much more complete.

Average Yearly Deaths per 100,000—Years 1903-1907 [1]

Name of Town.	Deaths from Pulmonary Tuberculosis.	Deaths from Tuberculosis of other Organs.
St. Petersburg .	300·4	69·2
Moscow . .	260·3	47·5
Warsaw . .	244·4	157·3
Odessa . .	250·9	32·6
Tiflis . . .	220·9	34·2
Saratow . .	230·7	7·6
Baku . . .	160·6	12·1
Wilna . .	196·0	20·1
Astrakhan . .	293·9	21·4
Nishni-Novgorod	340·7	46·0
Nikolagen . .	253·0	17·1

When these figures are compared with the deaths from pulmonary tuberculosis in the larger towns of Western Europe, it will be seen that our Russian towns are in far the most satisfactory condition.

Table of Deaths from Pulmonary Tuberculosis in the Following Towns [2] per 100,000 of Population:—

Bucharest . . .	422	*Astrakhan* . . .	293
Budapest . . .	386	Munich	282
Paris	382	Christiania . . .	279
Breslau	347	Lyons	274
N. Novgorod . . .	340	Madrid	270
Athens	336	*Moscow*	260
Vienna	329	*Nikolajew* . .	253
St. Petersburg . . .	300	*Odessa*	250
Warsaw . . .	244	Marseilles . . .	215
Leipzig	240	*Wilna*	196
Milan	231	Rome	173
Saratow . . .	230	Hamburg . . .	162
Stockholm . . .	222	*Baku*	160
Tiflis	220	Copenhagen . . .	157
Berlin	220	Amsterdam . . .	147
Dresden	217	London	145

[1] Report of Chief Medical Inspector.

[2] Nowoselski and Mammonoff, *International Tuberculosis Statistics, etc.*, St. Petersburg, 1907.

The above shows fewer deaths in the larger Russian towns than in those of many other European cities.

It is also satisfactory to note that the percentage of deaths from pulmonary tuberculosis in our large towns decreases yearly.

Considered in five yearly periods the average deaths from pulmonary tuberculosis per 100,000 were as follows:—

In St. Petersburg		In Moscow	
1881-85	548	1878-82	436
1886-90	474	1883-87	395
1891-95	398	1888-92	409
1896-00	330	1893-97	351
1901-05	300	1898-02	298
		1903-07	260

The Rural Districts

Although there is a progressive decrease in deaths from pulmonary tuberculosis in our great cities, there is on the contrary a continual increase of all forms of tuberculosis in the agricultural and industrial districts. The death-rate in the Russian agricultural districts is much greater than in those of Western Europe.

Social Conditions of the Peasantry

This state of affairs must be ascribed to the insanitary condition of the houses, and to the constant lack of nourishing food amongst our peasants. The following illustrates the manner in which these live:—

Dr. Schingaroff's investigations show that very frequently houses sufficient in size for two persons are inhabited by a family of seven, and often by domestic animals in addition.

One hundred peasants' houses were measured in three Tartar villages and the average cubic air space was found to be half that actually needed for health—this in a district where forests abound and where wood is exceptionally cheap.

The heating arrangements by means of stoves in most peasant houses are of the worst; the inhabitants are saving in wood, and close up the stoves before the wood is thoroughly burnt out, consequently the exhalations therefrom, escaping into the rooms, poison the air. Doctor Schingaroff, who examined the villages in the Woronesch Government, reports that such noxious exhalations from

stoves were of daily occurrence in one-third of the houses. In many villages one finds houses with earth floors and stoves without chimneys.

It is the fact, though difficult to believe, that in certain villages in the Governments of Kasan and Wjatka wood splinters are still used for lighting purposes.

Such wretched conditions of existence amongst our peasants account in a great measure for the spread of tuberculosis.

Evils of the Factory Settlements

Even worse conditions exist in the factory settlements in Russia, where the death-rate is 2½ times greater than amongst the peasants. (Dr. Wachs). The explanation of this is to be found in the especially trying conditions of life, in the lack of proper regulations for work, deficiency of medical assistance, disgraceful sanitary condition of dwellings and workrooms, and in the widespread existence of drunkenness and syphilis. Further, the great majority of workmen in Russia are completely uninsured against unemployment due to sickness and old age. These conditions compare most unfavourably with those in Germany, in which country the enforced sickness and old age insurance and also the workmen's associations play a prominent part in the anti-tuberculosis campaign.

From the above short description of the conditions of life of our peasants and workmen, who form 85 per cent. of the total population of Russia, it is easy to understand that tuberculosis becomes more deeply rooted in our villages and industrial centres, and that the general death-rate from pulmonary tuberculosis is on the increase, except in the towns. In regard to the towns, it was naturally impossible for the authorities, or for society in general, to remain blind to such a serious condition of the public health. A demand was made for far-reaching measures to combat the malady, such demand arising perhaps as much out of self-interest as out of humanity.

The Movement in Russia

Let us now consider the measures which have been taken in Russia against tuberculosis.

Up to the commencement of the year 1890 the public hospitals alone were concerned with treatment of tuberculosis, and there was no general attempt to treat tuberculosis as a widespread national

evil. When, however, in Western Europe a great public anti-tuberculosis movement became apparent, this naturally attracted the attention of the more thoughtful representatives of Russian society. Individuals and charitable associations took up the question of combating tuberculosis, and decided to adopt an organisation dependent on the efforts of private persons. The first result of this was the establishment of sanatoria.

Sanatoria

The first sanatorium was opened in 1891 at Halila in Finland, 70 versts from St. Petersburg. This institution was founded by Dr. Dittman, and was subsidised by the Finnish Government, but owing to lack of means it was soon afterwards closed. Later it was purchased and enlarged by the Emperor Alexander III. out of his private funds. At the present time 118 patients are cared for, of whom 65 are received without fees. This sanatorium possesses a considerable quantity of land, one-fourth being pine forest.

Shortly after the opening of the Halila Sanatorium the Association of Russian Doctors in St. Petersburg undertook to collect subscriptions for a new sanatorium. At the end of a year the property of "Taizy" was, under Imperial instructions, made over to the Association, with buildings, land, and a sum of 476,000 roubles. In addition, the Emperor promised a subscription of 5000 roubles yearly. This sanatorium was finally opened in 1900, with accommodation for 56 beds, 20 patients being received gratis.

From this time there has been a steady yearly increase in the number of sanatoria founded by private persons or by charitable societies. In order not to weary the reader with details it will be sufficient to mention here that there exist now in Russia some 25 sanatoria in which sufferers are received either without fees or for very small charges. These are divided amongst the Crimea, Caucasus, Finland, and Poland.

The Association of Russian Doctors

However necessary such sanatoria might be, it was very evident that such means alone were insufficient, and that these institutions could only be regarded as a part of the equipment necessary to combat a disease so widely spread amongst the population.

The leaders of the movement were convinced that nothing short of drastic social reform was required to raise the moral tone of the people, and to press forward organised and determined measures against this national plague. "The Association of Russian Doctors" took the initiative in founding a widespread and popular organisation, dedicating the movement to N. I. Pirogoff.

In the year 1899 the committee of the Seventh Pirogoff Congress, moved thereto by Professor Scherwinski's report, resolved as follows:—

1. To move that the Directorate of the Congress include the question of tuberculosis in the next agenda of the Pirogoff Congress.
2. To select a Commission to prepare the preparatory details of this question for the Congress.
3. To charge the Commission with the complete elaboration of the programme.

A provisional Commission for the study of tuberculosis was organised in March 1900. The following were the results aimed at:—

Russian Anti-Tuberculosis Association

1. The drawing up of a general programme for the study of tuberculosis in Russia.
2. Decision as to the measures to be taken for combating tuberculosis.
3. The drawing up of draft statutes for a "Russian Anti-Tuberculosis Association."

In 1902 the provisional Commission became a permanent one, and undertook as its first duty the organisation of a "Russian Anti-Tuberculosis Society."

Government Opposition

Unfortunately no result was arrived at, as the Government declined to confirm the statutes of the Association.

This must be regarded as the second important attempt to form a general anti-tuberculosis association.

In the year 1903 the above Commission called a meeting of all interested, and placed before it the first proposal for the organisation of an Anti-Tuberculosis Congress in Russia.

In 1905, owing to the strained political situation, the Commission was obliged to suspend its labours.

Association for the Protection of Public Health

Following the example of the Pirogoff Association, other societies formed commissions to deal with the anti-tuberculosis question.

In 1901 the Association for the Protection of Public Health organised a Commission with a view to combating tuberculosis. The following were its aims:—

1. To lay before the Russian Government the means and measures proposed.
2. To solicit the Government and public bodies to adopt the necessary decisive measures.
3. To issue popular books and pamphlets, and to organise public lectures, exhibitions, etc.

The various sections of which the foregoing Commission consisted devoted themselves to the work on much the same lines as those adopted by the St. Petersburg Commission.

A similar Commission was established by the Sanitary Association at Warsaw.

Action of the Russian Home Office

In 1903 the Russian Home Office established a Standing Anti-Tuberculosis Commission, charged with the special duty of keeping the Government informed of anti-tuberculosis measures in Russia and in foreign countries. This Commission, in close touch with the Anti-Tuberculosis Association, endeavoured to obtain, on the part of the Russian Government, an acceptance of the measures of the International Association, this latter body having shown itself desirous of receiving the countenance and support of the Government.

Apart from this Commission and from other societies previously formed, a number of new associations came into being with the object of furthering the anti-tuberculosis movement.

Anti-Tuberculosis Associations

Such associations exist in St. Petersburg, Moscow, Kiev, Odessa, Tula, Poltawa, Jalta, Alupka, Rostow on the Don, Saratow, Tiflis, Warsaw, Lodz, Lublin, Revel, and Riga (Finland is not included).

These associations propose:—

1. To open sanatoria, hospitals, and grounds for tuberculous patients.
2. To establish summer colonies for sick and weakly children.
3. To assist sick and their families by help in kind.
4. To build cheap apartments in towns for the indigent population.
5. To disseminate knowledge of the actual nature of the disease, and information as to the proper means of prevention and cure by the help of pamphlets, books, newspapers, lectures, exhibitions, museums, etc.

All anti-tuberculosis institutions do not work with one and the same energy, but where opposition is not encountered and where sufficient funds are available, the work progresses steadily and constantly attracts more helpers. For example, the Tula Association, though only quite recently established, has already a dispensary, a free sanatorium, and an admirably provided summer colony for children.

In Warsaw there are already two dispensaries and a summer colony, where 3000 children can be received. A special tuberculosis magazine is published there in Polish. There is also an institute for the care of children, established out of private funds. The special province of this very complete institution is to improve the neglected hygienic conditions under which the children of the poorer peasants live. It seeks to instil rational hygienic ideas amongst the poorer population by the provision of baths, douches, and by arranging for gymnastic training, dentistry, etc., either free of charge or for small fees. Popular instruction of the mothers in hygiene is also undertaken.

Connected with this institute is another, founded in recent years by private subscription, for the purpose of providing Pasteurised milk for infants or sick children gratis or at a small charge.

The Political Movement

The energy of individual associations, however, is insufficient to achieve any great results in the campaign against this widespread malady. Philanthropy alone cannot hope to cure the immense mass of infected population. As previously remarked, the colossal proportions which tuberculosis assumes in Russia mainly arises from the poverty and ignorance of the majority of the people, from the severity of the labour conditions, the lack of proper regulations (especially those having regard to insurance of workers and insurance against sickness), the manifold police obstructions to anything calculated to enlighten the population, and to the feeble development of social confidence and independence.

The All-Russian League

To deal with such conditions, to endeavour to lessen their influence, and to amend them, is the task which must be undertaken by Russian society in general if any real results are to be attained. This problem

had already been under consideration even before the formation of the Pirogoff Association. In 1907 the standing committee, formed to deal with anti-tuberculosis propaganda and methods, resumed its labours, and aimed at the institution of an All-Russian League, which should include all individual organisations striving directly or indirectly to combat the disease.

In order to demonstrate the province of future activity of the League, certain of the statutes are here briefly given :—

1. The aim of the All-Russian League is as follows :—To develop and give effect to all measures which are indispensable to the success of the movement, and to unite all associations, institutions, and authorities who are seeking the same object as the League, or who sympathise with its operations.

2. The following are the methods proposed to effect this :—

(*a*) To decide on an organised plan of campaign.
(*b*) To form branches of the League throughout Russia.
(*c*) To call periodical meetings of Congress to discuss anti-tuberculosis and allied questions such as medicine, hygiene, etc.
(*d*) To propagate information as to the origin and cure of tuberculosis.
(*e*) To found special libraries, museums, exhibitions, and information bureaus.
(*f*) To organise inquiry commissions for the study of tuberculosis.
(*g*) To circulate books and newspapers on the subject.
(*h*) To establish institutions of various kinds for the study and cure of the disease.
(*i*) To secure the co-operation of the Government and of public bodies in the work.

The foregoing indicates the wide field of action undertaken by the Association, and points to the need for the co-operation of the whole body of Russian society if a successful issue is to be arrived at.

The provisional Directorate of the League endeavoured, as far as possible, to enlist the support of members of society, civil authorities, and private individuals. In the course of four months the Directorate of the League had issued propaganda calling for decisive action against the disease, had published articles in the general and medical press, and had called on all medical and philanthropical societies to lend their assistance.

Russian society was not deaf to the appeal, and from all sides applications for membership were received.

In March the membership was so considerable that the Directorate decided to call the first committee meeting.

The committee consists of individual members of various societies and public bodies, and also of members of the Directorate of the League. The general meeting is open to all members of the League.

On the 20th April 1910 the All-Russian Anti-Tuberculosis League was opened in the Medical Military Academy in St. Petersburg.

Thirty-four representatives of various societies and a great number of members took part in this general meeting. Thirty-four representatives may not appear a great number, considering the enormous size of Russia, but when it is remembered that many came from the most distant parts, some of them travelling over 1000 versts, and that included amongst them were representatives from Siberia, the Caucasus, the Crimea, and the Baltic provinces, this modest number assumes a considerable significance.

It is a matter for congratulation that the inauguration of the League was greeted with approval by the Government, by the learned bodies, and by society in general in all parts of Russia.

In the General Assembly the general scheme of proposed work was outlined and universally approved; the Directorate has now before it the task of carrying the programme into effect.

It was thus that the anti-tuberculosis campaign in Russia assumed its new shape, following on those lines which have secured such brilliant results in Western Europe.

The future must decide if the League fulfils the hopes and expectations formed for it; one thing is certain, and that is that without the League no good results are possible.

I conclude my paper with the words employed at the inauguration of the League:—"Vivat—Crescat—Floreat."

A. W. Nikolsky.

CHAPTER XXVII

THE ANTI-TUBERCULOSIS MOVEMENT IN ITALY

Historical—Recent Efforts—Tuberculosis in Italy—Various Types of the Disease—Anti-Tuberculosis Movement—Dispensaries—Hospitals and Sanatoria—Results of Treatment—The Marine Hospice—Notification of Tuberculosis—Infection in Schools—Obstacles to the Movement in Italy—A Complex Problem—The Co-ordinated Scheme—Social Conditions of the People.

Historical

The infectious nature of tuberculosis, or at least of its pulmonary form, has long been recognised in Italy. So long ago as 1754 the Magistrate of Public Health of Florence decreed that every physician of the Grand Duchy of Tuscany be obliged to report to the Tribunal of Public Health in Florence, and to the Government Commissioners and Judges in the other provinces, any case of declared tuberculosis, under a penalty of 100 scudi; and, later, Ferdinand of Naples issued a decree ordering the destruction by fire of the clothing and effects of persons dying of this disease. When the view of the transmission of the disease by heredity subsequently gained the upper hand in the minds of scientific men these two measures of compulsory notification and of disinfection fell into disuse. The belief in its infectious nature continued to be firmly held amongst the common people, and even before the date of the discovery of the bacillus by Koch was so strong as to add greatly to the miseries of those unfortunate enough to become the victims of tuberculosis. Of late years, and since the communicability of the disease has come to be looked upon as an established fact, the fear of it amongst the lower classes of Italians amounts almost to a panic.

Recent Efforts

Under these circumstances it might be supposed that in Italy the campaign against tuberculosis would be eagerly taken up, and, stimulated by this fear, would make more rapid progress than in

other countries where scepticism as to the dangers of infection renders the people more indifferent. A few years ago an agitation was indeed begun; the question of its prevention was discussed at many conferences, a "National Anti-Tuberculosis League" was formed. Many schemes were put forward to cope with the scourge, and it seemed as if an active crusade were about to be started against it. Unhappily in most cases nothing further was done; the League was dissolved for lack of funds, and very few of the projected schemes came to anything. The propaganda thus initiated was, however, not quite ineffectual, since it led to the transference of patients from the general wards of the hospitals to special wards or to separate buildings. Although in many places the expense involved in this undertaking was so great as to prevent any further effort to combat the disease in those neighbourhoods, in some cities, on the other hand, large hospitals were actually constructed to receive the graver forms of the disease. In this way many dangerous cases of tuberculosis were removed to hospital and there isolated with great advantage to the public health. The discussions which then followed on the efficacy of sanatoria for preventive and therapeutic purposes, by revealing to the governing classes a difference of opinion among scientific men as to their value, had the effect of paralysing any effort to provide them, which the former had at first been inclined to make. The accounts of the enormous expense incurred in some foreign countries such as Germany, Switzerland, and England in building sanatoria (amounting to as much as £250 sterling and upwards per bed) further served to discourage a comparatively poor country like Italy from following their example, with the result that up to the present moment no really serious and sustained attempt to grapple with the problem on broad and practical lines has been made.

Tuberculosis in Italy

Nevertheless, that the need of energetic and better directed efforts is very urgent, a glance at the statistics relating to tuberculosis in Italy abundantly proves. Although these show a slight diminution in the mortality during recent years, such decrease is probably due rather to the remarkable progress which has been made in general sanitation, than to any special efforts directed against tuberculosis itself. In the following table are the deaths from tuberculosis per 1,000,000

inhabitants in the three consecutive years of 1887, 1888, and 1889, and in the three consecutive years 19 years later, namely 1906, 1907, and 1908. As a fair index of the improvement effected during the same period in the general sanitary condition of the country, the corresponding statistics in regard to typhoid fever have been added.

DEATHS FROM TUBERCULOSIS AND FROM TYPHOID PER 1,000,000 INHABITANTS

Year.	Tuberculosis.	Typhoid.	Year.	Tuberculosis.	Typhoid.
1877	2101	939	1906	1677	281
1888	2126	800	1907	1698	255
1889	2119	768	1908	1656	272

When we look at the total number of deaths from the two diseases in the years 1888, 1898, and 1908 respectively, this contrast between them in the rate of decrease in mortality is perhaps still more striking.

	1888.	1898.	1908.
Total deaths from tuberculosis . .	59,934	55,726	56,544
Total deaths from typhoid . .	23,453	17,412	9,287

Large as these totals are for the deaths from tuberculosis as given in the official records, they are doubtless considerably below the real numbers, since many deaths certified as due to diarrhœa, chronic bronchitis, meningitis, or chronic pneumonia were certainly due to tuberculosis, whilst many more, no doubt, occurred in which the disease causing death was complicated by tuberculosis. It may therefore be safely assumed that considerably more than 60,000 persons die annually in Italy from tuberculosis alone. As there is practically no notification of the disease, it is impossible in Italy to arrive at an accurate idea of the total number of those living who are affected by active tuberculosis in one or other of its various forms. Some of the highest authorities on the subject would doubtless estimate it at not less

than ten times the number of those dying from it annually, or at somewhere about 600,000 persons.

Various Types of the Disease

The mortality returns quoted above refer to all forms of tuberculosis. It is interesting to analyse them according to the classification followed by the Italian Statistical Office, and to note to what extent each variety contributes to make up the grand total, taking for the purpose the official figures for the same years as before, namely 1888, 1898, and 1908.

	1888.	1898.	1908.
Disseminated[1] and Pulmonary Tuberculosis	32,178	38,335	41,587
Tuberculous Meningitis . . .	3,100	4,535	5,969
Tabes Mesenterica	12,485	9,124	5,514
Disseminated Scrofula and Lupus .	2,926	1,656	932
Tuberculosis of Bones, Articulations and other Organs, and Pott's Disease	9,245	2,076	2,542
All Forms . . .	59,934	55,726	56,544

The Anti-Tuberculosis Movement

Pulmonary tuberculosis and tuberculous meningitis are thus seen to be responsible for maintaining the mortality at its present high level, the other forms on the contrary showing a satisfactory diminution. This decrease has been effected chiefly amongst persons under 15 years of age. The cause of the slight improvement in the condition of the country as regards tuberculosis is therefore to be looked for mostly in those causes which have moderated the infant mortality, and not in the attempts which have so far been made to initiate a special campaign against tuberculosis itself. Praiseworthy efforts towards this end have not been altogether wanting, as a short record of what has already been done in various directions will show. A beginning has at any rate been made by providing here an anti-tuberculosis dispensary, or there a sanatorium, a hospice, or a hospital. What is chiefly lacking is adequate organisation, for little success has so far

[1] By "disseminated" is meant *general miliary tuberculosis.*

attended the attempts at co-ordinating the various institutions, required for an effectual compaign, as has been achieved by Dr. Philip in the now famous "Edinburgh system."

Dispensaries

There are several anti-tuberculosis dispensaries at work in Italy, including those of Florence, Bergamo, Genoa, Brescia, Rome, Milan, and Turin, in which the central idea is supposed to be the seeking out of infected individuals, and the application of measures to prevent them from infecting others. Some progress has also been made by means of the hospital isolation. A ministerial circular issued in 1897 ordered that tuberculous patients under treatment in hospitals should be removed to a special part of the hospital where they could be isolated from others. This plan, for various reasons, did not prove altogether satisfactory, for it often happened that both doctors and patients rebelled against it, the latter refusing to enter the special wards, and the former frequently allowing tuberculous patients to remain in the ordinary wards.

A better arrangement was carried out in Rome in 1905 when the Ospizio Umberto I. was opened with 256 beds, subsequently increased, by the erection of Döcker barracks, to 450 beds. This hospice is only the surviving portion of a really good scheme, recommended by Commendatore Ballori to the Hospital Commissioners, for providing (1) a sanatorium for the reception of early cases; (2) a hospital for advanced and incurable forms; and (3) a dispensary annexed to the latter—a scheme which unfortunately could not for lack of funds be carried out in its entirety. In the central part of this institution on either side of the main entrance are the rooms used for the dispensary. Here male and female patients from outside receive advice every morning in rooms reserved for each sex, and according to the stage of their malady are either received into the hospice or else treated as out-patients of the dispensary. The treatment of these out-patients is supplemented by meals consisting of soup, milk, and bread, given in refectories for the purpose, and all receive instructions of a kind fitted to educate them in hygiene. All "open" tuberculous cases presenting themselves at the dispensary are notified to the Municipal Office of Hygiene, in order that the due prophylactic measures may be carried out by the authorities.

Hospitals and Sanatoria

Besides the cases coming through the dispensary, all those sent in from the different public hospitals of the city, which have been received by them as urgent, or discovered to be tuberculous during treatment for other ailments, are admitted to the hospice, which is thus useful in freeing those institutions of a source of infection highly dangerous to their inmates.

Patients in the hospice submit readily to segregation, and in practice it is not found that the lighter cases are depressed by mixing with the more serious ones. The building is well and simply constructed so as to render aeration and isolation easy, and the food supplied to the patients is good and varied. The institution, under the skilful direction of Professor Angelini, is doing valuable work both in its dispensary and hospital departments. At the former, up to 31st December 1908 there had been 34,451 consultations, and 4924 cases had been notified to the authorities. At the latter there had been during the same period 3726 admissions, with a mortality of 40·3 per cent.

At Leghorn there is a hospital for tuberculous patients into which cases in all stages of the disease are received. At Venice the old hospital for infectious diseases has been adapted to the use of 58 tuberculous patients, and the results have been so satisfactory that it is being enlarged to 132 beds, and a section added for paying patients of moderate means.

At Turin a suburban "hospital-sanatorium" was opened last year. It is constructed to receive 200 patients, and has resting galleries, recreation-rooms, and refectories of an up-to-date kind.

Bologna at present sends its patients to the sanatorium of Budrio, which, having only 70 beds, is quite inadequate, but a new building is in course of construction, and will shortly be opened.

Catania has an isolation pavilion with 18 beds. Rovigo will soon have one of 17 beds. In Florence there are three special pavilions in the Hospital of Bonifazio reserved for tuberculous cases. Pisa has begun the construction of a tuberculosis hospital, while Verona and Naples are preparing to build others. At Milan a new one is about to be built with 320 beds divided amongst four pavilions, two of which are to be of the sanatorium type for early cases, with rooms containing from 4 to 8 beds each, and some with only 1 bed, the other two pavilions receiving advanced cases, and having wards containing as many as 11 beds. This hospital will be

surrounded by a large garden, and arranged in every way according to the most approved ideas. If necessary, two more pavilions can be added, so as to bring the accommodation up to 480 beds.

The "Sanatorio Criminale" opened for tuberculous prisoners on the Island of Pianosa has given such excellent results that the Government proposes to add four new pavilions, and to adapt to the same purpose the suppressed penitentiary of Montesarchio, in order to utilise its mountain climate for the benefit of these criminal patients.

One of the chief obstacles in the way of providing sanatoria for the poor of Italy is, as has already been said, the question of expense, which precludes the less wealthy communes from attempting to construct substantial and elaborate buildings of the kind used for the purpose in other countries. In 1906 the Genoese authorities decided to obviate this difficulty by erecting at San Martino d'Albaro a hospital for tuberculosis, consisting of 8 pavilions of the Döcker type. These constructions had been hitherto used in Italy and elsewhere on a large scale as barracks for troops, reserve pavilions for infectious diseases in connection with already existing hospitals, etc. Each pavilion cost, including the expense of erection, a little over 17,000 lire, or about £680 sterling, and accommodates 19 patients, giving each an air-space of about 20 cubic metres. In the space of three months the new hospital was ready, and its beds, 152 in number (95 for men and 57 for women), filled with tuberculous patients drafted from the Vala Bielato of the Civil Hospital of Genoa. The comparatively mild climate which Italy enjoys renders less necessary the solid and therefore expensive constructions required in more northerly and rigorous climes; and the elaborate indoor arrangements for recreation, etc., which help to make these institutions so costly elsewhere, are almost superfluous in a country where, as in Italy, it is possible to live out of doors all day. These Döcker barracks therefore appear to be admirably adapted for their purpose where variations of temperature are not extreme and considerations of expense prohibit the building of the ordinary type of sanatorium.

The hospitals and sanatoria referred to above comprise nearly all of those reserved exclusively for tuberculous cases in a population which at the end of the year 1908 was estimated at close upon 34,000,000. The following table shows the distribution of their beds throughout the different provinces of Italy in the year 1907, the latest date for which official statistics are available on this point:—

Piedmont	5	beds.
Liguria	9	,,
Lombardy	50	,,
Veneto	105	,,
Emilia	66	,,
Tuscany	95	,,
Latium	306	,,
Sicily	32	,,
Total	668	beds.

Results of Treatment

The number of admissions to these in 1907 amounted to 1047 males and 663 females, or in all 1710 patients. There were 755 deaths, equal to a mortality of 43·6 per cent. of 1732 patients sent out.

