Rest and other things : a little book of plain talks on tuberculosis problems / by Allen K. Krause.

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A Little Book of Plain Talks on Tuberculosis Problems

BY

ALLEN K. KRAUSE

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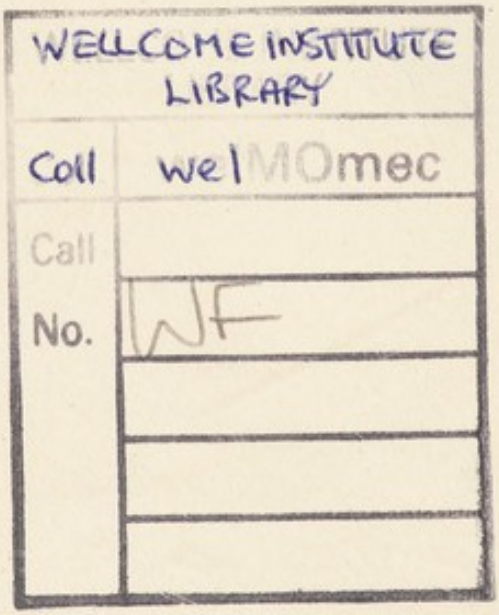

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Contents

REST

Rest[1]

ELSEWHERE in this issue of the REVIEW there appears a paper by Joseph H. Pratt[2] of Boston, the title of which will excite the reader's impatience or admiration according as he considers it the function of a medical publication to give space only to what was never said before or to what is important enough to bear skilful repetition—incessant reiteration without irritation.

Nevertheless, until the time comes when every tuberculosis patient, upon being asked what is the most important element in the treatment of tuberculosis, will unhesitatingly answer, "Rest!," the subject will always be timely. This happy day has not yet arrived. To-day, almost thirty-three years after Trudeau set down his first patient on the small porch of the Little Red, "fresh air" and "putting on weight" still dominate the therapeutic field—at least in the minds of nine out of ten patients. Few patients consult their physician about staying out of doors; relatively few, unless they suffer from indigestion, about eating enough; but before completing a "cure" practically every patient takes up the matter of rest with the medical attendant

[1] An editorial, reprinted from the *American Review of Tuberculosis*, January, 1918, i, 680.

[2] The Importance of Prolonged Bed Rest in the Treatment of Pulmonary Tuberculosis, *American Review of Tuberculosis*, January, 1918, i, 680.

at least once. We have *The Journal of the Outdoor Life*, and any number of "health" periodicals that print page upon page on diet and exercise. So far as the writer knows there is no publication devoted to "Rest." Yet who is there among us that would not put his money on the tuberculosis patient living at perfect rest—physical and mental rest—in a close room rather than on the same person wielding a pick and shovel beyond his capacity in all outdoors?

There can be no doubt that with acute respiratory disease, strain makes up a team of immediate etiological factors that is responsible for more individual outbreaks of tuberculosis than any other single cause. Whoever believes that preëxistent benign tubercle develops, in a vast number of instances, into clinical tuberculosis, and at the same time tries to appreciate what may happen to such benign tubercle under strain or intercurrent respiratory disease will have no difficulty in understanding why this is so. Both in anatomic and physiological disturbance the circumtubercular effects of strain and intercurrent disease can be identical, and the ultimate results the same—the conversion of a relatively insignificant formation into a menace. It is the writer's opinion that no one can deny the influence of strain on the production of tuberculous disease, and for this reason he has always been amazed that everyone will not face squarely the issue of relief from strain in the therapy of tuberculous disease and give it the prominence it deserves.

For what is rest but relief from strain? And where shall we place it in therapy, if not first, and always first? It is, of course, conceivable and, indeed, highly probable that rest may mean all things to all men. It may mean the sloth of the indolent or the relief from tension that follows change of occupation. The t. b. m. might seek his rest in a "night out;" the wornout housewife, on a shopping tour. The views of a certain ex-President and a certain R. L. S. would probably differ widely as to what is rest. To some of us it has always seemed a marvelous commentary on the reasoning intricacies of the human mind that we send a worked-out horse to pasture to vegetate while for the broken business man we prescribe a sweating course of handball at the gymnasium. These considerations simply go to show that rest is perhaps a relative state of consciousness to which different constitutions and temperaments will react differently. But in this clash, this welter, of individual physical and mental reactions, is it not possible to find common ground? Let us put the matter another way: Instead of saying "rest" let us say "relief from strain." Let us then put the matter thus—that relief from strain is any state of physical or mental activity or inactivity that does not reach the point of conscious fatigue; and by fatigue we would include *ennui*.

Is not this the main, the guiding, one is almost tempted to say, the only principle to be followed in tuberculosis therapy? The febrile, acutely ill must,

of course, always be put to bed: there can be no question about this. But the vast number, the majority, of the tuberculous sick, those who are sitting out their time awaiting the day that will take them back to the land they came from—what of them? For them tuberculosis regimen should mean exactly what we have just said: anything congenial that keeps the patient below the fatigue line. And this the physician cannot prescribe in terms of minutes or of hours. The fatigue line is an individual affair, registered only in the patient's own consciousness. The patient has his "cure" in his own hands. He who heeds will succeed, if success is possible: he who is unresponsive or refractory may fail. For the tuberculous, fatigue is the flash from the focus and he who acknowledges the message by immediately throwing on the brakes is the patient whom we can appoint engineer of his own case. The patient who never pushes himself to the point of fatigue or who at once stops short when it is upon him will never delay his "cure" by any measures within his control, but will hasten it with geometrical ratio. The man who will not stop is a poor risk, no matter what the nature of his case may be.

This, in the writer's opinion,—this always keeping below the point of fatigue,—is all that there is to the matter of rest in the therapy of tuberculosis; and when he says "all there is to the matter of rest," he means everything in the routine therapy of the disease. All other measures ever advocated in its

treatment will not begin to counterbalance the violation of this single rule of rest or exercise—never become tired, or if tired, rest, and rest until completely refreshed.

And what under the circumstances is our duty as physicians? It is this: To explain to the patient why relief from strain is so important, to explain, too, that there can be no set formula for all patients nor one even for the individual patient, that rest can be measured only by a conscious reaction in the patient, that therefore the patient must rely on his own intelligence and behavior in the treatment of his case, and that meanwhile he, the physician, is always at hand, a guide and mentor, to help out in the little details of management and to give the patient all the support and comfort that a rich and wide experience can bestow in relieving the tedium of the protracted fight at hand. But, above all, to so engrave rest on the patient's mind that he will automatically and at once respond with rest to the first symptom of fatigue.

THE TREATMENT OF TUBERCULOSIS

The Treatment of Tuberculosis[1]

REST remains the sovereign remedy for tuberculosis. More direct and spectacular methods of treatment—inhalations, injections, drugs by mouth—come and go: the years since 1900 have spawned hundreds of them. Few have survived the momentary sensation of their announcement: none has earned even a vogue: all this despite the fact that none has been employed unless rest were also a part of the treatment. Rest alone has returned thousands of consumptives to productive life. Of those who, *while living an active life*, relied on drugs or vapors or "serums" or vaccines to fight their battle, few have made the journey back.

The lungs are the most frequent seat of human tuberculosis. In this type of disease the body is, as a rule, profoundly affected. Besides the cough, bleeding and sputum which are directly due to the local activities of the infection, the patient may exhibit the more general constitutional symptoms of fever, loss of endurance, dyspepsia, loss of weight, excessive nervous irritability, etc. These latter manifestations are all expressions of a poisoning from which the body is suffering, because of noxious substances absorbed from the diseased (tuberculous) areas in the lungs. All sound treatment must aim

[1] Reprinted from *The Journal of the Outdoor Life*, February, 1922, xix, 31.

to limit and confine the activities of these tuberculous foci and to reduce to zero or a minimum the absorption of harmful focal products.

Foci of disease represent morbid tissue changes set up in the lungs by living germs, so called *tubercle bacilli.* In several ways and by several avenues and at many times, tubercle bacilli may be carried from foci, which they have brought about, to other parts of the lungs or body. Wherever conditions are favorable for their lodgment and continuance of life and multiplication, they will arouse the production of new foci of disease. *Progressive* tuberculosis, therefore, is an infection, characterized by successive eruptions of newer and newer areas of disease—tuberculous foci (tubercles)—which result from the transportation of living tubercle bacilli from point to point in the body.

Fortunately, not all tuberculosis is continuously progressive. Indeed, it is only the very rare cases which are. In most human beings, the infection proceeds to a certain degree and then stops; and, if it is not of a size or character to arouse symptoms of illness or disability, its possessor may never become aware of it. In many the infection pursues a halting course. Active for a while, it may enter into a period of quiescence, which may continue for weeks, months or even years. But at any time the stress of many outside influences and human experiences may "stir" quiescent foci into renewed activity; and at any point the activity may become sufficient to bring about symptoms of illness. When

these symptoms occur, the person becomes a patient who requires treatment.