Allowing for those omitted in the above list, and for others which have been added since the year 1907, it is probable that the total number of beds in the country in institutions reserved for tuberculous patients scarcely exceeds 1000, an obviously inadequate supply for a country with a mortality from tuberculosis of 60,000 per annum. If only a few hundreds of those deaths take place in special hospitals where due precautions can be adopted during the patient's illness, it is evident that a vast proportion of the 60,000 must occur in the ordinary hospitals or in the patients' own homes. There, owing to the difficulties in the way of prevention and due disinfection, the danger of infection to others must be very great. Italy is thus manifestly behind in providing for her tuberculous sick. The success with which the country has dealt with other diseases, such as cholera, smallpox, and malaria,[1] where the necessity for organised effort has been realised, proves that an anti-tuberculosis campaign would be intelligently and energetically prosecuted, and would yield results quite as satisfactory as in other countries. A hopeful sign for the future is the action which has lately been taken by the Queen-Mother, who has promised to erect and furnish an Anti-Tuberculosis Dispensary on the slopes of the Janiculum Hill near Rome, and to endow it with funds necessary for its working and maintenance. The Institute of the Beni Stabili intends to provide another in the San Lorenzo district of Rome, and the Society for the Case Popolari another in connection with a group of its model dwellings there. It is to be hoped that these will be organised on lines

[1] The total mortality from malaria in Italy has been reduced from 21,033 in 1887 to 3463 in 1908.

similar to those followed by the Victoria Dispensary in Edinburgh, and that they will serve as models for the rest of Italy.

There seems to have been no attempt made so far to utilise the labour of patients in the sanatoria of Italy as a therapeutic measure. At all events, the experiment has never been given a fair trial, and it has been assumed that the plan would not succeed in Italy on account of the difficulty of inducing the common people to do any work without pecuniary recompense. Similarly, no attempt has been made to organise farm colonies as an adjunct to sanatorium treatment. Also hospitals reserved for advanced and incurable cases can scarcely be said to exist.

The Marine Hospice

Although Italy thus, in most respects, lags behind some other countries in the campaign against tuberculosis, she can claim priority in regard to one kind of institution which has proved of great value since it was first established on the initiative of Dr. Guiseppe Barellai, *medico primario* of the Hospital of S. Maria Nuova of Florence, who in 1842 founded the first Marine Hospice at Viareggio. Since that time many more marine hospices have been built, nearly every large town possessing one, to which several thousands of delicate and tuberculous children are sent every summer. Unfortunately all of them, with three exceptions, are closed during the winter, and the time each child remains—perhaps only from 15 to 20 days—is much too short. There are now in all 39 of these institutions scattered at various points along the Italian coast, chiefly, however, in the northern portions, only three, namely those of Naples, Lecce, and Palermo, being in Southern Italy. Very many cities also possess "Summer Colonies," to which weakly children are also sent for country and mountain air, and which must be reckoned amongst the most valuable weapons for combating tuberculosis. The first of these in Italy was instituted in Milan in 1881. Grancher's "Œuvre" in Paris, which places children of tuberculous parents with peasant families in the country, has been imitated with success in Italy by the cities of Florence and Genoa. In Genoa, on account of the scarcity of peasant families in the neighbourhood, a special home for the children has been instituted. In Florence the Anti-Tuberculosis Committee places *en pension* among families in the country those children indicated by the Anti-Tuberculosis Dispensary as in danger of infection; and the Sanatorio Regina

Elena of the same city, with its annexed Alpine Colony Vittoria, receives in addition to children of tuberculous parents, those who under any circumstances may be living with tuberculous patients.

Notification of Tuberculosis

In regard to the notification of tuberculous persons little progress has been made in Italy. The Regulation of 3rd February 1901 makes such notification obligatory "in cases which are dangerous to the public health." At the same time the law does not include it amongst the ordinary notifiable diseases, leaving it to the discretion of the Communes to make it notifiable or not. But, so far, no Commune has adopted compulsory notification of tuberculosis. It is, however, compulsory in the case of hospitals, hospices, orphanages, prisons, hotels, educational establishments, and nursing homes; in dairies and milk shops, and in all cases of death or change of domicile of the patient. The disinfection of the linen, bedding, and objects of personal and domestic use of those who have died from tuberculosis is compulsory and gratuitous. If a case is notified from a dairy the sale of the milk from the dairy is forbidden until the case is removed, unless the milk is first boiled under the supervision of the sanitary authority. Dr. Gatti in his excellent brochure, "La Lotta Sociale Antitubercolare in Italia," says that so far compulsory notification, even in this modified form, has not been a success in Italy, the total number of cases notified in the years 1902, 1903, 1904, 1905 having been only 8075, 6680, 6774, and 6295 respectively. The notifications of change of residence of tuberculous persons fell from 1339 in the year 1902 to 278 in the year 1905. Proper disinfection is not practised regularly, even in health resorts for patients, partly for want of funds.

Infection in Schools

A circular issued in October 1903 by the Minister of Public Instruction provides by Art. 13 that "pulmonary tuberculosis accompanied by cough and expectoration excludes from schools both pupils and teachers, as well as all others in the employ of the schools so affected." There are no statistics from which one can determine the number of tuberculous teachers in Italy, but there can be no doubt that on account of the peculiar danger of infection to which school teachers are exposed tuberculosis must be frequent. Yet

the law provides no control over this class of patient, there being no health officer whose duty it is to examine school teachers, although the danger of their spreading infection amongst their pupils is obvious in cases of "open" forms of tuberculosis. The circular, as far as they are concerned, therefore remains a dead letter. The disinfection, too, of schools is provided for by a special article of the General Sanitary Regulations. According to Professor Lustig, who investigated the question in 1904-5, disinfection, which should be carried out at least once a year, in a great many schools is never performed, and the visit of the sanitary officer, which should be made once a month, or oftener if required, in 90 per cent. of the schools examined by Professor Lustig never took place at all. Indeed, speaking generally, the deficiencies as regards the carrying out of public measures for the prevention of tuberculosis in Italy lies not so much in the want of adequate legislation for the purpose, as in the failure on the part of the authorities to apply vigorously the laws that already exist.

Obstacles to the Movement in Italy

According to Professor di Vestea,[1] the reasons why the campaign against tuberculosis has made so little headway in Italy are the following:—

1. A want of attention to direct means of defence. It is not sufficiently remembered that tuberculosis is an ambulatory malady, and that its subjects live for months and years amongst the healthy and amongst convalescents from other diseases, sharing with them the same dwelling-house and even bedroom, the same schoolroom, work-room or hospital ward, and the same means of transport in long journeys, especially by sea. He considers that the hospitalisation of the tuberculous poor still falls short in many places of the ideal of serving not merely for social defence but as a means of hygienic education.

2. The failure to recognise the fact that the campaign in Italy must be prosecuted in different ways in different localities, according to the nature of the dominating etiological factor in each—industrial conditions, alcoholism, emigration,[2] etc.

[1] "State of Tuberculosis in Italy" (Congress on Tuberculosis, Florence, 10th to 14th October 1909).

[2] In some districts of Italy, notably Chieti and Aquila, which were formerly almost immune from tuberculosis, the disease has of late years become very prevalent. The emigration from these districts to America has been very great, and a large proportion of the returning emigrants are tuberculous.

3. The inefficient application of the laws regarding the control of labour and the protection of childhood.

4. The disorganised condition in many Communes, even in some of the larger ones, of the public health service as to disinfection, on the efficiency of which the practical value of compulsory notification depends.

Professor di Vestea further considers that the law providing for the construction of modern dwelling-houses (*"case popolari"*) is not sufficiently liberal, and that the labouring classes do not show enough foresight and spirit of co-operation in taking advantage of its provisions. The problem of healthy and comfortable dwellings, he thinks, dominates and always will dominate the two most important undertakings of social hygiene, namely, the anti-alcohol and the anti-tuberculosis campaigns.

A Complicated Problem

The question of how to deal effectively with tuberculosis is therefore even more complicated than in other countries, and its solution correspondingly difficult. So much is this the case that a general feeling of pessimism exists in regard to it, especially amongst those who have studied the subject most closely, and know how deeply rooted are the causes which favour and foster the spread of the malady. It is evident that the enemy must be attacked from many sides, and that the efforts of the medical profession and of medical institutions can be only partially successful, unless supported by the co-operation of the authorities as well as by the interest and practical aid of the laity at large. Still it must be admitted that much more might be effected than has yet been accomplished if these efforts could be better organised and a definite plan of campaign agreed upon. Professor Santori has recently suggested such a plan. He would divide tuberculous patients into two groups, one of which would consist of those obliged to remain in bed, and the other of those able to walk about. For the first group he would have compulsory hospitalisation, except for the cases which could not possibly be removed from their homes and would require to be treated there. For the second group he would provide day hospitals, placing these on the outskirts of the cities, whilst in the country districts he would utilise the dispensaries for the poor already in existence, adapting them where necessary for the special needs of tuberculous patients. At these

not only would the patients receive appropriate treatment, but they would be taught also how to live hygienically and how to avoid conveying infection to others. This scheme he recommends at once as inexpensive and practical.

The Co-ordinated Scheme

To cope at all adequately with the evil, more elaborate and comprehensive methods will, however, be required. The anti-tuberculosis dispensary, on the sound lines of that of Florence for example, will have to be established in each centre of population; and in close touch and co-operating with it and with one another, as well as with the Public Health Department, a hospital for advanced and incurable cases, a sanatorium for early and curable ones, a day hospital, and, wherever possible, a farm colony. Most of these institutions, as has been seen, already exist in Italy, but in small numbers, and, as a rule, independently of one another. They must be multiplied, and their working co-ordinated, before they can make much impression on the vast amount of disease with which they have to deal. The notification of, at any rate, all "open" cases of tuberculosis will doubtless become compulsory, the aid of the various charity organisations being called in, where any instance of hardship arises from the enforcement of that or any other stringent measure, required to be taken in the interests of the public or of the patient himself.

Social Conditions of the People

But all these measures can meet with only a disappointing amount of success if those of a wider scope are neglected. Such are the proper care and feeding of the young, the hygienic education and training of the people, the regulation of the conditions of labour of the working classes, and the providing of sanitary dwellings for the poor. In all these directions a great deal remains to be done in Italy as in other countries. Until the necessary reforms have been introduced, and have effected a great amelioration in the social condition of the population, it would seem vain to hope that the anti-tuberculosis campaign can ever reach a really triumphant conclusion.

G. Sandison Brock.

CHAPTER XXVIII

THE MOVEMENT IN SCANDINAVIA AND DENMARK
I. NORWAY—II. SWEDEN—III. DENMARK

I. THE ANTI-TUBERCULOSIS MOVEMENT IN NORWAY[1]

Tuberculosis in Norway—Geographical Configuration—Prevention of Pulmonary Tuberculosis—Educational Campaign—Legislation regarding Tuberculosis—Sanatoria—Hospitals for Tuberculosis—Anti-Tuberculosis Dispensaries—Care of Tuberculous Children—After-Treatment—Results of the Movement.

On visiting Scotland and England in 1895 to study the anti-tuberculosis movement in these countries I had the pleasure of meeting Dr. R. W. Philip and of seeing his work. As one of his pupils I now write this short account of the movement in Norway.

Tuberculosis in Norway

From the middle of the last century, when a uniform system of registering deaths was instituted all over the country, it has been possible to estimate the prevalence of tuberculosis. Thus the figures show that up to 1890 the mortality from tuberculosis was steadily increasing. During the nineties the death-rate remained stationary, and since 1900 there has been a slow but steady decrease. The following table shows the death-rate from pulmonary tuberculosis in Norway, 1890-1908. In this period the death-rate has fallen in the south but has risen in the north, especially in the bailiwick of Finmark, where mortality in 1903 rose to 55 per 10,000, and has naturally influenced the average for the whole country.

Death-Rate from Pulmonary Tuberculosis in the Years 1890-1909

	Norway.	Bergen.
1890 . . .	2·77	3·1
1891 . . .	2·83	3·4
1892 . .	2·81	3·1

[1] Translation by Miss E. Djürberg.

	Norway.	Bergen.
1893 . . .	2·71	3·3
1894 . . .	2·71	3·8
1895 . . .	2·81	2·8
1896 . .	2·5	2·9
1897 . . .	2·6	3·1
1898 . . .	2·7	2·6
1899 . . .	2·8	2·9
1900 . . .	2·78	3·1
1901 . . .	2·37	2·4
1902 . . .	2·28	2·5
1903 . . .	2·43	2·2
1904 . . .	2·37	2·6
1905 . . .	2·45	1·9
1906 . . .	2·34	2·1
1907 . . .	2·42	2·2
1908 . . .	2·14	2·00
1909 . . .	...	1·77

Geographical Configuration

Norway, with her irregular geographical surface, on which large and small villages lie more or less isolated, with little communication from the outside world, offers an admirable field for the study of the tuberculosis problem. It would seem that the prevalence of the disease is influenced by the facilities for transit. Thus a valley with little trade or traffic is free from pulmonary tuberculosis. New roads are made, commerce streams in, the disease appears, and rapidly increases. When pulmonary tuberculosis appears in a locality, in which even glandular disease in children was unknown, it can be traced to a single infective case. In Norway the evidence does not point to bovine tuberculosis as a frequent source of infection in man. Such instances do occur, but there is no constant relation between bovine and human tuberculosis. In certain parts bovine tuberculosis is frequent, while in other large areas it only appears sporadically. Bovine tuberculosis may be frequent where human tuberculosis is rare.

The Prevention of Pulmonary Tuberculosis

At a congress of doctors from Western Norway in 1884 the writer urged the need of an anti-tuberculosis movement on the principles suggested by Koch's discovery. In 1887 the Norwegian Medical Association began its educational work as regards infection and pre-

vention. In 1896 Medical Director Holmboe and the writer published a paper on "Suggestions for the Public Prevention of Tuberculosis" (*Zeitschrift für Tuberculose*, Band i. S. 367, and Band ii. S. 191 to 356). In this we urged the necessity for State sanatoria for early cases, for local hospitals for advanced cases, and for legislation against the spread of the disease. These measures came into force on 1st January 1902, and since then the anti-tuberculosis movement has spread all over the country.

The great distances, the difficulties of transit, and the different local conditions, both as regards circumstances favouring infection and the social and economic aspects of the preventative work, have made it difficult to centralise the movement, which has mostly depended on private initiative. The need for a central working society has been felt—to collect information from all parts of the country and to encourage, advise, and assist local efforts as far as possible. Last year the Norwegian National Anti-Tuberculosis League was founded with these ideals.

Educational Campaign

For some time past an educational and hygienic campaign has been in operation. As already mentioned, the Medical Association in 1889 published its first popular pamphlet on tuberculosis. Many similar leaflets on the cause and prevention of the disease have been issued, but the greatest work has been done through the daily press. In addition to the great political journals there are many small local papers in every bailiwick, which find their way into practically every home. By these means the truth regarding tuberculosis is constantly being placed before the public. Further, lectures are given all over the country by doctors and by educated people who have themselves been patients. These lectures are given more especially to societies formed of young people, and I say with confidence that the prevention of tuberculosis is known to every person in Norway. There is, however, a great difference between knowledge and action, and much remains to be done in inducing the people to live the hygienic life. Great advance has been made in personal hygiene and that of the home, and in this as in other fields we need the assistance of the women of the country, who have already rendered valuable services in the campaign. Public hygiene has also advanced, and spitting in tramcars and railway carriages, which ten years ago was simply abominable, is now forbidden by law.

Legislation Regarding Tuberculosis

The Tuberculosis Act came into force on 1st January 1902, enforcing the notification of all cases and deaths from tuberculosis, and giving dispensary physicians the right to attend all tuberculous cases where a private doctor has not specially undertaken to carry out hygienic measures. If these measures are not carried out, the medical officer of health has power to remove the patient to a tuberculosis hospital, and to facilitate this the State defrays $\frac{4}{10}$ths of the expense.

A doctor has further the power to prevent a tuberculous patient taking employment as a nursemaid, or in any place where food is prepared or sold. Each bailiwick may also make by-laws for the compulsory notification of patients moving from house to house, so that disinfection may be carried out by the sanitary authorities. In case of death, disinfection of the house and of the patient's clothes is compulsory.

In the first instance these measures received some opposition from medical men, but the Act is now working harmoniously.

Sanatoria

Tuberculosis may be said to have succeeded leprosy in Norway, and on the suggestion of Dr. E. Kaurin, formerly medical officer at Reknaes Leper Hospital, Molde, the Government converted this hospital into a working-class sanatorium with 73 beds in 1897. It was also decided that the St. George's Hospital fund, about 1½ million kroner (£81,250), the interest on which had previously been used for the Leper Hospital at Bergen, should be applied to the tuberculosis movement, and in 1902 a working-class sanatorium with 120 beds was opened at Lyster, Sogon. At present the Government are about to build several other sanatoria, and including private sanatoria there are 473 beds available.

Sanatorium treatment in Norway is on the usual lines, but in 1902 Dr. Grundt, at Lyster Sanatorium, instituted a scheme of work as a therapeutic agent for the stronger patients. The work done has comprised carpentry, wood-cutting, path-making, mining, and bridge-building. In the past eight years 10 kilometres of paths have been made by patients in the sanatorium grounds.

The average duration of treatment is three months, and the expenses at the working-class sanatoria (2.50 to 3 kr.) are defrayed for the most

part by the State, or the Corporation, or the local Society for the Prevention of Tuberculosis, or in some instances by the patients themselves.

In addition to these sanatoria there are several for children. Fredriksvaern and Hageviken, near Bergen, have each 100 beds. Both were built privately, but receive an annual Government grant of 3500 kr. (£190). The cost per day at these is 1 kr. (1s. 1d.).

Hospitals for Tuberculosis

These were originally intended for the treatment of chronically affected patients unfit for work, but they now admit cases of relapse, patients waiting for admission to a sanatorium, and patients who might be doubtful cases for sanatorium treatment. This wider sphere of activity prevents their being designated Homes for the Dying. The most important work of these hospitals is the removal of the advanced and most infectious cases from poor homes. Consisting of 10 or 20 beds, they should be distributed all over the country, so that the patients are not too isolated from their families, who would otherwise object to their removal.

There are at present 23 such hospitals in Norway, and 16 more are being built, so that every bailiwick will have one, and some three or four. Most are built by private subscriptions, helped by the savings banks and corporations. In four bailiwicks the Council has decided that the bonus from the manufacture of gin shall go to the anti-tuberculosis campaign, and have built such hospitals. The cost per bed is usually 1000 to 1500 kr. (£55 to £80), and the working expenses 1.50 to 2 kr. per day.

Anti-Tuberculosis Dispensaries

The dispensary movement is developing extensively throughout the country, chiefly in the larger centres—Christiania, Bergen, and Trondhjem—and is dependent on local initiative and resources. In Bergen, a committee, consisting of delegates from the Norwegian Women's Hygienic Society, doctors and business men, collect money from local subscribers and the interest from legacies. The largest sum is raised in May by the sale of a little celluloid flower—the Mayflower — sold for three halfpence. In 1910 the sale realised 9000 kr. (£485).

At the Dispensary for Chest Diseases patients are examined and advised free of charge, and suitable cases are sent to the sanatorium or to the hospital for tuberculosis. Partly through the dispensary, partly through the Board of Health, all tuberculous families are known. When considered necessary a specially trained nurse visits the home, reports on the surroundings, and advises the patients as to hygienic and prophylactic measures.

In the case of a large family in a small house, or where the mother is ill, a woman is regularly sent to clean the house. If the house be too small the patient is helped towards getting a larger one, in which he can have a separate room. This is a difficult problem, as there is a shortage of houses, and many landlords are unwilling to have tuberculous tenants, as the house is not easily let afterwards. The Tuberculosis Committee intend to obtain flats of two rooms and a kitchen for the use of their patients, reserving the right to inspect the house at any time, and insisting on the observance of certain rules.

Care of Tuberculous Children

While children with pronounced disease are sent from the dispensary to the Chest Hospital, those in whom the disease is latent are sent for a two months' stay at the City Holiday Homes in the country. Last year 76 children were sent away, and it is hoped that this number will be doubled next year. In addition to these, 300 children were sent to the country for their summer holidays, which they spent partly in the Holiday Homes and partly boarded out in private families. It is also proposed to found a Children's Home, to which young families may be sent when the mother is tuberculous and requires sanatorium or hospital treatment.

After-Treatment

A small home has been provided for female patients who, on discharge from the sanatorium, would otherwise return to overcrowded houses. For these patients suitable work is also found, so that they may contribute a little towards their maintenance. The dispensary also distributes milk to poor patients on discharge from sanatoria, and last year 17,000 litres were given away.

Results of the Anti-Tuberculosis Movement

During the last decennium of the 19th century the maximum death-rate from pulmonary tuberculosis over the whole country was 25 per 10,000, and from 1900 to 1908 there has been a fall of 25 per cent. in the mortality. In Bergen the mortality had increased during the second half of last century, reaching the maximum of 38 per 10,000 in 1894. Since that year there has been a steady fall, and in 1909 it was 17·7 per 10,000.

Other influences, apart from the anti-tuberculosis movement, must share the credit of these results, but in the town of Bergen there is no question but that the marked fall in mortality is due to the early start of the anti-tuberculosis crusade. The most important element in this has been the educational work and the supervision of the hygiene of the home. During the past ten years 8 per cent. of all known cases of pulmonary tuberculosis have been treated in sanatoria or in hospitals.

The results are so encouraging that we go forward with greater energy, our aim being to reform the hygiene of the home, to insist on clean, well-lighted, and airy houses, and so prevent not only tuberculosis but in all probability the majority of other infective diseases.

Klaus Hanssen.

II. INCIDENCE OF TUBERCULOSIS IN SWEDEN

Deaths from tuberculosis in Sweden were first registered in 1860, and all such deaths must now be certified.

This rule, however, only applies to the towns, as in the country the figures are issued by the clergy.

During 1871-1895 16,180 deaths from tuberculosis were registered in Stockholm. The total deaths during the same period were 117,672. Fifteen per cent. of all deaths were consequently due to tuberculosis. During 1875-1894, according to Dr. Davertie, the deaths from this disease in all towns in Sweden were about 45,000, that is, 2500 per annum.

To ascertain how many cases of pulmonary tuberculosis occurred during a certain period, a committee was appointed on the initiative of "The Swedish National Society for the Prevention of Tuberculosis." This committee arranged an inquiry amongst practising doctors regarding the number of cases seen during the months of February-April 1906, which resulted in 14,538 cases being reported.

From these reports an attempt has been made to approximate the deaths from this disease all over the country. The number of people suffering from pulmonary tuberculosis in Sweden is calculated to be at least 30,000, amongst a population of 5,400,000.

State Competition

In 1898 a competition was arranged by the State, and a prize of £82, 6s. 6d. offered (also prizes of £54, 17s. 8d. and of £27, 8s. 10d.) for the best public pamphlets on "Tuberculosis." The first prize was won by E. Nilssan for an article entitled "On Consumption." The second prize was taken by Dr. R. van Past—"What can we do to Prevent Tuberculosis?" and the third prize by Dr. E. Bergwall for a short exposition of the question. The first of these articles was printed at the expense of the Swedish Government and distributed free. The second was also printed at the Government's expense, but was sold very cheaply at the rate of 2d. per copy. The State paid £1160, 16s. 2d. for the printing of these pamphlets, and in the *Swedish Calendar* for 1901 was a summary of Dr. van Past's article. This almanac is a most popular publication, and the majority of the people have thus obtained a short but complete summary of everything connected with tuberculosis.

The necessity of establishing special hospitals for patients suffering from tuberculosis was pointed out in these pamphlets, and also in the resolutions carried at the Medical Congress and in the Swedish National Society.

Although the Swedish hospitals are models in every way, very few tuberculous patients are received, chiefly because the hospitals are intended for acute disease. The official reports show that amongst the patients (during the period 1890-1900) in the provincial hospitals, numbering 60,000, barely 1500 suffered from pulmonary tuberculosis.

King Oscar II. Jubilee Fund

On the 18th September 1897, the 25th anniversary of King Oscar's accession to the throne, the fight against tuberculosis began in earnest.

On this day the King decided that a sum of money amounting to £120,746, 8s. 7d., and collected by subscription, which was handed over to him in memory of the day, should be used to establish three hospitals for the treatment of curable cases.

As this sum was not sufficient for building more than two establishments, the Government agreed to advance the sum of £46,652 for the building of the third, and the site of the building, being Crown property, was given free. The first sanatorium, "Halahult," was opened on the 19th July 1900, and is situated in the middle of Sweden. The grounds of the sanatorium extend to 247 acres. The second public sanatorium, "Osterasen," which was opened on the 2nd August 1901, is situated in the north of Sweden. The third, "Hessleby," was opened on the 5th October 1901, and is situated in the south-east part of the country. Each establishment can receive 100 patients. Besides these three sanatoria there will be a fourth in the western part of the country, and also a pavilion added to the sanatorium at "Osterasen."

The Royal Tuberculosis Committee

The Swedish National Society against Tuberculosis presented a petition to the Government to form a committee in order to discuss how far the State could support the fight against this disease.

To cover the expenses of this committee the National Society offered £548, 16s. 11d. The State agreed to this plan, and the committee proceeded to investigate the existing causes of tuberculosis.

Amongst the cases reported by doctors 77 per cent. were between 15 and 50 years of age.

As a result of the work of this committee the State agreed unani-

mously to assist financially in building sanatoria, and to advance half the sum for each, and they also agreed to give the building site free when Crown property could be used.

The State also agreed to allow them at least £2, 14s. 10d. per day, and declared that the erection and maintenance of such institutions was a necessity. State assistance was promised for ten years, amounting to more than £603,732, 3s. 2d. Before the end of 1908 several sanatoria had been built with the money granted by the Government.

Before this, the Swedish National Society for the Prevention of Tuberculosis had made plans to build smaller sanatoria.

Amongst these may be mentioned:—Stockholm has, in Sanct Garan's Hospital, two wards for tuberculous patients, with altogether 232 beds; one smaller pavilion at "Sabbatsberg" Hospital, and another with 300 beds. This number has proved insufficient. The Local Board of Stockholm decided to build a hospital for patients—belonging to Stockholm—with 500 beds. The cost per bed is calculated to be £219, 10s. 9d. This institution was opened in the autumn of 1910. Among private sanatoria may be mentioned "Romanas" and "Sapsja."

There are also several seaside sanatoria for children—for instance, Crown Princess Victoria's Seaside Sanatorium for Tuberculous Children, and "Apelviken" Sanatorium, both on the west coast of Sweden.

Several manufacturers have built sanatoria for their workmen.

The Swedish National Society for the Prevention of Tuberculosis

We have already mentioned this society, but as its activity is of great importance in the fight against tuberculosis in Sweden it requires a more detailed account. The society began on the 28th February 1904, under the patronage of the Crown Prince Gustaf (now King Gustaf V.). One of the most prominent men in the country, Baron Jamm (former M.P. and Governor of Stockholm), has acted as chairman. Dr. B. Buhre has from the beginning acted as secretary. The original number of members was very large—11,225 in 1905, increased to 22,457 in 1909. Considering that the population of Sweden does not amount to more than about 5,900,000, this is very satisfactory, as it amounts to one member in 270 inhabitants—4·16 per cent.

The Organisation of the Society

The committee consists of twelve persons all residing in Stockholm. Smaller societies have been founded in the provinces. The fees for

members are as follows:—A perpetual membership is obtained by paying £5, 9s. 9d. down, and the yearly subscription of 2s. 2d.

The members' fees have, during 1904-1909, amounted to £10,687, 10s. 1d., and during the same period gifts have been received to the amount of £7965, 19s. 1d.

The chief income has been from the so-called "charity stamps," which can be put on letters and parcels, but have not the value of postage stamps. On the 21st November 1904 the society decided to ask for permission from the Government to issue these stamps and to place them on the market. Permission was granted for a year, and has been renewed every year. The stamps have been different every year, and are designed by various artists. The money collected from these stamps (¼d. each) has from 1904-1909 amounted to £17,098, 7s. 10d.

During the years 1904-1909, 1049 lectures have been given in different parts of the country. Most of the lectures have been illustrated by slides. In Stockholm the lectures have been given at the permanent exhibition of the National Society, situated in one of the chief streets of the town, and containing anatomical and pathological preparations, statistic tables, maps, and plans for the fitting up of sanatoria, literature, etc. The exhibition is open to the public three times a week, and there is always a demonstration or a short lecture.

From the beginning of 1906 a quarterly magazine has been published, which is sent free to all members. A book was specially published and given to young soldiers, so that it should be read by those who, on account of tuberculosis, were unable to perform military service.

The best means of disseminating knowledge as regards the disease is by lectures in the schools, and the National Society has commenced by publishing a book on tuberculosis for the schools, based on a French publication.

The work of the National Society has already borne fruit. General interest has been awakened, and knowledge of the disease, its treatment, and infectious nature has increased.

The Fear of Infection

But in the footsteps of this teaching there has followed the fear of infection. Although the lectures do all in their power to prevent this, and in spite of warnings in the press against it, a terror of the disease still exists. A special magazine has therefore been published, and is circulated among the working classes all over the country.

Medical Education

The Swedish medical men have devoted themselves to the fight against this terrible disease. In order to achieve this, wider knowledge amongst doctors themselves is required, so that they fully understand the disease. To assist this, the Medical Society distributes every year a certain number of scholarships to young doctors, to enable them to study and practise at the sanatoria of the "Jubilee Fund." Scholarships are also given to nurses wishing to take out a course.

Training of Nurses

The society has also been active in training nurses for the dispensaries in the provinces.

At the beginning of this year a theoretical and practical course of six weeks was arranged in Stockholm, followed by two weeks' residence at the training institute "Halsan," belonging to the Medical Society.

Twelve trained nurses attended this course of general hygiene, hygiene of the home, domestic economy, the care of children, tuberculosis (with practical study at the Tuberculosis Hospital in Stockholm), their relation to the Board of Guardians for the Poor, and the choice of trade and profession for the patients.

This course gave very good results, and will be repeated.

Use of Existing Buildings in Treatment

At the committee for drawing plans and estimates for tuberculosis hospitals the question was brought forward whether existing houses might not be turned into hospitals for tuberculous patients. It was necessary to be as economical as possible, and it would be a saving to use old buildings rather than to build new ones. To test this plan, the National Society of the County of Upsala tried to carry it out. A little farm was bought and the old houses were turned into a small sanatorium for fourteen patients. This hospital has been open since 1906, and the results have proved excellent, and confirm the idea that tuberculosis can be treated successfully in a building such as this, and that the expense need not be greater than in the larger institutions.

Working Colonies

But even in the best of these establishments it happens that some patients, even after long treatment, are not absolutely cured.

Their state of health is certainly improved, inasmuch as the disease has not advanced, but treatment does not confer further benefit.

They continue to cough, and the sputum still contains the tubercle bacillus. They suffer occasionally from fever, but between the attacks can do light work. The disease has become stationary, but if they were discharged from hospital they might expose their family to danger of infection. It is probably this type of patient, struggling on with slowly advancing disease, who is the principal source of infection. Such patients do not require hospital care, but from another point of view there is great risk in allowing them to stay in their own homes.

In several places, for instance in Germany, homes have been established for this category of patients. They are called country colonies (Invalidenheime, Heimstatten, etc.). The expenses in these colonies are not so great as in hospitals or in sanatoria. A farm is very suitable for such an establishment.

Such a colony need not be arranged like a hospital, but should rather bear the stamp of a simple but comfortable home. The area of such colonies ought to be sufficiently large that the patient does not feel shut in, and present opportunities for gardening, farming, and other lighter occupation.

Besides farming and assisting in the house, the patient ought to choose a trade, or some kind of work which he already knows, or can easily learn, and which is not too heavy for his health.

As this treatment is suitable for Sweden, the National Society has bought a farm in "Skane," the southern part of Sweden, and turned it into a working colony.

Anti-Tuberculosis Dispensaries

The National Society has assisted in establishing the first dispensaries in the provinces, which have served as patterns for so many others, and the first summer sanatoria have also received assistance from the society.

Experience has taught that people who live in large manufacturing towns are to a certain degree apt to be infected by tuberculosis, although the disease only breaks out under certain conditions, and that this infection takes place during childhood, when they are most susceptible to infection. Consequently the first thought ought to be to protect the children. This can now be done by taking certain steps in hygienic arrangements to protect them from contact with sputum, and from inhaling it.

To spread a knowledge of the necessary steps whereby this hygiene

in the home can be attained, a house has been taken in Stockholm, in which small flats containing two rooms and a kitchen are let to workmen's families when either the father or the mother (or both) suffer from tuberculosis but are still able to work, and whose children, according to the doctor's statement, are perfectly well and strong.

The rent is reduced on account of their weak state of health and inability to do much work, but the tenants must submit to certain hygienic rules given by the doctor or nurses of the homes.

Printed rules are to be seen in every flat.

The tenants sometimes receive help for the cleaning, and a certain quantity of wood to make up for the ventilation, which in winter makes the rooms cold. Every child has one meal a day from the National Society. The invalid member of the family is not allowed to sleep in the same room as the children. For this purpose extra beds may be had. The children have their teeth examined and looked after free of charge. During the six years this home has been in existence no child has been infected. At the end of last year there were 34 children belonging to 12 families.

The order has always been excellent, and the families have, without grumbling, submitted to the rules.

All has turned out so well that a large home of this description is being built, where experiments can be made on a greater scale.

Model Homes in the Provinces

The second experiment will be in the provinces. The National Society has now begun the fight in earnest, and within a certain area, more lonely, and with bad means of communication. The population is more conservative and is not influenced by the outer world. Disease is here more prevalent. The place that has been chosen is situated in the north of Sweden in the parish of "Neder-Lulia," between 65° and 66° latitude, on the coast of the Gulf of Bothnia.

The population consists chiefly of farmers and fishermen, who are not in want, but who do not possess more than what is absolutely necessary for their existence. Their food consists of milk, potatoes, and coffee, very seldom meat or fish. Ventilation during the long and cold winter is almost unknown within this area. There are no manufactures. This district consists of the villages Antnas, Ersnas, Langnas, and Alvik — altogether an area of 89 square miles, with about 2000 inhabitants. In the village of Antnas a farm was bought, and the farm buildings turned into a sanatorium, a home for children, and a house for the doctor.

On the 1st March the doctor moved in, and also two nurses, and a thorough examination of the population commenced at once.

After this the work has been done in the following way:—The farms are visited by the nurse, who takes notes about the family, the rooms, beds, bedrooms, and hygienic conditions, etc. Then the doctor visits the family, and after having examined all the members he gives advice concerning alterations and improvements which ought to be done. A plan is given to them, and from time to time the doctor and the nurse visit to see that it has been carried out.

In cases where new windows are required, or where a fireplace must be built in a room, and the owner himself cannot afford to go to this expense, the National Society pays for all necessary alterations.

Tuberculous persons, who on account of the conditions of the dwelling-houses are infectious to their children, receive rooms somewhere else, but near their home. In some cases, when they cannot be protected against infection in any other way, the healthy children are boarded out in other families, or brought to the home "Halsan."

Spitting flasks are given to the invalids free, and the nurses show them how these are disinfected. Baths can be had free.

Patients who need treatment at the sanatorium are received at "Halsan" for a longer or shorter time, or can there undergo "rest treatment" per day, with or without meals.

Baths have been built in the villages, cod-liver oil is given to tuberculous children, and lessons are to be given in cooking, etc.

By lectures, distribution of pamphlets, and talks with the doctors and nurses, an interest in the fight against tuberculosis has been awakened.

A new complete examination of the population within the "trial territory" took place in 1908, and this examination showed that the high percentage of tuberculous persons, as found in 1906, still existed.

In Antnas village tuberculosis is found in 21·1 per cent. of the adults, in Ersnas village with 16·9 per cent., in Alvik with 8·6 per cent., and in Langnas village with 11·6 per cent.

On the contrary it seems as if a decrease in the disease had taken place amongst the children.

Tuberculosis of glands is decreasing (1908) in Antnas from 60·3 per cent. to 49·7 per cent., in Ersnas from 68·06 per cent. to 46·3 per cent., in Alvik from 53·6 per cent. to 48 per cent., in Langnas from 60·9 per cent. to 31·58 per cent.

The time has been too short to give a decided result, but the

population has become more amenable and more interested in the care of their health and in hygienic conditions.

The Mayflower

The first "Mayflower" was a little artificial flower made of celluloid, for use as a button-hole. It costs ⅛d., and is sold before the 1st May at a price of 1¼d. The idea of this flower originated in 1907 with Mrs. Beda Hallberg of Gothenburg. The first year it was only sold in Gothenburg, and brought in a sum of £801, 6s. 4d. net. The next year 157 of the villages and towns joined in, and formed a society called "The Society of the Kingdom." The income that year amounted to £7184, 15s. 11d. Every district has the right to use the collected money as they think best, but the *income must be used in the fight against tuberculosis.* This year the society counts on 278 local committees. The result of the sale this year is not yet known, as the accounts have not been sent in. Several sanatoria are maintained by the income from the sale of the "Mayflower," and large sums of money will in this way be collected.

Free Meals for School Children

An indirect measure is the feeding of poor school children. Some years ago money was collected in Stockholm for this purpose, and last year the Local Board of Stockholm assigned a sum of £3841, 18s. 7d. for this purpose.

Holiday Colonies

"Holiday colonies" have also been established for these poor and half-starved children, and means have been found to send them to sanatoria in the mountains.

The example of the capital has been followed by several other towns, and it seems as if the whole country had awakened to the necessity of protecting those children whose parents through poverty or illness are unable to do so.

If the fight against tuberculosis in Sweden commenced late, everything has recently been done to improve matters.

This little article shows in a few words the most important means that have been employed, and the lines and ideas which have been followed.

Sture Carlsson.

III. THE ANTI-TUBERCULOSIS MOVEMENT IN DENMARK

Tuberculosis has been fought in Denmark partly by hygienic measures and partly by measures directed against the disease—by spreading a knowledge of its nature, and how to prevent it in childhood, in adults, and also in cattle.

By an improvement in general hygiene, by increased prosperity and education, by more comfortable houses, by better provision for the sick, the mortality in Denmark during the last half century has greatly decreased.

This has been the experience not only of Denmark but of other civilised countries. When considering the mortality statistics of Denmark there is always a difficulty, as the certificates of death, being generally issued by laymen, are of little value.

The movement in Denmark began in 1880-1890, when Dr. Engelsted urged the establishment of a seaside sanatorium for 100-130 scrofulous children at "Refsnes." This was opened on the 17th October 1875.

Copenhagen began in 1876 to send about 50 children yearly to the little fishing hamlet Shageback on Barnholm. Another society in 1870 opened the "Children's Sanatorium" for Copenhagen and district. This is especially for poor debilitated and tuberculous children, and is situated at Hellebock on the north coast of Sjelland, with accommodation for 70 to 75 children. A larger seaside sanatorium was opened in 1902 at "Juelsminnid," with 100 beds.

The discovery of the tuberculosis bacilla led the Board of Health to issue an official notice concerning the spread of the disease and how to treat it in the early stages. About this time the late Dr. Budde worked unsuccessfully for the establishment of a sanatorium at Sara.

Nothing was done until the General Danish Medical Society discussed the question in 1895, and chose a committee for the establishment of a sanatorium.

It was proposed to encourage the study of tuberculosis by publishing pamphlets, and to petition the Government to issue rules to prevent the spread of the disease by compulsory disinfection after a death, and that every case of death should at once be reported.

The elected committee, the chairman of which was Professor

Reisez, and the treasurer, Mr. G. A. Hagermann, commenced at once to collect money, and in a short time they built a sanatorium for paying guests, and, later on, another for the people.

On the 11th May 1906 an amendment of the epidemic law was published, in which it was made compulsory for a doctor to certify deaths from tuberculosis.

The Medical Society in 1898 asked the Government, by a petition signed by 100,000 names, for permission to establish public sanatoriums for such patients as were unable to pay to obtain medical treatment. The Government found the expense too great and the petition was put aside.

Copenhagen was next to act, and in 1897 Dr. E. Bang got permission to give sanatorium treatment at the Oresund Hospital, and in 1899 it was decided that a sanatorium should be built by Baserup Maad near Raeskilde, which was opened in November 1901.

The first sanatorium was opened at Vejlefjord by the Company Sanatorier on the 1st March 1900, and many patients flocked there. This was only built for paying patients, and consequently things did not improve, but in October 1900 the Social Democratic Party proposed one sanatorium for tuberculous children and two for adults. The proposal was strongly opposed by the Government, who considered that the question might be solved by private enterprise, with the necessary support from the Government.

This state of things was the beginning of the fight against tuberculosis in Denmark, when Dr. Carl Lenertzen and Dr. H. Rordan founded the National Society against Tuberculosis on the 16th January 1901. The chairman of this was "Overpresident" V. Oldenburg in Copenhagen. The membership amounted in the first year to about 12,000 and the following year to 27,000, and after one year a sanatorium was built at Silkeborg and two smaller ones at Hasles and Ry. These three sanatoria were opened in the course of the year 1903. The State supported the building by guaranteeing the interest and discount on a loan of £27,442, 7s. 4d.

At the request of the National Society the Government appointed a Commission on the 18th November 1901 to consider the arrangements for the prevention of tuberculosis.

This Commission worked so energetically under Overpresident Oldenburg's supervision that the work was completed in December 1902, and two proposals for a new law were sent to the Government. These were discussed in the Folketing, 1904-5, without any greater

alterations having been done, and were passed as "Laws regarding Tuberculosis." This brought Denmark into the position of a country which took an active part in the campaign.

The first law contains the most important regulations:—Orders to notify every death from tuberculosis, compulsory disinfection after a death, isolation of advanced cases, cleanliness in public schools, and special provision for the teaching of tuberculous children. One of the most important points is that no children are admitted to a public school without medical examination, and all require a certificate that they do not suffer from any infectious form of tuberculosis. Teachers who are dismissed on account of pulmonary tuberculosis receive a pension of two-thirds of their salary. Finally, it was decided that the yearly grants should be made for lectures and pamphlets on the tuberculosis problem.

According to the law for supporting hospitals for tuberculosis, the Government supports the following hospitals for poor patients suffering from tuberculosis:—

1. Seaside hospitals for tuberculous children are supported by 1s. 7½d. per day per patient.

2. Seaside hospitals (sanatoria) for children by 11¾d. per day per patient.

3. Public sanatoria for milder forms of the disease by 2s. 6d. per day per patient.

4. Tuberculosis hospitals by 2s. 0¼d. per day per patient.

5. Convalescent homes for tuberculosis supported by 11¾d. per day per patient.

6. Nursing homes for tuberculous patients who cannot work for their living, supported by 11¾d. per day.

Government assistance can be obtained by every poor patient, by numbers of hospital patients, and by every one whose circumstances are such that they would suffer by paying the full price (3s. 3¼d. a day for board) at the public sanatoria.

All support given under these laws to hospitals is not considered as parish relief, nor is the assistance of the patient's family during his time in any of the public institutions.

A sum of £548, 16s. 11d. for building tuberculosis hospitals was for five years left at the disposal of the ministry, being £68, 12s. 1d. per bed, calculated as half of the building expenses.

These laws are interpreted very liberally, and consequently no patient need suffer from want of suitable treatment.

In 1904 the Postmaster-General issued a charity stamp called "Junmaarket." The money collected for the stamps is used for sanatoria for children. The first year £3677, 5s. 6d. was collected from the sale of these stamps, and every year at Christmas an increasing number of them is sold. They now amount to about £21,953, 17s. 11d., which are used towards the recently proposed sanatorium at Louisehoj ved Koldingfjord, with beds for 130 children. This sanatorium will probably be opened next year.

The National Society opened a sanatorium for women at Skorping in 1906, and in 1908 opened another for men, built by the Co-operative Society, but rented by the National Society, and situated at Faxinge.

The National Society's sanatorium for women (the money collected by the St. Joseph's sisters) is a combined hospital-sanatorium.

Besides these, smaller sanatoria have been opened at Ranne, Thars-homme (Faere Islands), and one is being built at Reykiavik.

The tuberculosis hospitals which were built under the Tuberculosis Law are intended to receive less severe cases, and these hospitals are now all over the country, and, as a rule, are attached to the older hospitals. The largest is in Copenhagen, with 197 beds, which was opened in 1905. The number of beds for tuberculous patients amounts to over 700.

At the end of 1910 there will be, in addition to 230 beds in the seaside hospital for children, about 186 beds at the disposal of tuberculous patients in well-fitted sanatoria.

The number of beds for all forms of tuberculosis will amount to 23,200, or one bed for 1100 inhabitants, and one for each 13,000 to 14,000 inhabitants with pulmonary tuberculosis alone.

It is natural that this development could not take place without a great increase in the Government expenses.

The annual budgets for the campaign against tuberculosis are as follows:—

		£	s.	d.
1904-05	About	8,918	15	4
1905-06	„	12,722	5	7
1906-07	„	76,509	6	7
1907-08	„	69,813	7	10
1908-09	„	112,513	14	5
1909-10	„	88,529	1	9
1910-11	„	85,620	4	0

Along with the development of sanatoria and hospitals, money

has been spent for the education of the people by the publication of pamphlets both by the Medical Society and the National Society.

The sanatoria have also yearly sent out reports and accounts.

Dispensaries, on the French pattern, have been introduced, but they have not spread as in other countries, owing to the growth of the invalidity fund.

In 1909 the "Autumnflower" was introduced; it is a little button-hole flower which is sold for the benefit of tuberculous children. The idea, which in Sweden is called the "Mayflower," proved very successful, and brought in £186,608, 2s. 5d., and it is spreading all over the country.

CHR. SAUGMAN.

CHAPTER XXIX

THE ANTI-TUBERCULOSIS MOVEMENT IN SWITZERLAND[1]

I. THE GENESIS, DEVELOPMENT, AND RESULTS OF THE MOVEMENT

Prevalence of Tuberculosis in Switzerland—Origin of the Movement—Sanatoria and Dispensaries—The Central Swiss Committee—Women's Organisation—Private Initiative—Legislation—Swiss Sanatoria—Results of Treatment—Dispensaries—*Goutte de lait*—Social Reform—Decrease in Mortality.

Prevalence of Tuberculosis in Switzerland

Switzerland, like all civilised countries, pays heavy tribute to tuberculosis. This terrible scourge in its varied forms claims a yearly average of 8500 to 9000 victims, that is to say, a greater number than all other transmissible diseases combined. Our national mortality from tuberculosis in its various forms is about one-seventh of the total death-rate. In a work published in 1905 (H. Carrière, "La Tuberculose et l'armament antituberculeux en Suisse," *Tuberculosis*, 1905, p. 65) it has been shown, from statistics of the years 1901 to 1903, that out of 1000 deaths between the ages of 20 and 29 years 470 were due to tuberculosis of the lungs and 90 to other forms of the disease—in other words this disease was responsible for more than half of the registered deaths between 20 and 29 years. Children help largely to swell these lamentable figures, but in their case other forms of the malady predominate—out of 1000 deaths of infants under 1 year of age, only 8·6 are due to pulmonary tuberculosis and 21·9 to that of other organs; in the case of children between 1 and 4 years of age the corresponding figures are 39·7 and 135, and these figures advance to 123 and 232 in those between 5 and 14 years of age. After 14 years pulmonary tuberculosis resumes the lead, and out of 1000 deaths of persons between 15 and 19 years of age we find 414 due to pulmonary tuberculosis and only 153 due to other forms. Amongst children the

[1] Translation by Colonel R. L. A. Pennington.

most common form of the disease is tuberculous meningitis; it accounts for about 67 per cent. of our infantile tuberculous mortality, whilst intestinal tuberculosis is relatively rare, forming only 4·4 per cent. of that mortality. This fact is of interest at a time when the question of the respiratory or intestinal origin of the disease is so warmly debated.

The object of this work is not to study details of the mortality in Switzerland, nor to seek the causes. The foregoing figures are introduced here as prefatory to a short account of the anti-tuberculosis movement, as they are eloquent testimony to the immense importance and urgency of the work.

Origin of the Movement

Monsieur le Pasteur Bion of Zürich, the great philanthropist to whom we are indebted for the creation of "holiday colonies," made the first appeal twenty-five years ago; he called on the Swiss people to found a National Anti-Tuberculosis Association, and to provide funds to combat the disease. But in those days the question was hardly ripe, nor was the ground sufficiently prepared, and Monsieur Bion's appeal found little support. It was not until some years later, at the commencement of 1895, that serious attention was directed to the movement, the Canton of Berne taking the lead and founding our first great general sanatorium at Heiligenschwendi above the lake of Thoune.

Sanatoria and Dispensaries

The anti-tuberculosis movement in its early days in Switzerland went no further than the establishment of sanatoria, a fact more readily explicable as regards Switzerland than in the case of other countries. The birthplace of sanatorium treatment was the Canton of Grisons, in Switzerland, and this canton is even now the rendezvous of patients from all parts of the world. It was only natural that the wonderful results of treatment should for a time obscure the prophylactic side of the problem. It was natural, too, that in the early days greater anxiety should have been manifested to cure the tuberculous, to render them innocuous from the point of view of contagion, than to safeguard the general population from infection. Later on came a period of exaggerated reaction; the conditions of the problem appeared to become inverted, and there seemed at one time a tendency to devote special

attention to the healthy at the expense of the sick. It was the struggle of the sanatorium and of the dispensary whose echoes have long resounded through congresses. But time has brought its remedy, and shown that therapeutic and preventive action must go hand in hand, and our methods have consequently adapted themselves to these principles. We now endeavour to combat not tuberculosis alone in the shape of a morbid entity like smallpox or scarlatina, but the social tuberculosis malady, and this we attack at one and the same time on medical and social ground.

The lead given by the Canton of Berne was speedily followed, and anti-tuberculosis associations now exist in the majority of the cantons forming our little confederation. New sanatoria were opened, and later dispensaries, which are now to be met with in all the principal localities.

The Central Swiss Committee

In the early days our local anti-tuberculosis operations were independent of each other, a number of little organisations each working in its own sphere, with consequent waste of force. This no longer exists. A general association, founded in 1902 and embracing all Switzerland, now ensures co-operation, and thus in a measure gives effect to Pasteur Bion's generous thought. The object of this association is to assist the work of the local associations and to co-ordinate as much as possible the movement. It is named the "Central Swiss Anti-Tuberculosis Committee." This association took steps, at the outset, to publish a very practical programme of general instructions. It compiles an annual report reviewing the progress of the movement; this may not at present show decisive results, but it indicates that the work is on the right lines, and encourages renewed efforts. The creation of this central committee marks an important date in the history of the Swiss anti-tuberculosis campaign, which has derived therefrom a considerable impulse—cantons which had already formed organisations were encouraged to extend and complete them; the others, realising the importance of the work, took up the question seriously, and the time is now approaching when these organisations, co-ordinated by the central committee, will show satisfactory results.

Amongst the associations which have devoted special attention to the question may be mentioned the "Société Suisse d'utilité publique," which has brought about a general inquiry into the subject of tuberculosis, one of the results being the establishment of sanatoria in several districts.

Women's Organisation

The part played by the Swiss women in the movement merits attention. The women's associations in Switzerland, following the example of the Soleure section of the "Société feminine d'utilité publique," recognised that the field of action was one specially suited to their activities, and at once offered their support. It was felt that such assistance was of the utmost importance, and that it could not be too warmly encouraged. The co-operation of women is of the utmost value in combating a malady of the class of tuberculosis where the social elements play a part no less important than the pathogenic factors; where it is not merely a question of healing, but also of prevention; of combating physical and moral misery in all its forms; and of extirpating it in its lairs. In such conditions there must be duties which the tenderness, delicacy, and sympathy of women qualify them best to undertake, for they alone can appreciate and understand them.

Private Initiative

It is interesting to note that the whole of our anti-tuberculosis operations, enumerated later on, are entirely due to private initiative, which provides for their administration, assures them the means of existence, and meets the often recurring deficits. Up to now the State has limited itself to granting subsidies according to circumstances. Such action appears to be entirely satisfactory, for direct State interference in the actual anti-tuberculosis operations would probably prove too uniform, too rigid, too costly, and consequently, perhaps, fatal. Private initiative being more adaptable, more capable of varying its methods, more responsive to local conditions, should preponderate; State assistance should be confined to encouragement by means of judicious subventions, and to support by means of judicious social legislation.

Legislation

The actual anti-tuberculosis legislation has met with the same moral and material difficulties in Switzerland as in other countries. The present standard of public education, and prejudices which are still numerous and deep seated, compel us to advance prudently and gradually, and we have still to await the establishment of serious legislation such as that which deals with other transmissible maladies

throughout the whole land. Still, a commencement has been made. Arosa, Davos, and Leysin have long since adopted regulations which prescribe disinfection of abode after death or departure of the tuberculous, and which forbid spitting on the ground. The Canton of Grisons has certain laws dealing with the malady; these demand a report of death from tuberculosis either by the doctor attending the case, or by the head of the family, or the house proprietor, and prescribe the disinfection of the quarters, furniture, and all else used by the deceased. When cases of tuberculosis multiply in a district the authorities are compelled to institute inquiries into the causes and to undertake the necessary measures to improve the hygienic conditions. Finally, the authorities are required to take steps to prohibit spitting.

In January 1908 instructions were published by the Government of the Canton of Zürich which sanctioned the gratuitous examination of sputum, prescribed the placing of spittoons in public places, and rendered compulsory a report on death from open tuberculosis, leaving it optional to the doctor in such cases to decide if disinfection be necessary.

The Canton of Berne, the most populous and important of the Swiss cantons, has a law (23rd February 1908) under which subsidies are granted to public hospitals and institutes (sanatoria, dispensaries, etc.), whose special object is the treating of tuberculosis. Under a subsequent decree (3rd February 1910) it is obligatory to report cases of *open* tuberculosis when the doctor is satisfied that there is risk of a patient infecting his surroundings; it is also obligatory to disinfect the abode after departure or death of a case; public places must be provided with spittoons and notices forbidding spitting on the ground; analysis of sputum is made free for the indigent; the communal authorities are authorised to establish dispensaries, and to forbid the use of insanitary houses.

It may be mentioned in conclusion of this short review of our legislation that the Government of the Canton of Thurgovie issued instructions on 1st July 1908 directing a report to be made of all cases of open tuberculosis, and of all change of domicile of persons suffering from any form of tuberculosis, and making disinfection obligatory in case of death.

The foregoing points only to a modest beginning. For certain reasons which it is needless to go into, the Legislature has not as yet felt in a position to give compulsory notification that full extension

which would render it really efficacious. But the fact that the promulgation of the foregoing instructions gave rise to no serious recriminations indicates a happy change in public opinion and a weakening of those rooted prejudices which render legislation so difficult. However, these prejudices still exist, and we can hardly expect their early disappearance, for is it not the case that during the debate on the Bernese law a deputy protested in the name of the rights of man against the spitting interdict, and claimed for the free citizen the right to expectorate when and where he chose.

The foregoing summarises the genesis and evolution of the anti-tuberculosis movement in Switzerland. The operations and results will now be shortly reviewed, commencing with sanatoria.

Swiss Sanatoria

We possess in Switzerland ten general sanatoria for adults.

In addition, there are two similar establishments for children at Heiligenschwendi and Leysin, an annexe for children in the Zürich sanatorium at Wald, and the sanatorium at Erzenberg in the Canton of Bale-Campagne, which, though private, may be regarded of general utility by reason of its low fees.

These establishments, placed amongst the mountains in the vicinity of forests at altitudes of from 860 to 1660 mètres, avoid all luxuries, but offer every comfort and advantage that a sanatorium should possess. Built on these principles, the cost has not been great, and no ground has been given to the adversaries of sanatoria to object to excessive expenditure. The cost of a bed varies between 3900 francs (£156) (Leysin) and 7000 francs (£280) (Clairmont-sur-Sierre), which is modest in comparison to the cost in other countries.

Our sanatoria receive indigent patients for 1 franc 50 cents to 5 francs a day. This sum is paid either by the patient, or by his commune or canton, or by charitable individuals or associations. The upkeep of our sanatoria is relatively small, thanks to the economical management. The total cost of each patient is between 2 francs 20 cents and 4 francs 50 cents a day, the difference between these figures being dependent on locality. The cost of upkeep of a sanatorium at Clairmont-sur-Sierre, a small village deep amongst the mountains, far from all centres, and connected with the plains by a single main road, is necessarily greater than that of a sanatorium at

Davos, an important locality, provided with all modern resources and on a line of railway.

Our sanatoria, after the completion of those of Soleure and Argovie, will number in the whole about 780 beds. This number is far from sufficient for those who are not able to afford the cost of private establishments.

Results of Treatment

The latest statistics deal with the results of treatment in sanatoria ("Rapport sur l'activité de la Commission centrale Suisse et des Associations cantonales et communales pour la lutte contre la tuberculose en 1908," Berne, 1909). In 1908 the sanatoria of Heiligenschwendi, Davos, Braunwald, Wald, Malvilliers, Leysin, and Clairmont-sur-Sierre received 1383 patients (residence of under four weeks not included). The average number who benefited by the treatment (omitting children) was 80·5 per cent., whilst 18 per cent. showed no improvement; the average mortality was 1·5 per cent.

These figures refer only to clinical results, but if we consider economic recoveries we find that 57·6 per cent. had recovered their complete power of work on leaving, 24·5 per cent. had suffered some loss of that power, and 17·8 per cent. had suffered considerable loss. The statistics are naturally more favourable if instead of taking all patients as a whole we deal only with those suffering from tuberculous lesions of the 1st and 2nd degrees, according to Turban's classification. The following table illustrates this:—

Degree.	Clinical Results.		Economic Recoveries.			Deaths.	Total.
	Improved.	Not Improved.	Complete Capacity to Work.	Capacity to Work.			
				Lessened.	Much Lessened.		
I.	451=96·1%	18=3·7%	402=85·70%	52=11·2%	15=3·1%	1=0·2%	470
II.	348=86%	48=11·9%	250=63·1%	102=25·7%	44=11·1%	6=1·4%	402
III.	314=61·4%	183=35·8%	133=26·7%	180=36·2%	184=37·1%	14=2·7%	511
Total	1113=80·5%	249=18%	785=57·6%	334=24·5%	243=17·8%	21=1·5%	1383

The statistics of the Bale general sanatorium show that these results, in themselves satisfactory, hold good for a certain number of years; five years after quitting the sanatorium 52·9 per cent. of those patients who could be traced still possessed their complete power of work; in 4 per cent. the power was reduced; and 43 per cent. had died from tuberculosis. These figures are encouraging; they demonstrate the utility of sanatoria, and prove that the thought and work bestowed on them have not been in vain.

Dispensaries

The province of the sanatorium is therapeutics, that of the dispensary is prevention, one being the complement of the other. We have now commenced to apply this simple but formerly much debated principle in Switzerland, and we find dispensaries in all important localities. The town of Neuchâtel set the example by the establishment of the first dispensary in 1905; Berne, Geneva, Bale, Zürich, and other towns followed soon after, and there are now 33 of these institutions in operation.

Provision for Children

Amongst the anti-tuberculosis prophylactic institutions may be mentioned the hospitals for sickly, rickety, and tuberculous children, that is to say for all threatened with tuberculosis; the school sanatoria, the convalescent homes, and other analogous establishments, numerous in Switzerland, but differing little from those in other countries. Finally, a specially Swiss institution may be mentioned, *i.e.* the holiday colony.

In 1876 the Pasteur Bion conceived the plan of sending poor and weakly children from the great towns for a few weeks' sojourn amongst the mountains. His clerical duties in a great industrial centre had given him an insight into much wretchedness and misery, and his feelings revolted at the sight of these little ones living in crowded tenements, deprived of the necessary sun and air, a certain prey to tuberculosis. He appealed to the public for support, and with the funds obtained founded the first "holiday colony" of the town of Zürich. This was a beginning, even though its full importance may not have been realised, and in these early days there were many difficulties. But the inaugurator before his death had the satisfaction of seeing

a great extension of his work, which has even spread outside Switzerland. Such colonies are now to be found in 70 districts and number 120.

Goutte de lait

The system of the "Goutte de lait," which we have adopted from France, is in the same class. This system aims at warding off the maladies of infancy by attending to the hygiene and rational feeding of infants from the cradle, and thus acts as a preventive to tuberculosis. It has spread rapidly through Switzerland, and there are now few important localities unprovided with "Gouttes de lait" or dispensaries for infants.

Social Reform

It is hardly necessary to remark that every measure which aims at relieving the less fortunate in this world contributes indirectly to stay the ravages of tuberculosis. Much has already been done in Switzerland, but it must be confessed that the State is as yet far from having fulfilled all its duties—always heavy and always complicated by our political organisation. Side by side with our factory legislation, which may almost be regarded as a model; side by side with the projected laws for insurance against sickness and accidents, is the work undertaken for the improvement of dwellings. Tuberculosis finds powerful auxiliaries in the cramped and congested habitations, swarming with bacilli, into which are crowded numbers of the working population of our large towns. The situation in Switzerland in this respect may perhaps be less deplorable than that in some other countries, but it still leaves much to be desired. Our authorities are alive to this, and of late years they have instituted inquiries which have led to energetic and practical sanitary reforms.

Decrease in Mortality

The question remains: Are the results arrived at proportionate to the labour expended? The mortality statistics give an idea of the ground gained. Leaving out of the question extra-pulmonary tuberculosis, the statistics of which have only recently been reliable, we find that the mortality from pulmonary tuberculosis was 208 per annum per 100,000 during the period 1889-1893; in the three next quinquennial periods it fell to 201, 188, and finally to 181 (1904-

1908). This shows a reduction of 37 per 100,000, representing an annual saving of 1300 lives in the 3½ millions of the Swiss population.

Our statistics show another interesting fact, viz. that whilst from 1888 to 1892 the maximum mortality from pulmonary tuberculosis was shown between the years of 15 and 49, it is now shown between the years 29 and 59. It would thus appear that death occurs later in life than formerly, or in other words, that the life of patients is prolonged.

H. Carrière.

II. THE ANTI-TUBERCULOSIS DISPENSARY AT NEUCHÂTEL[1]

Anti-Tuberculosis League—Regulations—Work of the Dispensary—Rules—Duties of Dispensary Physicians—The Visiting Sister—Assistance to the Poor—Distribution of Cases—Insanitary Houses—Co-ordinated Measures.

THE Swiss Confederation is divided into twenty-two small Republics or States, and it is incumbent on each of these States, or cantons, to organise the campaign against tuberculosis in the manner it considers most suitable. The Government of the State of Neuchâtel had before it for some years the question of tuberculosis, and eventually decided to establish a sanatorium, but owing to financial reasons this has not yet been built. Other cantons possess popular sanatoria for the treatment of curable cases amongst the poor.

ANTI-TUBERCULOSIS LEAGUE

A Neuchâtel Anti-Tuberculosis League was formed in 1905 in the district of Neuchâtel to support and complete the Government programme. The population is 30,000, of which number 23,000 belong to the town of Neuchâtel and 7000 to nine neighbouring villages. Under the auspices of this League, which is entirely independent of the municipality, a collection was organised, and 3000 persons subscribed some 30,000 francs (£1200). It is interesting to note the value of private initiative in a small country, and it is a matter of congratulation that in a district of moderate incomes and no great fortunes, such considerable funds can be raised in a short time to support an anti-tuberculosis organisation.

REGULATIONS

In March 1906 the League framed its regulations, establishing headquarters in Neuchâtel, and affirming its intention of combating tuberculosis by all possible means up to the limit of its finances. Its financial resources are:—

1. The contributions of its members (minimum, 1 franc yearly).
2. Gifts and legacies.

[1] Translation by Colonel R. L. A. Pennington.

3. Subsidies from public bodies (so far none received).
4. Proceeds of collections and sales.
5. Interest on capital.

With an annual budget of 18,000 francs (£720) the League has so far supported itself, and after four years' work its reserve fund is upwards of 20,000 francs (£800). This statement is a tribute to the continued interest of the Neuchâtel population. Following on the lines of analogous anti-tuberculosis societies, the work undertaken by the League was to awaken the people to the danger of this disease, so prevalent in Switzerland, and to limit and circumscribe it by all possible means. Lectures with illustrations were given by several doctors both in town and country. The committee of the League concluded that the most effective means of combating the scourge lay in the establishment of an anti-tuberculosis dispensary, to a certain extent on the model of that organised by Dr. Philip in Edinburgh.

Work of the Dispensary

This dispensary, opened in Neuchâtel on the 15th February 1906, is the first of its class in Switzerland; for this reason it may be of interest to describe its work, and to show what it has been able to effect in a district whose resources, being derived from a population of only 30,000, are naturally limited.

In the first year 368 cases were treated by the two physicians nominated by the League, in the second year 493, in the third year 546, and 482 in the fourth year, showing that the Advisory Bureau and Dispensary was favourably received by the population, which readily grasped its aims and utility.

The regulations governing the institution are here quoted with a view to indicating its general line of action:—

Rules of the Neuchâtel Dispensary

1. The Advisory Bureau and Anti-Tuberculosis Dispensary of Neuchâtel is founded by the Anti-Tuberculosis League in the Neuchâtel district, and controlled by the aforesaid League.

2. The Advisory Bureau will supply individuals with the information necessary to guard against tuberculosis. The dispensary will pay especial attention to the poorer classes in the Neuchâtel district, and will combat the disease as follows, by—

(*a*) Isolation of early cases.
(*b*) Provision of the necessary hygienic instructions to patients.

(*c*) Distribution of spittoons and of antiseptics to patients; exercise of controlling prophylactic measures in the home.

(*d*) Facilities for disinfection, and washing garments.

(*e*) Assistance, as far as funds permit, to the sick and their families in the form of nourishment and fuel.

(*f*) Assistance in placing the sick in sanatoria, hospitals, or hospices.

3. The personnel of the dispensary consists of 2 physicians, 1 visiting sister, 1 concierge, who is also charged with the washing. This personnel is nominated, and its emoluments fixed, by the committee of the League.

4. The physicians have charge of the organisation and general direction of the Advisory Bureau and Dispensary; on 2 days in the week they are at the disposal of the public. Having regard to the social and medical record of each patient, they decide on the amount of assistance to be given in each case, acting on the principle of affording the maximum relief to early cases, and to the poorest classes. To this end the committee places yearly at their disposal the necessary sums allotted in the budget.

5. The duties of the visiting sister are to compile the social record of each case from all sources, and to superintend in the homes the application of the prophylactic measures, and the rational use of such assistance in kind as the dispensary may provide.

6. The concierge is responsible for the cleanliness and order of the buildings, and for the washing of the clothes of the sick.

7. The physicians will furnish a yearly detailed report to the committee on the progress and work of the institution, and on the funds placed in their hands. On this report the committee decides its policy for the following year.

The above were adopted by the committee of the Neuchâtel district on 20th January 1906.

Duties of Dispensary Physicians

The foregoing regulations (see Article 4) indicate that the dispensary physicians give no medical attendance and prescribe no medicines, their duties being limited to observation of the sick and to facilitate their cure by means of the finances at their disposal; it is not intended that they should in any way assume the duties of the general practitioners in attendance on the patients.

This procedure has received the unanimous approval of the medical profession, who recognise in the dispensary a disinterested auxiliary and not a competitor in their field of practice.

But if the dispensary in no way trenches on the domain of therapeutics, its social and prophylactic activity is the more marked.

When a patient has been diagnosed as tuberculous, the dispensary compiles his medical dossier, and continues it throughout his illness. He is expected to appear at stated times for examination, and comes under a strict surveillance. The members of his family also are

encouraged to present themselves for examination, and suspected cases are watched with the same solicitude.

The Visiting Sister

The visiting sister visits the homes of patients, prepares the social dossier, reports to the dispensary physicians the sanitary condition of the homes visited, the degree of poverty of the family, and assists in advising as to measures suited to individual cases. The dispensary then steps in and makes allotments to families, such allotments being proportioned to the actual state of poverty, to the probabilities of cure, and to the financial resources at its disposal.

Assistance to the Poor

The assistance afforded comprises—

(*a*) Such articles as spittoons, disinfectants, etc.
(*b*) Provisions such as bread, milk, eggs, groceries, meat, etc.
(*c*) Beds and bedding.
(*d*) Clothing and body linen.
(*e*) Firing.
(*f*) Amelioration of the hygienic condition of houses; clothing of tuberculous families.
(*g*) Disinfection of rooms and clothing.
(*h*) Sums for payment of rent.
(*i*) Washing of family linen. No cases in which change to the country is indicated.
(*j*) Guarantees for payment of sanatoria fees.
(*k*) Cost of sending tuberculous children to the country.
(*l*) Admissions to hospitals with a view to removing serious tuberculous cases which might infect others.

It may be of interest to show what the little Neuchâtel Dispensary, with its income of 18,000 francs (£720) per annum, has been able to effect in the matter of assistance during 4 years of activity—

Year.	No. of Families Assisted.	Spittoons Provided.	Litres of Milk.	Kilos of Bread.	Gifts of Groceries of 10 Francs.	Eggs.
1906	132	51	9,450	824	61	1500
1907	171	33	13,500	640	90	500
1908	154	38	7,555	1265	50	540
1909	164	32	5,430	945	86	540

The annual cost of the foregoing assistance in kind amounted to about 3500 francs (£140). In addition to the above, the Neuchâtel Dispensary has made the following payments:—

Year.	Payment of Rent.	Washing.	Number of Months in		
			Sanatorium.	Country.	Hospital.
1906	42	81	61	24	18
1907	72	139	62	46	27
1908	95	154	114	71	43
1909	38	180	94	38	46

The cost of these services has amounted annually to about 7500 francs (£300).

Distribution of Cases

A statistical table shows the number of persons examined and the distribution of known tuberculous cases amongst a population of 30,000 persons.

Year.	New Cases.	Found to be Healthy.	Diagnosed as Suspicious.	Diagnosed Tuberculous.					
				1st Stage.	2nd Stage.	3rd Stage.	Males.	Females.	Children.
1906	368	99	116	98	31	24	59	67	27
1907	493	104	136	184	36	23	73	105	65
1908	546	113	160	187	49	17	74	112	67
1909	482	80	168	170	37	14	71	94	56

Insanitary Houses

A further service undertaken by the League, and by no means the least important from the prophylactic standpoint, is the betterment of dwellings, and the establishment of a sanitary record of insanitary houses. In her domiciliary visits the visiting sister of the dispensary finds at times very woe-begone and insanitary habitations. If the dwelling of the indigent sufferer is not always dark, damp, and sunless, it is unfortunately too often restricted and wanting in proper ventilation, and lacks the required air-space and light. In these dwellings, lacking in cleanliness, situated in dark and damp alleys, between walls whose moisture rots the wallpapers and bed-

steads, lurks a hotbed of tuberculosis; and there are to be found the pale, emaciated, weedy children who become our future tuberculous patients.

Living in insanitary promiscuity, sleeping so many as 7, 8 or 9 together in a little room which affords less than the necessary air-space for one person, these children share their beds with brothers and sisters; and it is small wonder that the disease propagates with extraordinary rapidity in these hotbeds of infection. It is here that action is needed, and the work of the League—a difficult undertaking, but of the very first utility and importance.

At Neuchâtel the visiting sister notes these insanitary dwellings, and communicates the addresses to the architect member of the committee. The latter inspects the sites, considers the proposed repairs, and communicates with the proprietor. The formal notice to the proprietor closes with the following lines:—

"*The committee of our League has decided to use its endeavours to secure betterment of dwellings. The duty of its agents is to place before landlords the importance of improving habitations, with a view to remove as far as possible the causes of tuberculosis, and thus to help on the movement against this scourge.*

"*We solicit, therefore, your co-operation in our work of public utility, and beg that you undertake the improvements here asked for.*"

The proprietor frequently undertakes the required improvements. If he be unwilling to move, it is open to the League to report the insanitary dwelling to the public health authorities, who possess the necessary powers to act as seems desirable.

Localities where tuberculosis is endemic are to be found not only amongst dense populations but also in small towns and villages. Such insanitary spots are so many infective centres for successive tenants. It is highly important to mark down these localities, and to deal hygienically with these plague spots where Koch's bacillus has so long exercised sovereign sway.

At Neuchâtel the anti-tuberculosis dispensary has provided itself with a plan of the town, scale $\frac{1}{1000}$, on which each house occupies a space of a few square centimetres. Each case of tuberculosis is noted thereon by a certain mark, and each house in which death occurs is indicated in a similar manner.

It would be premature, after only four years' experience, to draw definite conclusions from this map, but from now onwards it is easy to judge which are the most infected quarters and where the

disease is most prevalent. The annotations of each successive year go to increase those of previous years in the same districts, in the same houses, thus indicating tuberculous colonies in the most insanitary buildings in the town, and in districts in which the population is most dense, or where hygienic conditions are the worst, and where there is insufficient light and air.

A study of this plan of the tuberculous localities of the town of Neuchâtel makes it evident that certain outlying quarters, whose situation is far more advantageous than that of the old town, are by degrees increasing their tuberculous population. This is brought about by tuberculous families who, under medical advice, have emigrated from the centre to the boundaries; their sick have accompanied them and have spread the infection amongst families formerly healthy.

Co-ordinated Measures

In order to remedy this state of affairs, powers are needed to weed out families attacked by the disease; to place the advanced cases, suffering from open lesions, in a special hospital; and to lodge the other members of such families in healthier dwellings. In this manner there would be no risk of spreading disease, and the health of those exposed to infection would be improved. But even such action, necessary as it may be, is insufficient. We need to aim at co-operation of the various authorities in an organised campaign.

The duty of the Anti-Tuberculosis Dispensary is to trace out the disease, to diagnose, to advise, and to succour. There must be allied to it a "hospice" to receive advanced incurable cases, and a sanatorium for curable patients. On leaving the sanatorium the convalescents should pass into a "working colony" to complete their restoration to health. Finally, the children predisposed to the malady should be sent away to the country, and educated in forest schools. If the dispensary be the centre of the anti-tuberculosis operations, the other adjuncts are also necessary and even indispensable. By such means alone is it possible to effectively and permanently control the white plague. This has been demonstrated beyond all question by Dr. R. W. Philip of Edinburgh.

C. de Marval.

CHAPTER XXX

THE MOVEMENT IN THE NETHERLANDS

Statistical—Sanatoria—Limitations of Sanatoria—The Dispensary System—State Subsidies—Health Societies—Training of Workers—Details of the Government Grants—Hospitals for Advanced Cases—Education of the People.

Statistical

Like most European countries, the Netherlands show for some years past an unmistakable reduction in the mortality from tuberculosis, but only from 1901 are the figures reliable (Tables I. and II.).

Table I.—Showing the Total Number of Deaths in the Netherlands from all Causes, and the Mortality from Tuberculosis during the Years 1901 to 1908 Inclusive, According to the Official Reports Published by the Central Bureau of Statistics.

	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
Population of the Netherlands	5,263,232	5,347,182	5,430,942	5,509,659	5,591,695	5,672,237	5,747,269	5,786,231
Mortality from tuberculosis of the lungs .	7,171	7,028	7,117	7,081	7,536	7,531	7,403	6,917
Mortality from tuberculosis of the brain .	1,113	1,050	1,069	1,077	1,070	1,194	1,129	1,154
Mortality from other forms of tuberculosis	1,835	1,850	1,978	1,922	1,360	1,293	1,331	1,288
Total mortality from all forms of tuberculosis	10,119	9,928	10,164	10,080	9,966	10,018	9,863	9,359
Total number of deaths from all causes . .	89,803	86,248	83,933	87,091	85,030	83,259	83,350	86,936

The figures prior to 1901 may be disregarded, as pulmonary tuberculosis came under the same head as diabetes, and tuberculous meningitis under cerebral complaints, and the change in nomenclature was associated with a sudden fall in the apparent mortality, which might otherwise have wrongly been ascribed to the tuberculosis movement which began in 1900, when the writer advocated the founding of a Sanatorium and Winter Garden, the latter being for chronic cases.

TABLE II.—INDICATING DEATH-RATE FROM TUBERCULOSIS IN THE NETHERLANDS PER 10,000 INHABITANTS.

Year.	Pulmonary Tuberculosis.	All Forms of Tuberculosis.	All Forms of Disease.
1901	13.73	19·37	172·00
1902	13·25	18·72	162·63
1903	13·21	18·86	155·74
1904	12·94	18·42	159·20
1905	13·57	17·93	153·16
1906	13·37	17·79	147·83
1907	12·97	17·28	145·98
1908	11·96	16·18	150·25

SANATORIA

The first sanatorium was opened in 1901 at Renkum, in the province of Gelderland, being built on the estate of "Orange-Nassau's lord," presented to the nation by the Queen-Mother Emma on laying down the Regency. In addition to this magnificent gift the Royal donor equipped and endowed the sanatorium. In 1902 the National Sanatorium at Hellendoorn was established, and another at Hoog-Laren in 1903. Others have followed, and there are now some 400 beds for the poorer classes. In addition there are some 150 beds for tuberculous children at seaside homes. All these institutions are chiefly supported from charitable funds, patients' fees, and by Government subsidy, the average fee being 3s. to 3s. 6d. per day, while one sanatorium alone can boast of 10 free beds.

LIMITATIONS OF SANATORIA

So small a number of beds cannot attain much in a population of five millions, more especially as the fees are beyond the means of the majority who require treatment. This difficulty would be largely met were there a compulsory sickness and invalidity Insurance Act, but it is superfluous to suggest, in a volume such as this, that the usefulness of an anti-tuberculosis campaign is hopelessly limited if it be concerned only with the treatment of existing cases.

THE DISPENSARY SYSTEM

Fortunately this fact has now been realised, and in 1903 an anti-tuberculosis dispensary was established in Rotterdam. Up to this time very little was known in our country of this system of controlling

tuberculosis, although in Great Britain it has been in operation since 1887. In my opinion Dr. R. W. Philip may well be called the father of the anti-tuberculosis movement by means of central and concerted action and supervised home treatment, and in later years his work has received in our country that earnest consideration it so fully deserves. This system has been adopted by the Dutch Central Association for the Prevention of Tuberculosis, and the Government was petitioned in 1908 for financial support.

State Subsidies

Up to that time only a small sum had been granted to the movement. Thus in 1904 the anti-tuberculosis movement received a grant of £840, while in 1909 this was increased to £8400, and in 1910 it amounted to £10,500, of which the greater part was divided among the Societies for the Prevention of Tuberculosis. It should be mentioned that £20,160 had already been given to sanatoria, while the Central Association had received £14,300. Not every Society for the Prevention of Tuberculosis is able to found a dispensary, although out of seventy-six such societies, thirty-three have been formed with this special purpose in view, these being confined to the larger towns.

Health Societies

In the smaller towns and villages the anti-tuberculosis movement is combined with the work of existing health societies, who enjoy the tuberculosis subsidy provided they comply with certain conditions, the foremost being that they employ a specially trained home visitor to keep a regular hygienic and prophylactic supervision over the homes of the tuberculous poor. In many of the smaller towns this work is combined with that of the district nurses, but these, owing to essential differences in the work, require special training. In the larger towns specially trained nurses only are appointed.

Training of Workers

The Central Association at The Hague has arranged a four months' practical and theoretical course of training for workers. This somewhat short term was fixed in order to turn out a sufficient number of educated home visitors to meet the demand, and the work is very thorough. At the end of the course an examination is held, and successful candidates receive a certificate and insignia for home visiting.

Details of the Government Grants

The Government returns to the local society two-thirds of the salary of the home visitor, two-thirds of the cost of disinfecting homes, two-thirds of the cost of distributing sputum flasks, and two-thirds of the cost of moving tuberculous patients into better homes. The local society grant, moreover, half of the sum returned as an honorarium to the physicians taking an active part in the work of the dispensary, and in payment for the examination of sputum. The societies also receive a grant for their general expenses, this being proportionate to the population of the town or parish in which they work.

Hospitals for Advanced Cases

The anti-tuberculosis campaign is only beginning in our country, and in no town in Holland is the complete system organised, nor is there a well-appointed hospital for advanced cases. Some of the large general hospitals have set apart wards for these patients, in spite of intense opposition from the majority of the medical profession, such institutions being often derisively called "Houses of Death," which is not in the way of popularising the idea. It is my firm conviction that such opposition is ill founded, and the words of the German author of the eighteenth century, Ruhmkenius, may be justly applied where he says that all arts and sciences count their adversaries by preference among those who know nothing or very little about it. The author of this article is fully convinced of the truth that "to give the best of care to these unhappy victims is a true charity to them, to place them where they seem to be no danger to the general health is a true charity to others" (Osler).

Education of the People

The people of Holland are being educated in the prevention of tuberculosis, and to this end the Central Association received an annual grant of £1000, in order that they may issue a magazine and have various lectures illustrated by the bioscope. In this way the people are being practically educated in the essential principles of hygiene.

W. G. Van Gorkom.

CHAPTER XXXI

FONS ET ORIGO — THE ORIGIN AND PROGRESS OF THE EDINBURGH SYSTEM

I. Bibliographical and Chronological—II. A Selection from the Writings of Dr. R. W. Philip—Progressive Medicine and the Outlook on Tuberculosis; Public Aspects of the Prevention of Consumption.

I. BILIOGRAPHICAL[1] AND CHRONOLOGICAL

1886. "An Improved Method for the Demonstration of Bacilli in Tubercular Sputum, and for the Obtaining of Pure Cultures from such Sputum," *Transactions of the Medico-Chirurgical Society of Edinburgh*, July.

1886. Proposal for Erection of Special Tuberculosis Department at Edinburgh.

1887. "On the Etiology of Phthisis, with Special Reference to the Cause of Death," *Transactions of the International Medical Congress*, Washington, 1887, vol. i. pp. 205-211.

1887. INAUGURATION OF FIRST TUBERCULOSIS DISPENSARY—VICTORIA DISPENSARY FOR CONSUMPTION, Bank Street, Edinburgh.

1889. "Tubercular Ulceration of the Bladder," *American Journal of Medical Sciences*, July.

1890. "Consumption: How to get it, and how to get rid of it, with Plea for Dispensary, Sanatorium, Hospital for Advanced Cases, Notification, etc." (Edinburgh Health Lecture).

1891. "Koch's New Treatment of Tuberculosis" (Pentland).

1891. "Pulmonary Tuberculosis: Etiological and Therapeutic, based on an Experimental Investigation" (Pentland).

1891. EXTENSION OF VICTORIA DISPENSARY FOR CONSUMPTION: Opening of larger premises.

1892. "A Thousand Cases of Tuberculosis, with Etiological and Therapeutic Considerations, based on Observations during the First Three Years of the Victoria Dispensary for Consumption, with Map of Edinburgh showing Distribution of Cases and further Statement of Edinburgh Scheme," *Transactions of Medico-Chirurgical Society of Edinburgh*, March.

[1] The references are to Dr. R. W. Philip's writings.

1894. Inauguration of Royal Victoria Hospital, Edinburgh (Sanatorium for Early Cases).

1898. "The Universal Applicability of Open-Air Treatment of Pulmonary Tuberculosis, with further Elaboration of Edinburgh Scheme," *British Medical Journal*, 23rd July.

1899. "The Prevention of Consumption: Personal and Citizen Responsibility" (Edinburgh Health Lecture).

1899. "What is to be expected from the Open-Air Treatment of Pulmonary Tuberculosis?" *Practitioner*, July.

1900. "The Open-Air Treatment of Pulmonary Tuberculosis," *Scottish Medical and Surgical Journal*, January.

1901. "On the Sanatorium Treatment of Pulmonary Tuberculosis." An Address introductory to the Discussion on the Subject at the British Congress on Tuberculosis (London), with illustrative plates and charts.

1901. "Tuberculosis of Lung," *Encyclopædia Medica*, vol. vii. (William Green & Sons).

1902. "Observations on the Clinical Course of Tuberculosis as affected by Modern Methods of Treatment," *Practitioner*, May.

1903. Extension of Royal Victoria Hospital: Opening of three new pavilions by Lord Rosebery.

1903. "The Rôle of Percussion in the Diagnosis of Early Pulmonary Tuberculosis," *Practitioner*, 7th January.

1904. "The Organisation of the Home Treatment of Pulmonary Tuberculosis," *Transactions of Fourth International Home Relief Congress*, Edinburgh, June 1904.

1905. "On Zomotherapy in Pulmonary Tuberculosis," *Practitioner*, January.

1905. Commencement of School for Tuberculous Children at Royal Victoria Hospital for Consumption.

1905. "De la Constitution de Dispensaires Antituberculeux Municipaux, et d'une Organisation plus complète contre la Tuberculose," *Congrès International de la Tuberculose*, Paris, October 1905.

1906. Opening of Pavilion for Advanced Consumptives by the Municipality.

1906. "The Tuberculosis Dispensary, and the Edinburgh Anti-Tuberlosis Scheme." Address before the International Conference, The Hague.

1906. Issue by Local Government Board of Scotland of Memorandum on the Administrative Control of Phthisis, with adoption of the Edinburgh Scheme as a model for a national system of anti-tuberculosis measures.

1906. "The Public Aspects of the Prevention of Consumption." Inaugural Address to the Edinburgh Sanitary Society, *British Medical Journal*, 1st December 1906.

1907. Introduction of Compulsory Notification of Consumption in Edinburgh.

1907. Further Extension of the Royal Victoria Hospital: Opening of new buildings by the Right Honourable A. J. Balfour.

1907. "Treatment of Phthisis," *Index of Treatment* (Messrs. John Wright & Sons).

1907. "Die Organisation und das Zusammenwirken Antituberculösen Massnahmen: Die Fürsorgestelle als Mittelpunkt." Address before the Verein für Innere Medizin und Kinderheilkunde, Vienna.

1907. "The Study of Tuberculosis: An Anticipation," *British Journal of Tuberculosis*, No. 1.

1908. "The Anti-Tuberculosis Programme: Co-ordination of Preventive Measures." A lecture delivered, on the invitation of the Committee, before the International Congress of Tuberculosis, Washington.

1908. Surgical Bearings of Tuberculin (Surgical Section of International Congress of Tuberculosis, Washington, 1908).

1908. "The Anti-Tuberculosis Dispensary." Introduction to a symposium, International Congress of Tuberculosis, Washington, and other contributions to the same Congress.

1908. "Tuberculosis among Children in Scotland," *Tuberculosis in Infancy* (Baillière, Tindall & Cox, London).

1909. "Rôle of the Consumption Dispensary in the Tuberculosis Campaign" (Messrs. Dollard, Dublin).

1909. "Progressive Medicine and the Outlook on Tuberculosis:" being the Address in Medicine at the Seventy-seventh Annual Meeting of the British Medical Association.

1909. The Edinburgh Anti-Tuberculosis Scheme: What it is, and what it does.

1910. "The Tuberculous Gland," *Lancet*, June 1910.

1910. Inauguration of the Royal Victoria Hospital Farm Colony by Lady Dunedin, and Address by Vice-President of the Local Government Board for Scotland.

1910. Transactions of Edinburgh Meeting of National Association for Prevention of Consumption: and Conference on Tuberculosis.

1911. "Rest and Movement in Tuberculosis:" being Introductory Address to the Edinburgh Sanitary Society.

II. A SELECTION FROM THE WRITINGS OF DR. R. W. PHILIP

PROGRESSIVE MEDICINE AND THE OUTLOOK ON TUBERCULOSIS:

BEING THE ADDRESS IN MEDICINE DELIVERED AT THE SEVENTY-SEVENTH ANNUAL MEETING OF THE BRITISH MEDICAL ASSOCIATION

IT is fitting that the first word this afternoon should be one expressive of my sincere thanks to the Council for the invitation with which they have honoured me to deliver the Address in Medicine at the Annual Meeting of the Association. In responding to the request, I am sensible of the responsibility no less than the compliment which is implied. As years go by, the choice of a subject does not grow easier. The immensity of the field constitutes an increasing difficulty.

Turning the matter over soon after the invitation reached me, I chanced to pass my old school, left, almost to a day, thirty-five years ago. It occurred to me that, in place of attempting to project a bird's-eye view of medicine as a whole, it would be well to limit attention to one department which illustrates in striking fashion the extraordinary revolution of thought which has occurred in little more than a generation. In selecting for my theme the outlook of modern medicine on tuberculosis I make no apology for the choice. No subject in medicine has wider interest. No assembly can appraise, as this great Association can, its significance and magnitude. You know its difficulties and have to face them every day. I am influenced, too, by the fact that the Association meets this year in Ireland, where, thanks to the admirable energy of Her Excellency the Vice-Reine and the generous co-operation of the medical profession, a great anti-tuberculosis movement is in progress. Nor can I forget the striking part played by the city of Belfast in times gone by through the remarkable labours and writings of Dr. Henry MacCormac, and in more recent times by those who are yet with us.

RETROSPECTIVE

Let me try rapidly to picture the change which has come over the spirit of our dreams. Recall the general attitude towards tuberculosis of thirty-five years ago. Recall the atmosphere of ignorance and help-

lessness and hopelessness. Then turn to the period I have selected, and view the bounding, surging movement which has compelled the great march forward.

To give greater precision, let me divide the thirty-five years into five lesser periods of seven years each.

The first period (1875-81) was one of darkness and fog. The great work of Läennec and Louis was threatened with eclipse. The unity and specificity of the tuberculosis process were obscured. Terminology was vague and inexact. Tuberculosis of the lung was labelled catarrhal pneumonia, with three stages of congestion, consolidation, and excavation. A "neglected cold" played a chief causal rôle. The hopelessness of therapeutics was depressing. Here and there appeared glimmering of light. Experimental research on the earlier lines of Villemin presaged the dawn.

The commencement of the second period (1882-88) saw the advent of daylight. Koch's announcement to the *Physiologische Gesellschaft* of Berlin, on 24th March 1882, came like sunrise to a sleeping city. The discovery of the tubercle bacillus inaugurated a time of Sturm und Drang—the strife of critics and opposing doctrines. The tremendous significance of the brilliant discovery could not be realised at once. Time was needed for the correction and adjustment of older views. Research had to develop on fresh lines. The character, life-history, properties, and morbific activity of the tubercle bacillus were studied by a host of observers. The conception came gradually—not an absolutely new conception indeed—that tuberculosis, notably pulmonary tuberculosis, must be given a place among infective diseases. The old feeling after truth, which led the Italian and Spaniard almost a century before to pass enactments prescribing preventive measures against tuberculosis, was found to rest on scientific fact. Gradually there emerged indications of a larger outlook towards prevention.

During the third period (1889-95) observation and research were pursued with increasing exactness and better result. The period is remarkable because of two events: (1) The announcement of tuberculin; (2) the more general adoption of the doctrines of aëro-therapy, a doctrine promulgated long ago, but little apprehended or applied. The intimation by Koch in 1890 that he had obtained in tuberculin an agent of specific value in the diagnosis and treatment of tuberculosis was an event only second in importance to the announcement of the bacillus itself. It needed years, however, to enforce the conviction that tuberculin, which was received with mingled criticism and almost hooted from the stage, embodied a principle of greatest significance to medicine.

The fourth period (1896-1902) saw the more rapid spread of anti-tuberculosis activity throughout the civilised world—the increasing determination of scientific, social, and, to some extent, official effort towards the tuberculosis problem. While experimental research was pursued with keenness, men's minds were awakened to the large issues of preventive medicine. This was the time of more general development of the Sanatorium. The Tuberculosis Dispensary, inaugurated in the Eighties as a centre of anti-tuberculosis operations, aroused attention. Notification was admitted as a practical measure. Tuberculosis associations were founded in different centres. Conferences and congresses began to be held. The commencement of the twentieth century found the subject pretty much in the air.

The fifth and last period of seven years (1903-9) is remarkable for the development of larger views on immunisation and the appearance of the opsonic doctrine and its application to therapeusis as a means of directing vaccine-therapy. Diagnosis has been made more exact by various adaptations of tuberculin. This is also the period of more rapid evolution of preventive measures. The physician and the sanitarian have joined hands, and have been aided not a little by thoughtful social workers who recognise the vast part played by tuberculosis as an agent of national devitalisation and impoverishment. The nations of the world are falling into line. Repeated international congresses have borne excellent fruit. With exchange of ideas endeavour has become better directed and more uniform. The significance of organisation and co-ordination of effort is gradually being appreciated. Administrative control is taking practical shape. And so the great work goes on.

Present Position and Outlook

To-day I invite you to pause for a brief hour and think what the discovery of the tubercle bacillus has meant to medicine and to the world, and what it may mean. Nor deem this a trite or exhausted subject. I hope to succeed in showing that, great as have been the advances already made, still greater are the possibilities which the discovery implies.

Consider the matter more closely. The determination of the essential cause has called order out of chaos. It has thrown to the winds the vague, nebulous talk of dualism which long perplexed medical science. Tuberculosis, however various its aspects, is one indivisible entity, dependent essentially on the presence and activity of one organism. Behind the changing pathological and clinical appearances the tubercle bacillus remains single and constant.

Nomenclature and Classification

The discovery has taught us to call things by their proper names. In presence of tuberculous infection, mysterious inflammations, formerly named in misleading fashion pneumonia, broncho-pneumonia, pleurisy, bronchitis, etc., are getting their proper place. We are facing the fact that tuberculosis is vastly more common and infinitely more various in manifestation than we dreamt of in years gone by.

We have come to realise that, when tuberculous disease is present in an organ, be it in the lungs or elsewhere, we have to deal with a specific disease the local manifestation of which may be comparatively unimportant compared with the systemic effects. Commonplace as the view may appear, it can hardly be emphasised too much. It is lost sight of sometimes when it should be accentuated most. Take, for example, the classification of pulmonary tuberculosis recently adopted by the International Conference of Tuberculosis at Vienna in 1907, which embodies what was previously known as Turban's classification. This recognises three stages of pulmonary tuberculosis, which I recall according to the official description :—

Stage I.—Disease of slight severity, limited to small areas of one lobe, which, for example, when affecting the apices bilaterally, does not extend beyond the spine of the scapula and the clavicle, or, unilaterally, does not extend below the second rib anteriorly.

Stage II.—Disease of slight severity, more extensive than Stage I., affecting at most an entire lobe, or of greater severity extending at most over half a lobe.

Stage III.—Disease of greater extent than just defined and all cases with considerable cavities.

It seems a pity that the stages which this classification admits are solely stages of anatomical change within the lung. Little cognisance is taken of systemic involvement. Yet, after all, the prognosis and treatment of a given case are governed by the degree of systemic intoxication rather than by the extent of local change. For, on the one hand, the local change may be extensive, and yet the prognosis remain comparatively good because of the absence of systemic disturbance. On the other hand, the local lesion may be relatively slight and yet the prognosis be serious because of the disproportionate degree of intoxication. On that account, I prefer a classification which gives approximately just expression to both the local and the systemic disturbance. Adopting the symbol L for the local or lung lesion, and admitting three stages as in the classification just referred to, we may speak of L_1, L_2, L_3.

To express systemic involvement, I use the symbol S. By the simple device of combining variously capital or small letters, the diagnosis can be expressed with reasonable accuracy. Thus, taking an early process in the lung, we can state the various possibilities as L_1s, that is, an early local process, with relatively slight systemic disturbance, or, L_1S, that is, an early local process with equivalent systemic disturbance, or l_1S, that is, an early local process with excessive systemic disturbance. It matters not what degree of local change be present, whether L_1 or L_2 or L_3, the same principle of classification is available. Thus L_3s indicates a case of extensive lung disorder with vomica formation, but comparatively slight systemic intoxication, while l_2S indicates a case where, with the local process one of infiltration only, systemic intoxication is excessive. The presence of complications is indicated by the symbol + followed by the lesion, for example, l_2S + ent. tub., *i.e.* the case just described with complicating tuberculous enteritis.

Such a classification not only gives greater fulness and exactness to the recorded diagnosis, but also conveys a summary of prognosis. This is important. It should be a chief aim of prognosis to estimate the degree of systemic disturbance in relation to varying local lesions. This means not the examination of the lungs only, but of every organ, and a complete review of the patient's condition. A comprehensive determination of this kind with a view to prognosis and treatment emphasises the fallacy of much of the present-day diagnosis, which is made to rest chiefly, if not entirely, on the bacteriological examination of the patient's discharge.

Diagnosis and Prognosis

The discovery of the tubercle bacillus in the patient's expectoration affords bacteriological proof of tuberculosis. This is incontestable evidence. It is the evidence which we seek for in dead tissues. But from the physician's point of view much more is needed. In the first place, if he wait for the appearance of the tubercle bacillus in the discharge he waits too long. The occurrence of the bacillus in the expectoration signifies a tuberculous invasion which has made considerable advance. The disease has progressed far, before it takes the form of a discharging lesion. The physician's duty is to conclude the diagnosis prior to this.

Further, the detection of the bacillus in the discharge or the determination, by one or other of the more recent bacteriological tests, that the patient is tuberculous, yields but a partial diagnosis from the standpoint of prognosis. Unfortunately the present tendency is to say, on the one

hand: Given no tubercle bacillus in the discharge, we may not diagnose the condition as tuberculosis; and, again: Given the bacillus in the discharge, the diagnosis is one of tuberculosis, and there's an end of it. But *quâ* prognosis, much more is needed.

In respect of early diagnosis and the completer diagnosis on which are based both prognosis and treatment, the physician has methods of determination beyond those of the laboratory, which can be refined and perfected only by careful, patient, and prolonged study at the bedside. The physician, while making use of all bacteriological advances as aids to diagnosis, cannot afford to forget that there is evidence imprinted on the patient's every tissue and organ, which, when read by the seeing eye and interpreted by the trained senses, gives completeness of view otherwise unattainable. The physician is primarily the thoughtful observer of Nature. Familiar with the features of healthy activity as these manifest themselves in every organ, he becomes quick, by repeated observation of disease, to catch the first slight deviations which indicate that the physiological has become the pathological. In illustration, let me cite a simple case.

Some years ago I was asked to see a young lady suffering from pulmonary tuberculosis, who was extremely ill, indeed almost moribund. There was little to be done. In passing downstairs from the sickroom I happened to meet a bright girl with whom I exchanged a few words. After expressing an unfavourable opinion regarding the patient, I ventured to ask who the girl was whom I had met on the staircase. To the reply that it was the patient's younger sister, I suggested we should direct treatment to her. The immediate rejoinder was: "But there is nothing wrong with her." I heard no more of her for twenty months, when I was asked to see her on account of pulmonary tuberculosis. The doctor in attendance reminded me of the previous incident, and indicated that the girl had "kept well" till a fortnight ago, when cough appeared, and a specimen of expectoration sent to the laboratory revealed the presence of tubercle bacilli. Examination of the patient showed extensive bilateral disease, and pronounced systemic disturbance. Months of much moment to the patient had slipped by, during which the disease was slowly making way. It was only when the lesion came to be a discharging one that the suggested diagnosis of twenty months before was seriously considered. In spite of speedy adoption of treatment, and a brave fight on the part of the patient, she died. Had treatment been instituted at the earlier date, the unfortunate issue would probably not have occurred. Such incidents are of frequent occurrence.

The extent to which faith is limited to the bacillary diagnosis is serious. I have before me a letter from a bacteriologist who, at the request of a throat specialist, had received a specimen of sputum from a patient in whom, to my knowledge, the diagnosis of pulmonary tuberculosis had been made six years ago, and who had done remarkably well. The writer reports that he found the patient discharging "a very large number of tubercle bacilli, which indicated that it was an advanced and progressive case of phthisis, but still not hopeless." It is clear that neither the unfavourable verdict nor the subsequent reassurance, coming from one who had never seen the patient, can be admitted as of much value.

What I am anxious to urge is, on the one hand, that the bacteriological diagnosis comes frequently too late, and in any case should not be waited for without an estimate of the results of every other method of examination; and, on the other hand, that the bacteriological diagnosis is much too narrow an issue on which to base prognosis in a given case. While, broadly speaking, the presence of a large number of tubercle bacilli in the discharge points to a considerable focus of disease, the actual number *per se* is not a sufficient gauge of the stage or gravity of the case. To the trained clinical eye there are a score of other points which must be appraised in order that the diagnosis may be of prognostic value.

Tuberculin in Diagnosis

Pleading as I am for exactness in the determination and interpretation of clinical appearances, I am not forgetful of the material assistance afforded in the early diagnosis by the discovery of tuberculin. The subcutaneous injection of tuberculin, as first proposed by Koch, is occasionally of much value. There occur every now and again in the experience of the best clinician cases where the symptoms, physical signs, and clinical course are difficult of interpretation—cases where the possible presence of tuberculous disease means too much to the patient to justify doubt or delay. In such instances the use of tuberculin is clearly indicated. Resting on an opinion formed by a persistent use of the method since its first introduction, I can testify to its value and its freedom from risk. There are also available more recent adaptations of tuberculin diagnosis, which include the cutaneous, percutaneous, and ophthalmic tests. These have a wide range of application. Perhaps the most generally serviceable is the cutaneous. The percutaneous

is a simple modification of this, in which the skin remains unbroken. The ophthalmic or conjunctival has similar application where there is no contra-indication because of existing eye disease.

These methods, which are readily carried out, yield convincing evidence as to the presence or absence of tuberculosis in the given *individual*. They do not, of course, afford certain proof—although the presumption may be present—that the *particular symptoms or lesion* under consideration are of tuberculous origin. They justify the diagnosis that the individual has tuberculosis, while they leave the localisation of the lesion to other means. In this sense the cutaneous and ophthalmic tests are commonly less conclusive than the subcutaneous. On the other hand, the former are often preferable. Thus they may be preferred when the point to be determined is the general one, Is the patient tuberculous? They may be preferred — especially the cutaneous—when the hypodermic method might be objected to either by the patient or his friends, or when the character of the lesion makes subcutaneous injection undesirable. The external methods—and in most cases the cutaneous—are preferable when an extensive test involving many individuals is undertaken, as in a public institution, for the purpose of determining the amount of tuberculosis present. In respect of all these tests it is unfortunate that, while they commonly indicate with remarkable certainty the existence of a tuberculous lesion, they fail to discriminate, so far as present methods go, between lesions of comparatively old and quiescent character and commencing lesions of aggressive nature. They fail also to detect some of the worst cases, notably disease rapidly advancing towards a fatal termination.

Etiological Relationships of Childhood

From the larger point of view we are much indebted to tuberculin for convincing evidence of the vast frequency of tuberculosis. Of paramount importance is the conclusive testimony it bears as to the frequent occurrence of tuberculosis in children. Its use has confirmed in remarkable fashion estimates, concluded on other clinical grounds, which have sometimes been criticised as excessive. Thus conclusions published by me, which showed that of groups of school children from 6 to 14 years of age no fewer than 30 per cent. presented stigmata of tuberculosis, have been thought extreme. Yet observations by means of the cutaneous test go to show that such conclusions are within the mark. Much evidence is accumulating on the point. In

the absence of investigations on a large scale from London or other great city at home, I cite recent continental observations.

Statistics from the city of Vienna are available, which deal with large numbers of children. They include (A) cases examined post mortem, and (B) cases tested with tuberculin. The figures are as follows:—

(A) Post-mortem results (Sluka and Hamburger):—

Of 848 cases dying from all sorts of causes, 335 were found to be tuberculous, that is, *circa* 40 per cent.

Arranging them in six groups according to age:—

Group I. (1st year of life)	showed	15	per cent.	tuberculous.
II. (2nd „)	„	40	„	„
III. (3rd to 4th yr.)	„	60	„	„
IV. (5th to 6th yr.)	„	56	„	„
V. (7th to 10th yr.)	„	63	„	„
VI. (11th to 14th yr.)	„	70	„	„

(B) Tuberculin results:—

(*a*) Of 988 consecutive patients coming to hospital and tested by cutaneous method (von Pirquet):—

Group I. (as above)	showed	16	per cent.	positive.
II. „	„	24	„	„
III. „	„	37	„	„
IV. „	„	37	„	„
V. „	„	57	„	„
VI. „	„	68	„	„

(*b*) Of 509 consecutive patients in hospital for diphtheria, scarlet fever, and other acute infections (except measles), tested cutaneously, and in case of doubt subcutaneously (Monti and Hamburger), 271 were positive, that is, *circa* 50 per cent. Or, taking them in groups:—

Of Group I. (as above)	undetermined.			
„ II.	„	9	per cent.	were positive.
„ III.	„	27	„	„
„ IV.	„	51	„	„
„ V.	„	71	„	„
„ VI.	„	94	„	„

It is to be kept in view that the figures quoted are based on investigations among children of the poorer classes, and refer to tuberculous *infection* and not to clinically determinable *illness* merely.

For the present we are concerned with the actual distribution of tuberculosis throughout large communities. It is also to be understood that the conditions pertaining in Vienna, and correspondingly the incidence of tuberculosis, are not strictly comparable with those in our own large towns.

None the less, collective evidence from many sources emphasises the view that it is especially in childhood that the tuberculous seed is sown. Tuberculosis is an all-pervading blight. Its occurrence would seem traceable largely to the nursery, or at least to the period of childhood. The German saying, "*Am Ende hat Jedermann ein bischen Tuberkulose*," might in the light of modern observation almost read, "Tuberculosis is commonly contracted in childhood."

The significance of this can hardly be exaggerated. The frequency of tuberculous infection in childhood explains much that previously gave rise to endless speculation. If we modify slightly the doctrine of heredity which formerly held sway, and ally it with that of the survival of the fittest, we shall come near to the truth. Heredity means not transmission of the disease, but of tissues which are extra liable and extra vulnerable. The widespread distribution of the disease and unhealthy environment mean the probability of infection in less or greater degree. The more liable tissue becomes more certainly infected, and the more vulnerable tissue suffers in greater degree. The less liable may escape altogether, and the less vulnerable resist successfully.

If the conclusion which seems forced on us be correct, that in a majority of instances infection occurs in childhood, we are faced with a problem of totally different complexion and proportions from that which was previously conceived. To solve it, we must search for causal conditions in the life of the child. It is impossible on the present occasion to condescend on details as to channels of infection. Suffice it to say, that prolonged observation has led me to conclude that inoculation may occur by way of the mucous passages at any point from the mouth and nostril downwards. I believe this is especially frequent in the naso-pharyngeal, tonsillar, and faucial regions. From the point of entrance there is usually a slow dissemination by way of the lymphatic circulation. The factors essential to invasion are devitalisation of the tissues and the presence of the bacillus.

In answer to the query, Where does the bacillus come from? it is natural and tempting to trace infection in childhood chiefly to infected milk supply. But do the facts bear this out? Tuberculin tests show that tuberculosis is relatively less common during the first

two years—when, if milk were the chief agent, we might expect it to be greater—and evidence of infection becomes progressively common as age advances. The facts of comparative ethnology tend also to qualify the view. For tuberculosis flourishes abundantly in not a few countries where feeding with milk from cows or other animals appears unknown. I am assured by numerous competent observers abroad that tuberculosis abounds in districts where the use of milk for alimentation is unknown. The extent to which tuberculosis depends on the ingestion of bacillus-containing milk remains, therefore, a moot point.

It seems rather as if some other cause were operative—a cause common to home and school life. The incidence of pulmonary tuberculosis shows a steady increase as the child grows. The ratio of increase is greater about the time the child goes to school. One morbid influence seems constant throughout the progressive stages of the child's life, namely, the comparative withdrawal of the developing organism from the natural and healthful stimulus of the open air. The facts appear to point conclusively to the relatively airless conditions of home and school life as a chief etiological factor. This view is corroborated by observations made under the system of domiciliary visitation which forms a leading feature in the activity of the Victoria Dispensary for Consumption. Under the system the home of every patient coming to the dispensary is systematically inspected by nurse and doctor. In addition to inspecting the house the doctor holds a "march past" of the household, so that other cases of infection may be detected as early as possible. The frequency with which several members of a household—it may be half a dozen children—are found to be concurrently affected is striking. There is a remarkable coincidence between the airlessness of the house and the frequency of disease. Sometimes every member of the family presents stigmata of the disease. Such homes are veritable "nests" of tuberculosis.

In this connection I venture the suggestion that it is to the extensive distribution of tuberculosis in childhood that we must trace the frequency of the graver symptoms and complications which occur in such infections as measles and whooping-cough. The more carefully we have regard to complete diagnosis, the more frequently will it be found that tuberculosis lurks behind the more acute illness. It is often stated that pulmonary tuberculosis occurs as a *sequela* of measles and other infections. Are there not grounds rather for believing that such infections tend to assume the graver character because of *pre-existing* tuberculosis? Do not such infections frequently rouse into

activity a pre-existing tuberculosis? Tuberculosis is, I believe, to be credited with a much greater proportion of mortality in childhood than is usually conceived, and is largely responsible for the aggravated manifestations of otherwise simple ailments.

Tuberculosis in Communities

Turning to the occurrence of tuberculosis in the community generally, I may recall calculations made a number of years ago as to the ratio between mortality and incidence of pulmonary tuberculosis. These led me to the conclusion that the mortality within a district might safely be multiplied by ten to express the number of cases of pulmonary tuberculosis worthy of medical surveillance, and I suggested that this number might be further increased without exaggeration. Subsequent observations have confirmed the belief that the estimate, far from being excessive, errs probably on the low side. The results obtained by means of the newer methods of diagnosis are strongly corroborative. If we reckon not merely patients who are so evidently ill as to require medical supervision, but the entire number of persons who give a positive reaction to tuberculin, the sum-total is vastly greater.

Such facts have a very practical bearing on prevention and treatment. They testify to the tremendous grip which tuberculosis has obtained on the race and its immense ramifications throughout the social organisation. They emphasise the significance of measures directed to the better sanitation of dwellings and schools as well as workshops, offices, etc. They illuminate and illustrate the housing question—using the phrase in the widest sense—as nothing else could do. No less do they accentuate the great need which exists for an organised and co-ordinated plan of operations in relation to tuberculosis as it occurs in our social communities. With so great a mass of tuberculous material to handle, we cannot afford merely to wait and treat individual patients as they happen to present themselves at out-patient departments. We must search for them in their hiding places. We must track them to their breeding grounds.

Towards this end *concerted action* is desirable. We must obtain all available information as to the distribution and spread of the disease with a view to its prevention and eradication. This is the justification of notification. Much more is needed. Approaching the matter from the standpoint of the pathologist, I was led some twenty-

two years ago to propose the establishment of the Consumption Dispensary as a central institution which should concern itself with every aspect of the tuberculosis problem, and would have regard especially to the patient's home conditions in relation to his own treatment and the limitation of the spread of the disease throughout the household. By the continuous activities of the tuberculosis dispensary and the system of domiciliary visitation to which I have alluded, there is maintained a ceaseless campaign and successful raid on the disease. If properly worked, there will be accumulated a remarkable mass of information regarding tuberculosis in the given district. Thus, in Edinburgh, the activities of the Consumption Dispensary has tended to the completion of a satisfactory plan of anti-tuberculosis operations, which includes compulsory notification, a sanatorium for early cases with approximately 100 beds, a working colony, a hospital for advanced and dying cases with 62 beds, in addition to suitable and extensive accommodation for patients of the pauper class under the Poor Law authorities. The several factors in the scheme are on terms of intimate relationship and co-operation. The scheme is closely related to the municipality through the medical officer of health, and by many links to the Charity Organisation Society and other such agencies. As illustration of the significance to the community of such concerted action, it is noteworthy that while during the first ten years of the development of the scheme, when its activities were more restricted, the mortality from pulmonary tuberculosis in Edinburgh fell 12·8 per cent., in the succeeding ten years (1897-1906) the mortality further fell to the extent of 42·1 per cent. Without tracing this remarkable drop entirely to the activities of the system, it seems fair to interpret these as chiefly contributory to the result.

The further goal towards which all effort is directed is the recognition by the State and the various administrative bodies concerned that tuberculosis is a social evil, the existence and effects of which call for consideration and active interference. The change which has come over the official attitude of the country is eminently satisfactory. So far as England is concerned, the most significant indication is found in the fact that last year there was issued by the Local Government Board an order calling for the notification of all cases of pulmonary tuberculosis occurring in patients under the Poor Law. In Scotland an advanced position was taken some years ago. In a Memorandum, dated 10th March 1906, pulmonary phthisis was declared by the Local Government Board of that country to be an infective disease within the meaning

of the Public Health Act, and the various elements in what may be described as the Edinburgh Scheme were recommended as collectively forming the basis of a national scheme of anti-tuberculosis measures. Ireland, thanks largely to the attitude adopted by her Local Government Board, is in possession of a Tuberculosis Prevention Act, which became effective on the first of the present month, and which gives her potentially the entire machinery for a complete and effectual campaign. These are striking indications of ripening opinion. Taken along with the wider public health enactments which have been a conspicuous feature of recent legislation, they afford a gratifying promise for the future.

Therapeutic

Many other points occur on which I am tempted to linger. Let me invite you to consider briefly two aspects of treatment. The first of these has no direct relationship with the tubercle bacillus—namely, aërotherapy. The second depends essentially on the bacillus—is, indeed, the outcome of our growing acquaintance with that and other organisms. I refer to tuberculin and vaccine-therapy.

The great quarry of scientific truth from which throughout the ages there has been reared the magnificent temple of Medicine contains yet untold wealth of building material. Of this in large part we can only dream. Sleeping or waking, such dreams vary with the dreamer. Apart from the mighty boulders still silently resting on their eternal bedrock, there may be found, lying loose within the quarry or at its edge, heaps of splendid building material which have not yet received a place in the noble pile. There are many reasons why this is so. Sometimes it would seem the ill luck of the worker, who is called to another sphere just as he was bringing to view the block fitted to be a column or pillar in the temple. Sometimes the mass is too great for one worker or even for one age to raise. Sometimes it may be the fault of the worker, eager, restless, too desirous to see results rather than patiently to work. Perchance it is the fault of fellow-workers who cannot realise the nature of the find—who cannot recognise the quality and distinction of the mineral, who cannot appraise its priceless value or the rare colour of the stone.

My thoughts turn in this direction because of Belfast, and because of Henry MacCormac, and because of the misunderstanding which still lingers round the great truth he sought to establish, with the result that what ought to be a mighty bearing column is still lightly discussed as almost of doubtful purpose in the edifice.

The Great Principle of Aëro-Therapy

Although, as the cynic may remind me, the great principle of aëro-therapy dates from the Garden of Eden, somehow as time went on the principle ceased to be followed save by a few. The experience of the past two decades has greatly influenced the medical attitude towards aëro-therapy. Its methods have gained an assured place in therapeutics. We have come to recognise, from a comparative study of pulmonary tuberculosis as it occurs throughout the world, that it is not a disease of any one latitude or climate. The fallacy which in the popular, and perhaps also in the medical, mind associated consumption particularly with these islands has been exposed. The relative infrequency of consumption in England and Scotland as contrasted with other European countries has not only contributed to dissipate ignorance as to its etiology, but tended actually to a reversal of the conception that climatic conditions have to do with its production. The pioneer work of the earlier sanatoriums in this country led rapidly and certainly to the conclusion that open-air treatment was a method of universal application. Facts and statistics have speedily accumulated which go to show that tuberculosis results chiefly from the exclusion or insufficient supply of fresh air in the dwelling-room, workroom, and other haunts of man, and, further, that in proportion as the supply of air and sunlight is improved, under better conditions of sanitation, there follows a corresponding reduction in the mortality from tuberculosis. Not only this, but there is abundant evidence that open-air treatment is successful in proportion as it is carried out completely, in winter no less than in summer. Indeed there is not wanting support for the belief that the results obtained under open-air treatment are fully better during the colder than the warmer months of the year.

Nor is it too much to contend, that the application of aëro-therapy has completely changed the clinical features of pulmonary tuberculosis. Under proper aëro-therapeutic conditions, the classic type of disease as described from generation to generation in the past has ceased to be. The aspect of the patient is metamorphosed. The delicate pink and white colouring or the hectic blush usually described is frequently replaced by a ruddy look. Pyrexia disappears marvellously. Within a short time, temperatures which have been swinging for weeks tend to become normal. The rapid pulse is slowed, and blood pressure increased. Night sweating is practically unknown. Cough quickly lessens or disappears, and expectoration is correspondingly reduced. Appetite

picks up and digestive disabilities disappear. Lassitude and disinclination for effort, physical and mental, pass away, and the patient becomes once more keen and fit for neuro-muscular expenditure. His entire physiology returns to a higher plane. The classic description of the consumptive, read alongside of patients under treatment on aëro-therapeutic lines, sounds exaggerated and false.

The brilliant results achieved under aëro-therapy in the arrest of what seemed hopeless conditions of disease afford encouragement for the wider adoption of open-air measures with a view to prevention. It is remarkable how far prevention lags behind treatment. What is capable of effecting the cure of definite tuberculosis is *à fortiori* capable of preventing its appearance. We admit this in theory, but the practical application is half-hearted and faltering. This is the more remarkable because we have a constant object-lesson in the relatively low place which England and Scotland occupy in relation to tuberculosis mortality as compared with other nations. There is little doubt that this finds its explanation in chief part in the habits of our people, their love of outdoor sports and the like, and in the continuous and steady amelioration of housing conditions from successive enactments, which have been passed during three-quarters of a century.

The history of medicine abundantly shows that where therapeutic procedure is based on physiology, the methods of application are simple and direct. This is conspicuously true of aëro-therapy. The accumulated experience of recent years has established three general propositions of much significance.

1. Aëro-therapy is a measure of universal applicability in all lands. There is no climate specially favourable for its practice. The advantage of brighter, warmer climates lies chiefly in the greater facility and comfort with which it may be carried out. Open-air treatment seems more natural when the sun is shining. On the other hand, in warmer climates there are inherent difficulties to the carrying out of the system all the year round. It may be doubted whether any climate, taken as a whole, is more suitable for the purpose than that of the United Kingdom.

2. Aëro-therapy is of universal applicability in every sickroom. It is not a special system to be practised in special institutions. It is utilisable in the bedroom of the ordinary dwelling as certainly as it is in the ward of a special hospital. Although more conveniently carried out in the sanatorium, it may be used no less completely and effectively in the ordinary dwelling-house, if only the principle of

application be rightly apprehended. There is no need to send patients to sanatoriums *merely* on this account. Sanatoriums have their uses. They are serviceable, especially in the interest of patients who, for one reason or another, cannot have a proper régime maintained in their own home. But even the poorest—and still more easily the well-off patient—can enjoy the advantages of aëro-therapy at home.

This is a significant admission, because it carries with it the further important conclusion that a sanatorium does not require, in order to be effective, to be erected in an inaccessible place, removed, it may be, a hundred miles from the centre of population which it especially serves. Many mistakes have been made in regard to this in the past. Much unnecessary expenditure and inconvenience have been caused. If a sanatorium is established for the poorer classes of a town it is eminently desirable that, while it should be removed to a sufficient distance to protect it from smoke and dust, it should still be sufficiently under the eye of the citizens to constitute from day to day an object-lesson in the application of aëro-therapy.

3. Aëro-therapy, while especially indicated in tuberculosis, is a measure of widest applicability in relation to disease. It is a mighty principle of treatment, both from the curative and from the preventive point of view. I have already alluded to the remarkable change in type which occurs in pulmonary tuberculosis when treated on open-air principles. No less striking is the absence of complications as compared with their frequency under the protective method. Throughout fifteen years of constant experience of aëro-therapy in the Royal Victoria Hospital for Consumption, I have watched closely for the occurrence of pneumonia, or pleurisy, or bronchitis, and have failed to meet them. Their absence from a considerable community, all of whom have already weakened lungs, is singular, and merits reflection. Further, there has never been an outbreak of epidemic disease, and it is the rarest occurrence to have a member of the staff off duty even for a day. It would seem, indeed, that the application of aëro-therapy is without limits, provided reasonable care be taken to preserve the warmth of the body. We are only awaking to the full significance of this great cleansing, antidotal, and vitalising principle, whose applicability in medicine is no less far-reaching than that of asepsis in surgery. It was a far-seeing, clear-visioned poet who wrote—

> Air, air, fresh life-blood, thin and searching air,
> The clear, dear breath of God that loveth us.
>
> . . . . . .
>
> Water is beautiful, but not like air.

The progress of surgery within recent times is sometimes contrasted with that of medicine, to the disadvantage of the latter. It is worthy of note that the remarkable developments of modern surgery are the result of the application of one or two great principles which may be described as medical rather than surgical. The two principles which have revolutionised surgery, namely, anæsthesia and asepsis, have allowed the surgeon to proceed fearlessly, leisurely, and without risk of interruption or complication, to the completion of operations which otherwise were impossible. In like manner, it seems to me, the adoption of aëro-therapy as a basis of treatment brings the physician to a vantage ground in respect of therapeutic possibilities from which he is debarred under the more protective system.

Let me urge that to place a patient suffering from pulmonary tuberculosis under the influence of aëro-therapy is not synonymous with the adoption of expectant treatment. Aëro-therapy is, in the truest sense, a therapeutic measure which has been found capable of giving the best results. Need I recall the classic experiment of Trudeau, who inoculated a number of rabbits with tubercle, and then allowed one-half to run about in the open air, while the other half were penned in darkened, airless hutches? Of the two groups, the former successfully resisted the effects of inoculation, while the other half succumbed. Aëro-therapy is no vague trusting to time and chance. It is the definite utilisation of one of Nature's elementary principles. It is the deliberate attempt at increased oxygenation. If, under conditions of imperfect aëration, the red cells fail to fulfil their office of oxygen carriers to the tissues with resulting anæmia, chlorosis, etc., it may well be that the withdrawal of a sufficiency of air influences, in like measure, the white blood corpuscles in a way not yet determined. We do not know what effect oxygen has on the white blood corpuscle. From the point of view of modern hæmatology, may the phagocytic appetite of the leucocyte not be whetted by aëro-therapy? Or, on the other hand, may not some influence be exerted on the invading organisms which makes them a readier prey to the leucocyte? Certain it is that, comparatively rapidly under the influence of aëro-therapy, the complicated clinical picture which we are in the habit of tracing to mixed infection commonly clears up, and an important step towards cure is achieved.

Henry MacCormac: Pioneer

It is to the everlasting credit of Henry MacCormac that he had a clear prevision of so much of this, and had the courage and determina-

tion to state his belief in no uncertain way, notwithstanding captious criticism and even ridicule. A few sentences quoted from different pages of his work on consumption will illustrate sufficiently his width of view. To those who do not happen to know the work I commend the volume, which was published in London in 1865. The fact that his therapeutic views are associated with an etiological conception of tubercle which was fallacious does not detract from the correctness of the former. From start to finish, the volume contains pregnant statements of remarkably striking character. Thus:—

"Tubercule is simply impossible in the case of persons who respire habitually air not prerespired, and who sleep in an atmosphere incessantly renewed. . . . Pure respiration is the law of life, impure respiration is the law of death. . . . It was once a general prepossession that taking cold, that damp night air, forsooth, was a source—the source indeed—of consumption, but this is a great error. The coldest, dampest air does not, never did since the world began, and never will, induce consumption. . . . If a person will but occupy three or four hours daily with active open-air life and effort, and sleep in a chamber the windows of which shall be pulled down winter and summer the night through, he may bid defiance to consumption and scrofula for ever and ever. So all-important is the respiration of a pure, unprebreathed atmosphere all night long that I should freely stake the prospect of health upon its observance alone, before and beyond any and every other means which omitted this most desirable and, indeed, indispensable requirement. . . . If the inhabitants of Great Britain and Ireland would but consent day and night to live in a pure, unprebreathed atmosphere, it would put a total close to the ravages of consumption and scrofula, white swelling, tabes mesenterica, water on the brain—in fine, the whole abhorred family of tuberculous disease."

Then, in relation to the bearings of climate, how modern he is!

"There is, in fact, no panacea in Californian air, no peculiar specific for lung troubles. If we cannot have the summer of California or the winter of sunny Mexico, we possess not the less a climate, whatever some may choose to say against it, replete with almost every possible element of vitality and well-being. We have air as pure as any obtainable on Californian or Mexican hills, air abounding in oxygen and ozone, air, in short, which, if we only do not respire it twice, leads to as perfect security from tubercular disease here as there. . . . The shores, almost any of them, of our own islands, our mountain slopes and airy downs, our many heaths and moors, will often, if not most times, prove prefer-

able to, while they are much more accessible than is any Nice, or Rome, or Madeira. The materials for the possible recovery from phthisis, I repeat, lie around every door."

These are remarkable words, are they not?—the sayings of a seer, the writings of a prophet. Reading them to-day, I cannot refrain from congratulating Belfast, and reverently saluting Henry MacCormac.

Tuberculin and Vaccine-Therapy

Turning from this to tuberculin. The quest after a specific remedy for tuberculosis has been long and disappointing. Until the discovery of the tubercle bacillus, the quest was in the dark. The best attempts were but random shots inspired by the hope that in some lucky moment the *materia medica* might reveal a drug, to which tuberculosis would respond as syphilis does to mercury and iodide of potassium. Among the legion of vaunted remedies, none can be credited with much beyond symptomatic value.

The recognition of the tubercle bacillus gave fresh impulse to research, and afforded occasion to determine on scientific lines the activity of bactericidal agents against the bacillus both *in vitro* and in the living tissues. Once more—notwithstanding recurrent claims to the contrary—the net result has been discouraging. No bactericidal agent, in the ordinary sense of the word, has yet proved effective in dealing the deathblow to the bacillus, which is not at the same time harmful to the living tissues of the human organism.

A more satisfactory picture presents itself when we turn to tuberculin. The discovery of tuberculin in 1890 meant an entirely new conception of treatment in tuberculosis. At first tuberculin attained but a precarious foothold in medical practice. On the reasons for this I shall not enter. During the years which have elapsed, it has been continuously used by me as a therapeutic agent. There has been ample time for experiment, observation, and reflection. These have been not less satisfactory because of the reserve and even distrust with which the agent was commonly treated. Necessarily mistakes occurred, and conceptions and methods have shifted from time to time. Looking back, it is gratifying to have the opportunity to state that throughout the period there has grown and remained with me the conviction, which is ever ripening, that in tuberculin we have a remedy of first importance in the treatment of tuberculosis. The cases treated have

been very numerous, and of varying kinds and types. The net result is a decisive verdict in favour of tuberculin.

The excessive dosage and too frequent exhibition of tuberculin of the first few years have been modified. The value of smaller doses, repeated at intervals, has been recognised. Gradually the cruder conception of its mode of activity has merged into that of vaccine-therapy.

On the principle of vaccine-therapy I may not dwell. Suffice it to remind you that its aim is the production of immunity by stimulation of the natural protective mechanism. Vaccine-therapy seeks to activate the leucocyte and the bacteriotropic elements of the blood. It is admittedly difficult to immunise a healthy animal against tuberculosis. More difficult still is the attempt to immunise an animal already affected. After all has been said and done, a complete immunity from tuberculosis seems a good way off. By the exhibition of tuberculin we introduce an agent closely related to the infecting organism, in the hope that we may thereby reinforce Nature's own effort at immunisation. But we are working in the twilight. The exact effect of varying doses of tuberculin on the subject infected with tuberculosis is obscure. We are even hazy as to what we wish to effect. What is meant by a so-called reaction—using the term in its widest sense? Is it something to be desired? How are we to direct and limit reaction? What are its bearings on immunisation?

It may be affirmed, with reasonable certainty, that pronounced reactions, both general and local, are to be avoided. On the other hand, it will be the conclusion of most observers that a mild reaction, local and general, is associated with progressive changes which make for improvement. A chief aim of clinical investigation should be the determination of the degree and limits of this serviceable effect. How are we best to attain satisfactory results? How are we to determine for different cases and occasions the *optimum* dose, and so exclude harmful effects which result from excessive dosage? Needless to say, both care and experience are required. It seems to me that, as physicians in immediate relation to the patient, we have methods of gauging from day to day the result of tuberculin treatment similar to, if not yet as certain as, those by which we gauge the effect and value of digitalis or other of the more potent drugs of the *Pharmacopœia*.

One of the more striking results of well-regulated dosage with tuberculin is the modification of symptoms indicative of systemic intoxication. From the first injection onwards, where dosage has been successfully determined, there is commonly reported by the patient

a sense of improvement and even well-being, with a corresponding limitation of constitutional symptoms. The patient loses the feeling of tiredness. Other symptoms lessen. The local effect of tuberculin on tuberculous tissues is no less striking. Everyone who has seen the change effected by tuberculin on a local lesion—for example, a gland, preferably a discharging one, or a superficial tuberculosis of mucous membrane or skin—must realise its remarkable influence. The hyperæmia induced in and around the tuberculous focus is conspicuous, and must have something to say in respect of the curative process. Similar evidence is available in relation to pulmonary tuberculosis.

With improper regulation of dosage or with want of care, the effects may be less happy. On the one hand, constitutional symptoms may be accentuated, as evidenced by the patient's sensations (anorexia, malaise, headache, etc.), colour, pulse, and temperature. On the other hand, local aggravation may be registered by changes determinable, when superficial, by eye and hand, or, when more deeply situated—for example, in lungs—by physical examination. Such changes are definite, and recognisable by the experienced clinician as clearly as are changes in relation to other groups of medical disease.

Speaking as a clinician, with prolonged experience in the use of tuberculin, may I say that I am unable to acquiesce in the proposal to replace thorough clinical observation by reference to one set of phenomena, namely, those of the blood? The latter afford contributory evidence, but they do not seem to me to constitute the case in the legal sense. While no one can fail to be impressed by the extreme value and beauty of the line of research, we have still much to learn as to the actual relationship between the opsonic index and the production of immunisation. It may yet be ascertained that the changes registrable in the blood afford a satisfactory index of the progress of other changes essential to immunisation. Meantime I do not feel that, so far as tuberculosis is concerned, this has been attained.

This is especially true of pulmonary tuberculosis, with regard to which there is available evidence, both systemic and local, which appears of greater range and reliability than that offered by opsonic determination. The opinion is not an *à priori* one. It is advanced after careful comparison of results obtained in a large series of cases. In some of these, treatment was regulated by estimate of the systemic and local evidence. In others, it was regulated by determination of the opsonic index. No trouble was spared to make the determination in both sets of cases as exact as possible. Throughout the series I have

not found that the balance was anyways in favour of the latter. It has seemed to me that the opsonic curve may sometimes suggest that the patient is not doing well, while other clinical evidence affords convincing proof to the contrary. Conversely, opsonic readings may appear to indicate satisfactory progress, when on other clinical grounds we have to conclude that the progress is downwards.

I refrain purposely from dwelling on the technical difficulties, inherent to opsonic determination, which meantime place the method outside the usual possibilities of the general practitioner. Such objection, great as it is, would not be sufficient to exclude a method, if proved of incomparable value as a means of scientific treatment.

I have already given expression to a *caveat* in respect of the attempt to conclude an *in absentiâ* diagnosis and prognosis in such a condition as pulmonary tuberculosis, for examination of the expectoration. Need I suggest that the proposal, which is sometimes seriously made, to *treat* a patient who has never been seen on similarly limited evidence is extremely dubious ?

In the use of tuberculin, success will not only depend on the accuracy and experience of the physician, but very largely on the patient's immunisation potential. This varies with the individual and the stage of the process—that is, whether the tuberculous lesion is local merely or systemic. The significance of the classification of pulmonary tuberculosis to which I have already referred is once more illustrated. It may be stated broadly, that in proportion as the disease is localised, and presents little systemic involvement (in other words, in proportion as L is greater than S), the hope of successful treatment by vaccine-therapy is enhanced. Tuberculin has remarkable influence in defining and delimiting tuberculous disease. Its influence is conspicuously conservative.

To take examples, I may cite tuberculosis of glands, bones, and joints. Here the effect of tuberculin is conspicuous. Treatment by tuberculin is advantageously combined with surgical interference. Tuberculosis of skin and mucous membrane is likewise readily cured. Tuberculous enteritis is favourably affected. The results in genito-urinary tuberculosis have been remarkably encouraging. In pulmonary tuberculosis much depends on the stage and character of the lesion. In the majority of early cases the result is satisfactory. In proportion to the advance of disease and the presence of systemic intoxication, the possibility of cure becomes restricted. The reason for this is twofold—on the one hand anatomical, and, on the other, physiological.

Anatomically, the process of arrest in tuberculosis is associated with cicatrisation. If arrest is to be effective and permanent, cicatrisation must be complete. This implies, in the case of pulmonary tuberculosis, corresponding shrinkage of the superficial structures forming the chest wall. In slighter cases the necessary shrinkage of the thoracic wall is readily attained. According as the disintegrative process in the lung extends more widely, with production of vomicæ, the chances of shrinkage of the thoracic wall, proportionate to the requisite contraction and cicatrisation of lung tissue, are progressively lessened. Inevitably there comes a time when intrathoracic disintegration is in excess of possible shrinkage from without. In such a case pulmonary cicatrisation will remain incomplete. It is impossible for the ulcerated surfaces to close.

Such considerations explain why treatment of a patient with slight apical change is comparatively simple and satisfactory, and why, contrariwise, in other cases it may be impossible on purely local grounds to attain an effective cure. Hence, doubtless, in a young subject, whose chest wall gives freely, treatment is commonly more successful than in the adult patient with fixed, rigid thorax. From the same cause, probably, it results that pulmonary tuberculosis in the young child so often heals spontaneously. In this sense there may be traced an analogy between the results obtainable in pulmonary tuberculosis and in empyema. In both conditions the important factor which renders the child's recovery more easy than the adult's is the relatively yielding condition of the thoracic wall.

From the physiological side the limitations to tuberculin may be stated thus: So long as the local process is the main feature—that is, so long as systemic disturbance remains relatively slight—we may anticipate benefit from treatment by tuberculin. On the other hand, with advancing intoxication, there comes a time when the introduction of tuberculin ceases to have value, or when the introduction of tuberculin may do positive harm. Where the system is already soaked with tuberculous toxins, the addition of tuberculin will probably make matters worse. The possibility of activation of leucocytes and bacteriotropic elements no longer exists. The limits of activation have been passed.

While this is so, the curious and interesting observation is sometimes made that, even when recovery seems no longer likely, tuberculin may yet exert important symptomatic influence. Thus I have frequently seen asthmatic manifestations strikingly relieved. The same

thing may occur in relation to cough, and even hæmoptysis. The explanation of this is not quite evident, and cases vary much. It is yet a point of therapeutic value worth remembering.

In much of this we are still groping a way through an intricate maze. If the quest be difficult, the fascination is great and the reward is fair. Amid the perplexities of the road, the worker of to-day holds a thread in his hand which was denied to the generations that have gone. It is significant that this great Association, representative of medicine in the land of Edward Jenner, should have this year constituted a separate section for deliberation in the department of vaccine-therapy. If it seem hazardous to increase the subdivisions of medicine on such occasions, we shall most of us be agreed that it was a happy inspiration which led the Council to make the present experiment, and no less befitting that the trial should be inaugurated under the direction of one who, along with his fellow-workers and pupils, has so conspicuously illuminated the subject.

The Larger Prospect

Time forbids further digression. What of the larger future? May we look forward with confidence to the time when tuberculosis shall cease to be? I think we may. Everything points to its early and final disappearance. This should not be impossible of achievement within a generation or two among the nations which regard the public health as an integral part of civilisation. Is not tuberculosis chiefly the expression of partial, ill-informed civilisation? It was introduced by ignorant, unthinking mankind, and mankind, educated and thinking, can expel it.

We are wont to speak of two factors in reference to infective processes—namely, the soil and the seed. It is a handy enough mode of expression, and its application to tuberculosis seems especially natural. But I should like to insist that, in addition to the soil and the seed, we have to reckon also with the tuberculous *seedling*. The invasion of tuberculosis is a slow process, much slower than is usually conceived Infection by the tubercle bacillus is not the work of a moment. For the most part it is dependent on devitalising influences which have been long at work. Even after infection, Nature's barriers are many. The bacillus does not get it all its own way. Considerable resistance is usually offered. The first line of defence at the lymphatic glands may show excellent fight. As physicians, we cannot be too alive to the call for

help which multiple enlargement of lymph nodes implies. Reverting to the former metaphor, this is the stage when the tuberculous seedling should be recognised. Happily this is possible in a variety of ways.

The realisation of the vast frequency of tuberculosis in childhood is the first step to its timeous recognition. The removal of the tuberculous weed is an easier process at the seedling stage than when it is a grown tree. Let us be jealous of the first buddings. The children of a community must be carefully scanned. This is a matter, as it seems to me, for the general practitioner, and not primarily for the medical inspector of schools. I would fain see parents insisting on the periodic examination of their children at home and the periodic inspection of home conditions. The family doctor should anticipate the school inspector. It is not alone in the home of the poor that the "march-past" of the inmates reveals the presence of tuberculous seedlings.

In the wider sense the principles of anti-tuberculosis warfare are clear enough. The chief difficulty lies in their practical application—especially their engraftment on the older *régime*.

Conceive a city built to-day *de novo* in accordance with physiological and hygienic law. The structure and arrangement of the houses would be a first consideration. The sunless, airless dwelling would be impossible. Every apartment would have the maximum of sunlight. Windows would be framed so as readily to fulfil their other function, namely, to let in air. From infancy the citizen would be trained to regard the dual function of the window as vital to his safety. The nursery would especially be bathed in air and sunlight. The schoolroom would be an object-lesson in hygiene. None would be sanctioned whose ventilation was not in large part associated with the open window. There would be no school without a large playground. In fine weather much of the work would be done outside. Throughout the town wide streets would be the rule. Open spaces would abound. Crowding in dwellings, offices, workrooms, factories, meeting places, would be criminal. The housing of cattle would be similarly regulated. In such a city, soil for tubercle would not exist. Tubercle would be unknown. It need never appear.

The immediate difficulty is, How to engraft these ideas on the older system? How best to reform the cities of an earlier civilisation? How to effect what is needed reasonably soon? Local authorities need to be reminded that they already possess far-reaching powers, and should be urged to make use of these, especially in respect of faulty construction of houses and streets. Dwellings and apartments unfit

for human residence or work must be more freely condemned. Where insufficient powers exist, fresh legislation must be called for. The case for such legislation is clear, and its inspiration will be found in the successful results of sanitary legislation in the past.

What applies to our towns applies no less to country districts. *A priori* it seems unthinkable that tuberculosis should be a frequent visitor in the countryside. And yet it is extremely prevalent. The other day the wife of one of our largest landowners, who is keenly interested in the well-being of the people, asked me how it was that in their lovely county consumption should abound. The answer is, unfortunately, that the same causes are operative there as in towns. I fear, indeed, that it may prove a harder task to control and eradicate tuberculosis in rural districts than in urban centres. It has always been less easy to change faith and practice in outlying districts. But the principles of reformation are the same, and in this instance the countryman has the advantage of greater ease of adjustment to the new life, if only the creed be accepted and its meaning practically grasped.

With the soil rendered unsuitable, I feel less concern about the seed in time to come. On the crop which remains in our present crowded centres, the awakened interest of our people is beginning to tell. The thorough tackling of existing tuberculosis, on the comprehensive lines already referred to, will prove sufficient, if only well-organised anti-tuberculosis schemes be associated with larger preventive measures.

The ravages of tuberculosis constitute a blot on our civilisation. It is time that we inaugurate a policy commensurate with the evil and worthy of the age. It is time that we grasp the larger conception of tuberculosis as not merely the cause of overwhelming mortality and infinite distress, physical and economic, but also a great devitaliser of the race, indirectly responsible for an incalculable amount of other illness. So soon as that is realised, and likewise that the agencies which condition its occurrence are as certainly removable as those which led to typhus, we shall act effectually. What is chiefly needed is the acceptance by the educated intelligence of the nation of the belief that the end is attainable. When that is achieved, the offices of the doctor will be placed on a higher plane. Instead of being asked merely to tinker up diseased frames, he will be recognised as a nurseryman in the Garden of Health. Is it too optimistic to anticipate the day when the physician shall have restored to him his proper *métier* of physical "educator"—in the largest sense—and guardian of the National Health?

THE PUBLIC ASPECTS OF THE PREVENTION OF CONSUMPTION

Inaugural Address to the Edinburgh Sanitary Society

Twenty-five years have well-nigh passed since the essential cause of consumption was definitely determined and announced to the world. Of the scientific fact there can be no manner of doubt. This is admitted on every side. Yet, this evening, the question forces itself urgently, what practical benefit has accrued therefrom to the communities of men? Have *communities* enjoyed the fruits to which they are entitled from Koch's great, epoch-making discovery.

In answering the latter question decidedly in the negative, it is admitted freely that certain natural causes have contributed to the result. In 1881 the world was hardly prepared for the swift intimation that consumption, whose nature seemed popularly known, and whose causation was regarded as ascertained, had been thoroughly misunderstood, and that, in place of depending on a variety of ill-defined causes, was due to a specific micro-organism recognised then for the first time.

The existing generation of medical authorities looked askance at the novel doctrine, and, in many instances, offered determined opposition. As the older generation has receded, and the younger has advanced, a change of thought—in some quarters a remarkable change of thought — has been effected. Through the labours of individual workers in different lands there has occurred a great determination of attention on more scientific lines. Especially is this true so far as the pathology of the disease is concerned. The change which has come over the pathological conception during a quarter of a century is immense. The comparison of any treatise on consumption of thirty years ago with the present-day treatises on the same subject reveals an extraordinary advance.

And no less on the therapeutic side have great strides been made. Striking alterations have been effected in relation to the curative treatment of the individual. The consumptive patient nowadays occupies a platform of hopefulness previously but little dreamt of. His horizon to-day is brighter with promise than ever it has been.

But the more public aspect of the question calls for much to be

done. Happily throughout the world there begin to emerge indications of awakening to the rightful claims of *communities* in this respect. The adoption of preventive measures against tuberculosis on a more or less extensive scale has been proposed in most parts of the civilised world. To some extent these have been carried out. But *if communities, as communities, are to benefit practically by the discovery of the tubercle bacillus to the extent which the discovery warrants, there is clamant need for a vastly wider organisation and co-ordination of measures than has yet been realised.*

In proceeding to elaborate this thesis, I desire it to be clearly understood that the significance of general sanitary measures in relation to the limitation and prevention of tuberculosis is not underestimated by me, far less forgotten. The importance of these can hardly be over-estimated in relation to the entire group of infectious diseases—a group to which we now relegate consumption. The earnest thinker and worker in the sphere of tuberculosis will be the first to admit that those great principles which have rescued the world from incursions of infectious disease, through overcrowding and ignorance, are applicable in the fullest sense to the solution of the tuberculosis problem. It is freely admitted that, with the development of wiser and wider sanitary measures, the incidence of and mortality from tuberculosis have remarkably lessened.

Notwithstanding, it remains true that an enormous proportion of the human race is still affected by, and a still greater number remains unnecessarily exposed to, tuberculosis. There is great reason to doubt whether the frequency of tuberculosis is even distantly guessed. The usually accepted statement that from one-seventh to one-tenth of the race die from tuberculosis—grave as it is—does not exhaust the truth. The records of post-mortem examinations show that at least one-third, and probably one-half, of all persons dying bear traces of tuberculosis in one shape or another. The experience of our hospitals and dispensaries emphasises the view that the statistics of mortality from tuberculosis insufficiently suggest the great frequency of its incidence. Through the system of domiciliary visitation, instituted by me many years ago in connection with the Royal Victoria Dispensary for Consumption in this city, I have had occasion to realise the appalling frequency with which several members of the same household in the contracted dwellings of the poor are simultaneously affected by tuberculosis. There is abundant reason for the statement that there are in every great centre crowds of infected dwellings—veritable nests of tuber-

culosis—entrance into which, or at least residence for any time in which, is necessarily accompanied with the greatest risk.

In a previous paper[1] on this subject, I made a calculation that the ascertained mortality from consumption in any city might be safely multiplied by ten, in order to represent approximately the number of persons living, *already seriously affected.* Fuller investigation into the subject has convinced me that this figure is, as, indeed, I hinted it probably was, much within the mark. I am satisfied that twice the figure is still short of the mark. Taking then, for example, the city of Edinburgh, whose mortality from consumption is approximately 400 per annum, we may assume that, within the area of the city, more than 8000 persons are already seriously affected by the disease. And it is to be kept in view that this figure applies to involvement of the lungs only, and is exclusive of tuberculous affections of other organs.

What, then, should be the attitude of the citizen to the question? He is entitled to assume that the etiological relationships of the tubercle bacillus to consumption have been completely established. He is entitled to demand, as a member of the community, in the interests of the community, that information should be obtained as to the actual extent of the disease in the community. He is entitled to inquire what special measures have been taken by the authorities for dealing directly with the tubercle bacillus as an existing cause of disease. He is bound in self-interest to weigh intelligently the sufficiency of these, with the help of such expert advice as may be attainable. In so far as they appear insufficient, he is entitled to insist on their amendment or their completion.

As I have had occasion to point out elsewhere,[2] "most existing movements against tuberculosis fail in attaining all they might, because they are too partial. In many centres throughout the world anti-tuberculosis societies have been founded. The intentions of these have been good, but in practice less has been effected than is to be desired, from insufficiency in the plan of operations. Excellent as much of the work has been, there is too generally lacking the element of efficient organisation.

"Through the agency of such societies there has been disseminated a

[1] "The Organisation of the Home-Treatment of Pulmonary Tuberculosis," *British Medical Journal*, 11th June 1904.

[2] "The Erection of Municipal Dispensaries and a Completer Organisation against Tuberculosis"; "Tuberculosis," January 1906, reprinted by Local Government Board for Scotland, and appended to their Circular (Public Health, No. 1, 1906); "Administrative Control of Pulmonary Phthisis."

large amount of serviceable information regarding the nature and prevention of the disease, and public interest in the subject has been aroused. Under the *ægis* of such societies, or other charitable or public bodies, provision has been made for the treatment of a certain number of cases of tuberculosis. Sanatoriums have been founded in many places for the curative treatment of more hopeful cases, and hospitals or asylums have been established for the reception of patients in more advanced stages of the disease. Some communities have favoured attacking the early cases, and aimed specially at the cure, or at least the relief, of the individual; while others have attacked specially the later cases, with a view to preventive treatment.

"In not a few instances the conception of founding sanatoriums has bulked too largely in anti-tuberculosis movements. The public have been led to expect too much from sanatorium *régime*, in respect both of individual cures and of the extinction of the disease. As the results of sanatorium treatment accumulate, and as these are found less uniformly good than the hopefulness of the over-sanguine had expected there begins to be manifested a feeling of disappointment and almost of annoyance. Already the question is being freely asked, 'Are sanatoriums worth while?'

"It is not my purpose on the present occasion to refute the view that sanatorium treatment is a failure. To anyone familiar with the facts this will appear needless. The sanatorium constitutes an important division of the work. But the problem of the extermination of tuberculosis is too vast to be solved in so simple a fashion. The outlook of the sanatorium is towards the recovery of a certain proportion of early cases. But the number of cases ultimately cured by sanatorium treatment is small in proportion to the major issue, namely, the suppression of the disease.

"Tuberculosis is a disease of infectious nature, and as such must be treated on the same broad principles on which we treat other infections. While this is true, there are many difficulties of a practical nature. Although of infectious nature, tuberculosis is a peculiar disease—peculiar in respect of its mode of dissemination and the conditions of environment on which this depend, peculiar in the variety of its manifestations, and peculiar because of its commonly prolonged course. On these grounds the plan of combating tuberculosis cannot be modelled entirely on those which have been found serviceable in the treatment of other fevers."

The solution of so vast and far-reaching a social problem can only

be hoped for by means of a most carefully organised and co-ordinated plan of action. Much will be gained by uniformity of plan throughout the country, and, so far as possible, throughout the world. Such a scheme of organised and co-ordinated operations against tuberculosis must, in my opinion, include, for all our larger centres, the following factors, to which I desire severally to direct your attention:—

I. Notification of the disease.
II. A tuberculosis dispensary.
III. A hospital for dying patients.
IV. A sanatorium or sanatoriums for selected patients with a view to cure the disease.
V. Colonies for the residence and guidance of patients in whom the disease is latent, or has been arrested, and from whom carefully selected and supervised employment is desirable.

I. Notification of the Disease

Since my earliest intimate associations with the subject, I have been convinced of the necessity for, and the advantages which must follow from, the adoption of compulsory notification. It is to-night almost exactly sixteen years ago since, on the invitation of the Edinburgh Health Society, I delivered a lecture on the subject of consumption. On referring to the published volume, in view of the present occasion, I find that I expressed myself as follows:—"So far as infectious conditions are concerned, as you know—thanks to the foresight and untiring energy of our veteran medical officer of health—we live in peculiarly happy circumstances. All cases of infectious disease which occur within the city must now be reported and recorded at the city's expense; and the result is that within a very short time after the outbreak of an epidemic, it is known exactly at headquarters how the disease is distributed, and special measures of investigation or treatment can be instituted. Again, it is similarly known if the epidemic continues longer in any certain districts than in others, and an explanation may then be suggested. To-night I should press strongly for *the inclusion of consumptive cases in such compulsory returns.* Nothing but good can, in my opinion, result from this extension of a most valuable method. Were it adopted, we should soon have most valuable confirmation—or, let us suppose, the opposite, although I do not think this latter likely—of the statements which have been made regarding the communicability of consumption, and the tendency to its occurrence in certain houses and districts.

Edinburgh will make a big move—and a move, I make bold to say, in which she will be speedily followed by many—if her medical officer of health will stimulate the authorities to this further development."

This view, as expressed in 1890, has continued unchanged. It has remained my fixed conviction that compulsory notification affords the only sound and ultimate solution of the consumption problem.

All the difficulties which, so far as I am aware, have from time to time been suggested in relation to the practical carrying out of notification, were all similarly advanced in connection with the proposed notification of other infectious diseases, and indeed in relation to other State and municipal procedure. Such difficulties were promised in relation to the income-tax schedule and other Government inquiries. Experience has shown that these difficulties rapidly melt away in practice. At the worst, they are insignificant, in the present issue, when compared with the vastness and gravity of the evil to be combated.

Until recently the real practical difficulty in the way of compulsory notification has been the attitude adopted by the Local Government Boards, both in England and Scotland. In the case of England, that attitude remains one of reserve, partly, no doubt, because of the lack of unanimity among medical authorities in the south. The Local Government Board for Scotland has recently, in its circular of 10th March of the present year, thrown aside its earlier reserve and voiced the view that a system of notification promises the solution of many of the difficulties of the tuberculosis problem.

The circular, which I would commend to your careful perusal, boldly pronounces that pulmonary phthisis is an infectious disease within the meaning of the Public Health (Scotland) Act, 1897. As a consequence of this, the sections of the Public Health Act, applicable to other infectious diseases, are applicable to pulmonary phthisis. The circular indicates that a system of notification is necessary if the Public Health Act is to be applied effectively to pulmonary tuberculosis. It sanctions the addition by the Local Authority, with the approval of the Board, of pulmonary phthisis to the list of diseases notifiable under the Infectious Diseases Act, 1889. It announces the readiness of the Board to give favourable consideration to applications from local authorities for such inclusion of pulmonary phthisis, insisting, however, that the local authority should first put itself in a position to deal sufficiently with cases after notification.

It thus appears that there is no need—as was at one time suggested—for fresh legislation, but that the Local Government Boards are possessed of sufficient powers to sanction and recommend compulsory notification. The chief cause for delay, in Scotland at least, has been the need for assurance that local authorities were able financially and otherwise to take such effective action after notification as the facts should justify.

Compulsory notification of consumption is not an untried conception. It has been introduced and carried out with much success in Norway and the United States—New York in particular. I have the direct personal assurance of Dr. Hanssen, the leading authority on tuberculosis in Norway, who was largely instrumental in carrying through the system of notification, that the plan has been carried out there for some years without the slightest hitch.

The experience in New York is similarly of a most reassuring character. In 1893, among other measures taken for prevention of consumption, notification "was *required* of cases of consumption in all public institutions, and notification was *requested voluntarily* from doctors, of cases occurring in their private practice." In 1894 there were notified 4166 cases; in 1895, 5618; and in 1896, 8334. This striking increase in the figures notified, even under a voluntary system, affords a strong proof that no hitch is likely to occur. Not only so, but so satisfactorily did the matter work out that in 1897 the Health Board of New York declared pulmonary tuberculosis to be "an infectious and communicable disease," and *required* "notification of all cases of consumption occurring in the city." Let it be kept in view that that declaration and enactment were made nine years ago. I have excellent authority for saying that since then compulsory notification has been carried out smoothly and efficiently.

In the United Kingdom opinion is gradually ripening. Several towns in England have during the past few years adopted a system of voluntary notification. Manchester was especially early in the field, and a most complete and effective system of voluntary notification has been established. Similar methods have been instituted in Brighton, Leeds, Bradford, and Liverpool. Finally, Sheffield, which for several years had had experience of voluntary notification, obtained powers in the Sheffield Corporation Act, 1903, to introduce compulsory notification. Notification was finally declared compulsory two years ago.

In Scotland, the first attempt at notification was made in Edinburgh, where a system of voluntary notification was instituted in 1903. The

system, for one reason or another, seems to have been carried out with less completeness than in some other centres. Notifications were made, apparently, with a certain amount of hesitancy. So far as I can make out, from inquiry among medical men, this was less from unwillingness than from uncertainty as to what was really proposed. No great encouragement was extended to practitioners to co-operate in notification. In spite of this lack, I may mention, as showing the significance of the method, that no fewer than 855 notifications were made from 1903-1905 to the city authorities by the Royal Victoria Dispensary. The notifications were attested by bacteriological examination at the dispensary and the determination of the tubercle bacillus.

Since the publication of the circular by the Local Government Board (March 1906), there are not wanting signs that compulsory notification will speedily be adopted throughout Scotland. Edinburgh has already faced the question, and almost carried compulsory notification.[1] Glasgow seems on the eve of achieving the same result. Several of the smaller burghs have either obtained or requested the sanction of the Local Government Board to the same end.

Looking further afield, the International Congress on Tuberculosis, held at Paris in October 1905, with representatives from all the civilised countries, whose outlook on the question was correspondingly very various, adopted unanimously the following conclusion :—"That it is desirable that it should be the general practice to notify all cases of advanced tuberculosis."[2]

After Notification, What Then?—Two mistaken conceptions are current as to what is implied in notification. On the one hand, there are those who suppose that notification implies the removal of every notified person to some institution — the segregation of all cases of pulmonary tuberculosis in the same way as segregation is practised in relation to the acute fevers. It is assumed that, unless sufficient hospital accommodation is available, there can be no significance in notification, and the expense incurred in a system of

[1] Compulsory Notification of Consumption finally came into operation in Edinburgh on 1st March 1907. It was adopted in Glasgow on 1st January 1910, for a period of three years. It is now in force over a considerable area of Scotland. Approximately 50 per cent. of the population are included under the measure.

[2] At the Sixth International Congress on Tuberculosis, held in Washington, 1908, it was resolved, "That the attention of State and central governments be called to the importance of proper laws for the obligatory notification, by medical attendants, to the proper health authorities, of all cases of tuberculosis coming to their notice, and for the registration of such cases, in order to enable the health authorities to put in operation adequate measures for the prevention of the disease."

notification is therefore unwarranted. On the other hand, there are those who seem to suppose that notification itself is somehow to effect the extermination of the disease.

I fear that in neither of these views is sufficient account taken of the far-reaching ramifications of tuberculosis. In some instances notification need be followed by no special measures. In some the removal of the patient to a suitable hospital will be sufficient. In many instances notification of a case of consumption is tantamount to the discovery of a whole nest of disease. As I have indicated, my experience in Edinburgh is that very generally several cases of consumption are found in the same household—some of them not previously dreamt of—and the house itself is probably infected. In such cases, then, notification will raise a vast number of questions as to the suitable disposal of the varying elements at this focus of infection. The several elements will require different lines of action. This naturally leads us to a consideration of

II. The Tuberculosis Dispensary

The dispensary as a factor in the campaign against tuberculosis is no longer on its trial. In any complete organisation against tuberculosis the dispensary will be found to play a most important part. This has been my belief for many years. It was this that led to the foundation by me in 1887 of the Victoria Dispensary for Consumption in Edinburgh.

The practical value of what was then an *à priori* conception has been firmly established during the development of details. Increasing familiarity with the idea has led recently to a widespread recognition of the significance of the dispensary. The rapid, and apparently independent, erection within the past six years of similar institutions in Belgium, France, and Germany affords remarkable testimony to their value. The recent International Congresses at Paris and The Hague have voiced a unanimous opinion regarding their extreme utility.

The object I had in view in proposing the establishment of a dispensary for tuberculosis was the formation of a central institution to which persons of the poorer classes affected by tuberculosis should be invited or directed. It seemed thereby that access would be readily obtained to existing foci of disease, not merely in affected individuals under examination, but also in other members of the same household, and in affected dwellings.

The programme of the Victoria Dispensary was as follows :—

1. The reception and examination of patients at the dispensary, the keeping a record of every case, with an account of the patient's illness, history, surroundings and present condition, the record being added to on each subsequent visit.

2. The bacteriological examination of expectoration and other discharges.

3. The instruction of patients how to treat themselves, and how to prevent or minimise the risk of infection to others.

4. The dispensing of necessary medicines, sputum bottles, disinfectants, and, where the patient's condition seemed to warrant it, foodstuffs and the like.

5. The visitation of patients at their own homes by (1) a qualified medical man, and (2) a specially trained nurse, for the double purpose of treatment and of investigation into the state of the dwelling and general conditions of life and the risk of infection to others.

6. The selection of more likely patients for hospital treatment, either of early cases for sanatoriums or of late cases for incurable homes, and the supervision, when necessary, of patients after disease from hospital.

7. The guidance, generally, of tuberculous patients and their friends, and for inquiries from all interested persons on every question concerning tuberculosis.

Premises and Staff.—The Victoria Dispensary, as at present arranged, contains—

Two consulting rooms,
A laryngoscopic room,
One large waiting room,
Two dressing rooms (male and female),
A general office where names are entered,
A laboratory for bacteriological examinations,
A drug and food store.

The dispensary is open thrice weekly for three or four hours.

The staff consists of—

1. Four qualified physicians,[1] who attend when the dispensary is open for the purpose of examining and instructing patients. Three of the physicians are honorary.

2. One of the medical officers[1] receives a salary of £60 a year, and

[1] Since the date of lecture the staff has been further increased. It consists now of six qualified physicians, two of whom are honorary and four are salaried.

devotes a large amount of time to the work. In addition to examining patients at the institution, along with the honorary physicians, he pays domiciliary visits to the dwellings of patients, in co-operation with the trained nurse. He makes bacteriological examinations of expectoration and other suspect discharges. By arrangement with the city authorities, he notifies all cases of tuberculosis which he meets. He advises regarding the disinfection of houses during illness and after the removal or death of the patient. He supervises treatment of patients at their own home when this is desirable. He selects suitable patients for the sanatorium. In co-operation with the city authorities, he drafts the more advanced or dying patients to a hospital now dedicated to such cases in the neighbourhood of the city.

3. A nurse who has been carefully trained in modern open-air methods at the Royal Victoria Hospital for Consumption, Edinburgh—the sanatorium in connection with the dispensary—visits the homes of the patients. She readily wins their confidence by her interest in their welfare. She instructs the patients, or their friends (wives, mothers, etc.), both as to treatment and prevention. In co-operation with the visiting physician, she reports regarding the patients' residences and other conditions according to the annexed Schedule of Inquiry. The reports, when completed, are vouched for by the signature of both doctor and nurse.

Schedule of Inquiry regarding Dispensary Patients

No. in Ledger..... *Date of Report*.....

Name — Age
Address — Married or single?
Occupation — Has patient changed occupation?
Able to work full time? — Or part time?
If unable, confined to bed?
How long ill?
Situation of house (area, ground floor, 1st, etc.)?
Number and ages of inmates?
Number and description of rooms?
General aspect of house (clean, damp, dusty, smelly)?
Number of windows? — Can they open?
Are they kept open (*a*) by day?
(*b*) by night?
Have they always been kept open?
Does patient sleep alone (*a*) in bed?
(*b*) in room?
How is washing of clothes done?

How long in present house?
If has moved within two years, previous addresses
Have there been illnesses or deaths in house?
(*a*) In own time?
(*b*) In previous occupancy?
Exposed to Infection (*a*) at home?
(*b*) at work?
(*c*) among friends?
Present health of other members of household?
What precaution taken to disinfect?
T. B. in sputum?
T. B. in dust of room?
General dietary? Teetotal?
General condition (well-to-do, badly off)?
Proximate income of household?
Assisted by societies, church, friends, rates?

Signed.....*Reporter.*
.....*Medical Officer.*

4. A volunteer Samaritan Committee of ladies, in conference with the doctors, takes charge of more distressing cases, where, through prolonged illness, the financial conditions have been much reduced. In many cases they visit the patients' houses. With the assistance of the numerous charitable and parochial organisations which exist in the city, they are enabled to adapt the relief necessary to the particular case. The members of the Samaritan Committee further occupy themselves with the question of suitable employment for tuberculous persons fit for some effort, although unable to work an entire day. In some cases they arrange likewise for persons who have been discharged from the sanatorium. Attention is also paid to the case of school children affected with the disease, so as to have their education supervised on more physiological lines. The operations of the committee are regulated at fortnightly meetings, and a minute of the business is kept.

5. An officer—a working man, who gives his entire time to the dispensary—lives on the premises. This man receives and enters the names of the patients on the afternoons when the dispensary is open. When the dispensary is not formally open he attends to requests from patients or other persons. The officer is conversant with the home and work conditions of many of the patients, and is a valuable lieutenant both to the doctors and nurse.

Results of Dispensary Operations.—The organisation of the dispensary is thorough. Each part of the system is closely related to the rest, so that a large amount of work is expeditiously and inexpensively over-

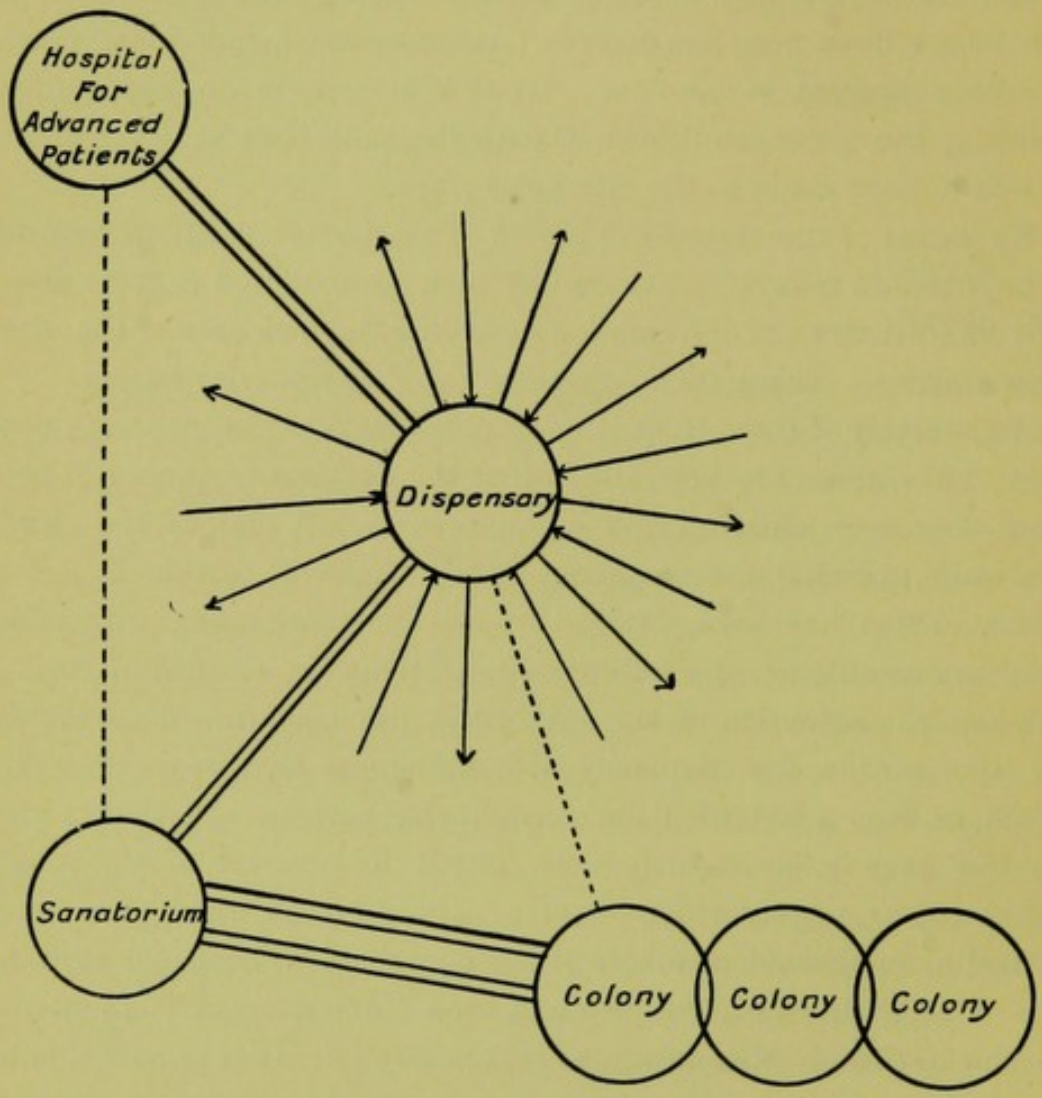
taken. From first to last we have found no difficulty whatsoever in relation to the nurse's house-to-house visits. On the contrary, these have been most gladly welcomed by all types of patients, and her inquiries willingly answered. There can be no doubt that the system of domiciliary visitation by a specially trained nurse, in co-operation with the doctor, has been a sanitary agent of great importance to the city.

The dispensary's programme has been successfully carried out by the staff during the past nineteen years. During each year some 17,000 attendances have been registered. As many as 87 individual patients have been received in one day. About 1000 reports are made annually regarding the home conditions of patients, and about as many notifications have been made to the city authorities.

By means of the systematic record of the home conditions, according to the schedule referred to, there has been accumulated a great mass of valuable statistics and information regarding the incidence of the disease in the district. These are continually added to from day to day.

An analysis of these records has yielded facts of the greatest importance. Thus, there has been illustrated the extreme frequency of tuberculous disease in children and in housewives. A map of the city has been made, showing the frequency of the disease in certain houses and streets. Proof has been obtained of its occurrence along with various insanitary conditions of dwellings (insufficient air, absence of sunlight, etc.), and the attention of the authorities has been drawn to the fact. The reports show the frequency with which one or more persons share a room, or even a bed with the consumptive patient. Particular attention has been paid to such cases, either by removal of the affected patient (*a*) to a sanatorium, or (*b*) to a hospital for dying cases, or by removal of unaffected members of the household to healthier surroundings. One of the doctor's duties in such circumstances is to examine into the health of other members of the family. It is remarkable how frequently two, three, or even more persons, not previously suspected, have thus been shown to be tuberculous. Another important point has emerged, viz., the frequency with which the tuberculous patient, from one cause or another—often from financial reasons—changes his house. By this means infected areas become quickly multiplied. The records also show the absence—apart from the interference of the dispensary—of precautions with a view to disinfection. Now, happily, by arrangement with the city authorities, the dwellings of such patients are disinfected at the city's expense.

It has been sometimes maintained that such a dispensary is impracticable, as running counter to the interests of, and therefore likely to be opposed by, the medical practitioners of the place. This has not been the experience of the Victoria Dispensary. From the first, a large number of doctors co-operated cordially with the promoters of the movement. Now that the aims of the institution are thoroughly understood, the great body of the profession avail themselves freely of its resources. A large proportion of the patients received at the



institution are sent by medical practitioners either for diagnosis, in doubtful cases, or for treatment and other guidance. The Royal Infirmary and other hospitals throughout the city work similarly in harmony.

It should be clearly understood that a dispensary such as this is a much more elaborate institution than exists in relation to the out-patient departments of consumption or other hospitals. The latter, doubtless, do excellent work, so far as their resources allow. Their

effort is, however, primarily directed towards the treatment of the individual patient, and little attention is extended to the wider aspect of the tuberculosis problem.

The Dispensary Ideal.—The tuberculosis dispensary should be, for every city or district, the uniting point of all other agencies. It should not be an isolated institution, but form an integral part, indeed *the centre, of a great network of operations.* To the dispensary, tuberculous patients of the poorer classes, and patients with chronic colds or persistent ill-health, should be invited. Tuberculous patients presenting themselves at infirmaries, hospitals, and other charitable institutions, should be directed to the tuberculosis dispensary. Employers of labour and heads of public works should be apprised of the existence of the dispensary, so that invalid employees may be directed thither. The public should be made aware that the dispensary is prepared to answer all inquiries regarding tuberculosis, and to advise, in a given case, what is best to be done. The dispensary should constitute a centre for the dissemination, in the widest fashion, of information regarding prevention and treatment.

You may obtain a clearer notion of my conception of the dispensary if you will glance at the above diagrammatic scheme. It illustrates the position of the dispensary as the centre towards which patients and other inquirers regarding tuberculous matters are directed, and from which advice and other information are distributed. The double lines indicate the connection which should exist between the dispensary and the other elements in the organisation—on the one hand, the hospital for advanced cases; and on the other, the sanatorium for early cases Other points illustrated by the sketch will appear as we proceed.

Every step in the gradual development of the Edinburgh scheme has strengthened my belief in the efficacy of the tuberculosis dispensary as *a base for further operations.* In this belief, I recommend to every considerable community the establishment of such an institution, which will serve at once as *a developmental centre and uniting point of other agencies.*

It seems to me, indeed, difficult to over-estimate the value of the dispensary as an instrument of preventive medicine — whether as a *bureau* for receipt and distribution of information and assistance, or as a *clearing-house* in respect of the vast amount of tuberculous material with which every community will find itself called upon to deal.

III. Hospital for Advanced or Dying Patients

There can be no manner of doubt that the far-advanced or dying cases constitute the greatest source of infection. This is most especially true in the case of those affected by the disease resident in the contracted dwellings of the poor, where perhaps an entire family shares a room with the consumptive patient. All such patients require immediate removal to a hospital reserved for advanced and dying cases of consumption.

Take, as an example of this sort of thing, two cases from the dispensary list:—

1. E. F., a married woman, aged thirty-five, visited the dispensary, and was found to be so ill that she was immediately ordered home to bed. The dispensary medical officer visited her, and determined the presence of very advanced disease. As no hospital accommodation then existed for such cases, he continued attendance for months, till her death. His report is that he never visited such a filthy, desolate house. It consisted of one room, in which resided the patient, her husband, and child. The patient was bedridden for many weeks. Beside the bed stood a pail, into which the poor creature made feeble attempts to expectorate. The expectoration was visible all over the bedclothes, the floor, and the wall. Till the visit of the Victoria Dispensary medical officer, followed by that of one of our trained nurses, there was no attempt at nursing or proper feeding, still less of disinfection. Suitable nursing and strict measures of disinfection were then instituted, both during the patient's life and after death.

2. W. B., aged twenty, presented himself at the dispensary suffering from advanced consumption. His case was similarly undertaken by the dispensary medical officer. He lived in a sunk flat, in a room where his father had died of consumption just twelve months before. The room was large and clean, but sunlight never reached it. Ventilation was defective in the extreme. His mother supported herself and three more of a family by going out, from this insanitary home, to wash and assist in other people's houses. Treatment, disinfection, and other measures of prevention were dealt with by the dispensary medical officer.

Such cases might be multiplied indefinitely from the records of the dispensary.

It was with a view to the reception of such advanced patients, whose

surroundings and hygienic conditions are prejudicial, not only to themselves, but to all who are brought into close contact with them, that in the health lecture referred to (1890), I proposed that a portion of our city hospital should be devoted to the reception of dying cases of consumption:—"With a view of preventing the spread of phthisis among the very poor, for the community's sake, I should have *a portion of our city hospital—in lieu of any better institution elsewhere—devoted to the reception of dying cases of phthisis,* whose surroundings and hygienic conditions are not only fatal to themselves, but, in my judgment, eminently prejudicial to all those who are brought into the close contact with them which the life of a family in one or two rooms involves. Such cases cannot, of course, in any number be received into the Royal Infirmary, nor is it desirable that they should. But I desire to-night to rouse the citizens to the responsibility they assume in permitting such chronic sources of infection to smoulder in their midst under conditions which are undoubtedly most calculated to lead to fatal propagation."

More recently I was frequently consulted regarding this and other aspects of the question by the late Mr. Pollard, the then convener of the Public Health Committee, whose keen, far-reaching interest in this matter is worthy of fresh record. His desire to have the matter viewed from most varying standpoints resulted in a conference within the City Chambers on 9th February 1899, between a sub-committee of the Public Health Committee, representing the Town Council, and representatives of the Medical Faculty of the University of Edinburgh, the Royal College of Physicians, the Royal College of Surgeons, and the Veterinary Colleges.

The outcome of all this was the proposal—contained in a careful and elaborate report by Mr. Pollard, dated 23rd July 1900—to the effect that 100 beds in the old City Hospital should be utilised for the purpose. This proposal, after what has appeared—may I say, with all respect?—rather unnecessary delay, has finally come to fruition in the arrangement happily achieved by Convener Gibson for the reception of 50 cases[1] of advanced consumption at the New City Hospital, Colinton Mains, an arrangement which, I understand, is working well.

At no distant date I anticipate we shall have hospitals for advanced consumption as generally distributed throughout the country as are hospitals for the more acute infectious diseases.

The Local Government Board for Scotland has, in the circular already

[1] Now increased to 62.

referred to, indicated most plainly that "the isolation of such dangerous cases is a primary duty of the local authority."

With reference to hospitals for advanced cases, it should be strictly kept in view that *patients must*, in the ordinary course, *continue in the hospital until the end.* The end may, and in many cases certainly will, be long delayed. If the hospital is to fulfil its mission, from the sanitary and economic standpoint, patients once admitted must not be discharged, save for quite exceptional reasons. To make the patient a little better and then discharge him from further treatment is almost completely to negative the purpose for which the hospital was instituted.

IV. Sanatoriums for Selected Persons with a View to Cure

While isolation for advanced cases is desirable from the point of view of prevention, the sanatorium is concerned chiefly with the effective arrest of the disease, and the education of the public how to treat and prevent it.

The great aim of sanatorium treatment is to get the patient at a sufficiently early stage, and, by means of open-air treatment, proper dietary, and a carefully conceived regimen, to assist Nature in her attempt to resist invasion by the tubercle bacillus. The purpose is to increase vital resistance, and thus establish more or less immunity to the disease. As the discovery of more specific methods of treatment proceeds these will naturally be utilised.

The essential of the present-day sanatorium idea is the free exposure of the patient to open air. He must be bathed in fresh, pure air day and night, and this irrespective of the goodness or badness of the weather, as popularly understood. The more sunshine, or at least sunlight, the better for the patient. The two conditions which the tubercle bacillus cannot withstand are fresh air and sunlight. If the patient will only be out of doors, lying, sitting, walking, or working, according to the nature of the case, a large part of each day, and when indoors will allow the freest access of fresh air day and night, satisfactory results may be obtained almost anywhere.

Sanatoriums should be founded in *immediate* relationship to the large centres. I desire to insist on this point with much emphasis. It is of the first importance to the hopeful tackling of the question, in the widest sense, that patients and the public should get rid of the prevalent, but most erroneous, belief that a cure can only be effected

and health maintained under conditions which their ordinary residence and station in life will not permit them to enjoy.

It has been demonstrated in the most conclusive way—and in this matter the experience of the Royal Victoria Hospital for Consumption at Edinburgh has been most freely cited in evidence—that, just as consumption occurs in all countries where the disease has obtained a footing, "it can be treated in all climates with approximately equal success, or want of success, according as the larger indications for treatment are fulfilled or overlooked."[1]

It is consequently evident, and emphatically advantageous, that the sanatorium or hospital for curative treatment should be reasonably *near the town chiefly interested.*

Results of Sanatorium Treatment.—The results of sanatorium treatment are highly encouraging, notwithstanding statements made from time to time to a contrary effect. Under sound sanatorium treatment the lives of thousands have already been saved. Hundreds have, to my knowledge, been rendered fit to return to ordinary work, or, without complete recovery, have been able to resume work of a less exacting nature. If treatment be undertaken reasonably early, it is the exception to find a patient who does not progress persistently so long as treatment is maintained. In many instances results are obtained which can only be described as marvellous.

If the results are not so uniformly good as might be desired, the sum total of complete or economic cures is still very great. The results would be much better if there were a more complete understanding as to what constitutes an early and suitable case. In too many instances sanatoriums are overloaded with advanced and even dying cases, which ought to be dealt with in the special hospitals already referred to (p. 442).

From the educational point of view, both as regards patients and the community, that sanatorium plays a highly important part. Patients learn how to treat themselves, and they leave the hospital apostles of the true faith, which thus gradually spreads throughout the land.

The immense economic value of working men's sanatoriums is best illustrated by facts relative to the system of compulsory insurance against sickness in Germany. Since the year 1897 such insurance societies have, in self-interest, maintained no fewer than 101,806 tuberculous patients at special establishments for a period amounting

[1] "On the Universal Applicability of the Open-Air Treatment of Pulmonary Tuberculosis."—*British Medical Journal*, 23rd July 1898.

to 7,687,805 days at a cost of about £2,000,000 sterling. The insurance companies have spent £10,550,000 sterling in building sanatoriums. The percentage of patients who, five years after treatment, were still able to work, and did not require any allowance from their insurance fund, amounted to 27, 31, 32, and 31 for the years 1897, 1898, 1899, and 1900 respectively.

Sanatorium Buildings.—As to sanatorium buildings, these need not —and should not—be expensive. As the result of prolonged experiment and thought on this matter, I am satisfied that the separate one-storeyed pavilion is the best type of building for the purpose. The Royal Victoria Hospital for Consumption, Edinburgh, was designed by Messrs. Sydney Mitchell & Wilson, Edinburgh, to meet my views in the matter. After trial of those portions of the building which have been in existence for some years, I can most confidently recommend it as answering every purpose of a sanatorium perfectly.

Each pavilion is of winged form, the obtuse retreating angle being oriented, so as to face south-south-east. Each of the two wings constitutes a ward. The three outside walls of the wings consist largely of windows. Thus there is secured a maximum of air and sunlight. The pavilion is entered from behind. From the entrance passage a short projection northwards contains bathroom and lavatory accommodation. The intervening triangle between the wards and back passage serves as a nurses' room, where simple cooking or other special service may be arranged in the case of patients confined to bed. Opening off the passage also are two dressing-rooms for patients' clothes. No luggage or extra clothing is allowed in the wards proper.

Internally, the wards conform in all respects to those of a modern isolation hospital as regards smooth surfaces, absence of angles, and unnecessary furniture. There are no steam or hot-water pipes in the pavilions. An open fire is provided. This is less for heating purposes than for the sake of a cheerful appearance and ventilation. There is no attempt made to keep the ward temperature at any fixed point. It is deliberately allowed to approximate to that of the outer air. Lighting is by electricity. The windows are of French form, opening outwards, with swinging fanlights above. These are kept open to the fullest, constantly, both day and night. Thus the patient when indoors is practically as if he were in the open air. The cubic space per bed has been kept about 1200 cubic feet. In view of the entirely free access of air, that amount might be lessened. About 100 square feet of floor area are allowed per bed. As each patient commonly has a bath

daily, the number of bathrooms is considerable, one bath being provided for every four patients.

The adjacent pavilions are some 40 feet apart. Each pavilion contains accommodation for eight to twelve patients. The pavilion is raised on pillars some 3 feet above the ground, so that air may circulate freely beneath. The building material is of brick. Verandahs and balconies have been avoided, as tending to interfere with the entrance of sunshine and passage of free air throughout the building. The winged form of building is serviceable, as its sides afford shelter to weakly patients who may be allowed to lie out in front. Hinged screens may be attached to the end of the buildings, so as to afford further shelter.

In addition to the pavilion proper, open shelters are distributed in large numbers throughout the grounds. These are occupied by the patients most of the day, and many of them are similarly occupied by night. In a public sanatorium stationary shelters are, on the whole, advisable, distributed round the periphery of the park, so that they can be more or less governed from a central point. Such shelters should be shallow—only of sufficient depth to accommodate the width of a bed —say 3-4 feet. The roof should slope from behind, forwards and upwards, to prevent accumulation of stagnant air. In addition, the roof should be provided with skylight or ventilator. The roof and sides should be largely of glass. The shelters are entirely open in front. During wet and more stormy weather waterproof screens, which are readily attachable, afford sufficient shelter.

The sanatorium should be provided with sufficiently extensive private grounds, so that walking and other exercises, including games and work, may be enjoyed with comfort. The planting of trees is advisable, to break the force of the wind, to aid in drying the soil, and to serve as dust catchers.

In addition to the patients who reside for longer periods in the sanatorium—that is, until an effective cure has been attained—a certain number of patients are received at the Royal Victoria Hospital for day treatment, returning home at night. Where the patient's home conditions are sufficiently good, this arrangement has been found to work well. Thereby the extent of the sanatorium's operations is much increased and the excessive demand for admission somewhat relieved. Such an extension can be readily made to any hospital without serious outlay. Extra shelters and the cost of board are the only added expenses.

In this connection, it is worthy of consideration by the city whether a portion of some of the public parks should not be more freely provided with suitable shelters, where patients, more particularly in the early stages, might practise rational treatment on their own account. There seems no reason, indeed, why a *special* park should not be devoted to this, with a central dining-room, where suitable meals might be provided at cheap rates for such affected citizens, who in this way would be enabled to practise open-air measures in the fullest sense without inconvenience.

The value of the sanatorium has been increased at the Royal Victoria Hospital by allowing certain patients to use shelters or other accommodation overnight, while during the day the individual pursues some calling outside the hospital. This ensures the advantage of medical supervision without the economic loss involved in more formal detention in hospital.

V. Tuberculosis Colonies

The charge has sometimes been brought against sanatoriums that they tend to produce habits of indolence and idleness. I can conceive of conditions which justify the charge, but it is far from the truth in respect of properly regulated sanatoriums. *While sanatorium life is a life of treatment, it need not, and should not, be for the great proportion of patients an idle existence.*

My idea of a sanatorium for the working class is that of a busy hive, where patients, subject to doctor's directions, contribute—some less, some more—by their own regulated efforts to the upkeep and beauty of the place,—a kind of working colony. Thus, out of some eighty patients presently under treatment at the Royal Victoria Hospital, approximately two-thirds do more or less to assist the institution. Of patients working an entire day, there is a joiner, an engineer, a bath attendant, a laboratory assistant, two gardeners, and a groom and handy man. There is a regular corps of painters—some six or more patients—who work for a couple of hours in the morning and a like time in the afternoon. There is an infinite variety of minor engagements, such as raking, weeding, cleaning in various departments, and assisting in different branches of household work. In most instances the work, of whatever kind, is conducted outside. In the case of patients who work all day, suitable remuneration is afforded, in addition to their keep.

This is satisfactory so long as a patient remains in the sanatorium. But as the time for his discharge approaches, a difficulty arises regarding the sort of life he should lead. Return to ordinary occupation is apt to be synonymous with relapse. It is on this account that, for many years, I have been endeavouring to create public interest in the establishment of working colonies for tuberculous patients,[1] in whom the disease has been arrested more or less completely.

After much inquiry, I am satisfied that such colonies could be made practically self-supporting. The residents in the colony would be recruited by selections from patients whose disease had been successfully treated at the sanatorium. The reduplication of the double lines on the diagrammatic scheme (*q.v.*) emphasises the close relationship which must exist between the colony and the sanatorium. The workers would remain at the colony under medical surveillance, and the character and amount of their work would be suitably gauged and directed. The produce of the colony resulting from the patients' labours would form an important supply for the sanatorium. Thus the two divisions of the scheme would advance together conveniently and economically. Above all, a satisfactory solution of one of the ultimate difficulties in relation to the problem would be achieved.

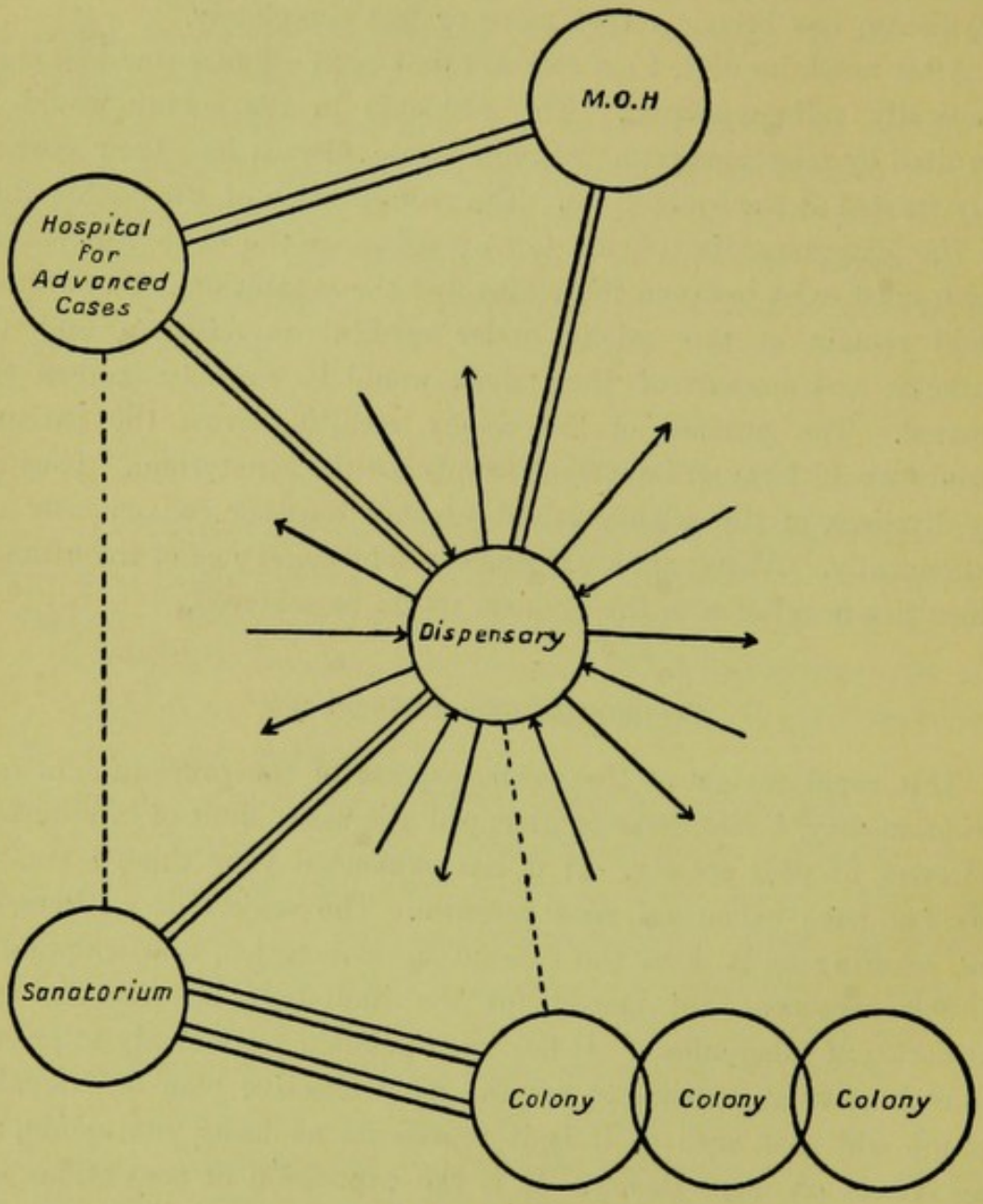
Co-ordination of Measures

This rapid review of the public aspects of the prevention of consumption may, I fear, have overstepped the usual limit of introductory addresses to your society. If it has exhausted your time, I trust it may not have exhausted your patience. The subject is an immense one, covering as it does, the conception, elaboration, and adoption of suitable measures, not merely for the limitation, but for the final extinction of tuberculosis. It has been possible for me only to present a sketch of what appears to me the most effective plan of campaign. Let me add that, such as it is, it represents no hasty conception, nor does it rest on mere theory. It is the expression of convictions and opinions which have gradually taken shape while I have been occupied, close on twenty years, with the development of the various departments of the Royal Victoria Hospital, the Dispensary for Consumption, and the Farm Colony.

For the sufficient elaboration and maintenance of such a scheme

[1] Since established in the Royal Victoria Hospital Farm Colony at Springfield, seven miles south of Edinburgh.

it is impossible to trust entirely to individual effort or benevolent enterprise. It is *essentially a matter for communities.* If the issue be placed clearly before the citizens, I am confident they will readily fall in with well-devised, comprehensive measures. It cannot be doubted that it is in the best interest of communities that sufficient



General Plan.

measures should be undertaken, and the financial responsibilities involved must rest with the communities. The anti-tuberculosis organisation should be more or less completely under the direction of the medical officer of health. It should form, however, a separate, well-defined department of public health activity.

The accompanying extension (p. 450) of the previous diagrammatic scheme illustrates the relationship which should exist between the medical officer of health (M.O.H.) and the organisation.

The medical officer of health must be in close touch with the hospital for advanced cases and with the dispensary. By means of these two arms he will effect a vast deal in the direction of prevention. Where notification is in operation, the significance of the relationship will be enhanced. His connection with the sanatorium and the colony may be less direct. None the less, he will find both these factors of service, even from the preventive point of view.

It has been my endeavour to indicate the leading features of each factor in a scheme of organised and co-ordinated operations against tuberculosis. It cannot be too strongly emphasised that the strength of such a scheme lies especially in its organisation and co-ordination. Each factor is, doubtless, of value. Each department has its own sphere of operations. As isolated elements, their possibilities are relatively limited. In proportion as the various departments are intimately connected and co-ordinated, they each become more serviceable. The key to complete success in the campaign against consumption lies in the *harmonious co-ordination of well-directed measures.*

PRINTED BY WILLIAM GREEN AND SONS, EDINBURGH.

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In Chapter VII Dr. Sutherland gives an inter account of the methods of treatment adopted in a torium, including that by graduated exercise. No ac ledgement, however, is given to the splendid pioneer inaugurated by Dr. Paterson at Frimley in 1904, any allusion made to the fact that, even before wor started at Frimley, Grunat at the Lyster Sanatori Norway had instituted manual labour as a thera agent for the stronger patients in 1902. Some o methods suggested seem hardly necessary for the ord hospital patient, such as sponging with tepid wa which eau de Cologne is added, the giving of a glass o and milk at 4.15 p.m., and the addition of raw meat dietary. These, although doubtless sometimes permi must be looked on rather as luxuries than necessari the ordinary patient, and in many cases would cer be undesirable.

Professor Béraneck writes on the theoretical and pra basis of tuberculin in treatment, but his article necessity by so much incomplete as it is merely an sition of his personal views, and not in any way a c study of the subject. It is impossible not to regre no attempt has been made to correlate and compa various and often conflicting opinions which are on this important subject, or to give the argumen and against the diverse methods of treatment by the preparations of tuberculin which have been from ti time brought into use. Such a critical review migh find a place in any work which professes to deal wit treatment of tuberculosis as well as with its administ control and prevention.

In writing of the public health aspects of the Edin system, Dr. Hewat truly says that the "notificati cases can do no material good unless it be combined measures for helping the patients and for preventin spread of the disease." Much may be hoped for if who are responsible for the administration of mea framed for dealing with the problem from a national of view realize to the full the importance of this As it is at present, neither the Insurance Committ the County of London, nor the Metropolitan As

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