If we possessed a chemical compound or a specific bacterial preparation (one comparable to the antitoxin for diphtheria), and with it could reach the foci of disease in such a way that it would destroy all tubercle bacilli contained therein, or neutralize and make impotent the harmful substances which poison the body, our treatment would be simple, and swift and certain in good results. An enormous amount of study and experimentation has, however, thus far completely failed to disclose such short cuts to healing. Our problem to-day is to convert a progressive disease-process into one which is subsiding or nonprogressive, and to prevent the spread of bacilli from already present foci into healthy tissues.

Experimental research, as well as elementary experience, teaches us that nothing so promotes the natural healing of a diseased or injured part as rest. Disagreeable and crippling though pain may be, it is a highly useful and defensive reaction on the part of the body; and, whenever it arises because of injury or disease, all animals instinctively respond to it by using the affected part as little as possible. Primitive man learned that the fixing of a broken limb by splinting promoted and hastened repair of the wound. We may lay it down as an axiom that uncontrolled movement of a diseased or injured part (if this is possible) will promote spread of the disease and delay recovery from the disability.

Wherever we have what we call more local tuberculosis, in places which are available for the treatment, we apply rest directly. We splint the carious spine or hip joint with rigid casts, and thus limit motion to a minimum. In cases of tuberculosis of the larynx we interdict speaking above a whisper, as a result of which the vocal cords and surrounding structures are put at relative rest.

When they present themselves for treatment, persons with lung tuberculosis may suffer from every conceivable degree of illness and disability. At one end of the scale we may encounter the patient whose only manifestation of illness is a consciousness that he has increasing difficulty in performing his customary work; at the other, patients who are profoundly ill, with high fever, great prostration and rapid wasting. Between these two extremes are legions of men and women, not ill enough to feel themselves fit for bed, who tire easily,—too easily,—have a little fever and elevated and irritable pulse, find their food without its old savor, gradually lose weight, and perhaps suffer from a slight cough which hangs on with unusual tenacity. Cough, blood-spitting, fatigue or feeling out of sorts, may first send these to the physician, who, if disability is due to tuberculosis, usually finds more features of illness than the patient complains of.

And now begins the struggle to restore the patient to old-time vigor, and *keep him there.* For *it is a struggle. Every person who has enough lung tuberculosis to cause symptoms is saddled with a serious affliction*

and enters upon a battle for his life. The earlier he realizes this fact and, acting accordingly, does his part, the more quickly he establishes a wholly coöperative attitude with a competent physician, yielding himself to a discipline and reëducation which will be always prolonged, and, to the rebellious and flabby-charactered, irksome; the more readily he adjusts himself to a life and environment which involve the non-indulgence of many former habits and appetites, and the release and freedom from many activities which, though pleasurable, entailed strain, the more likely it is that he will win the fight and not die of consumption—soon, or many years afterward, and after many relapses and false convalescences.

From infection to first illness, lung tuberculosis is a slowly creeping and insidious thing; between the two incidents the interval isprobably more often years than weeks or months. Healing may not be so sluggish, but to many it will seem interminable.

It is of the first importance to rid the patient of the constitutional symptoms of intoxication—of fever, fatigue, loss of appetite, etc. Exercise may whet the appetite, relieve the fatigue and tone up the system of the man without organic disease; but it has never done the same for the consumptive *when and so long as he has such symptoms.* We should no more exercise a tired and feverish consumptive than work a worn horse.

Experience will prove to anyone that, except in cases of acute disease and very ill patients, there is no appetizer for the consumptive like rest; there is no

restorer of aching, tired limbs like rest; there is no fever-reducer like rest. And why? Fever, tiredness and distaste for food are, we repeat, symptoms of intoxication. Intoxication results from the absorption of focal substances, and its intensity and degree are commensurable with the amount of such substances absorbed. The rate and capacity of this absorption depend upon the circulatory and respiratory activities of the body. These latter again vary directly with bodily activity, any increase of which (exercise) raises pulse and blood pressure and breathing depth and rate. Rest, bringing about a diminution of physiological demands, tends to reduce the amount of focal absorption and thus lessen intoxication. As intoxication goes, appetite comes back, fever falls and a sense of well-being sets in.

When this happens, the body functions more normally in every way. It is able to build up its depleted reserves and better combat the infection, thus assisting all the more in the healing of foci of disease, the extension of which is rendered less likely because of the comparative physiological inactivity of the affected part.

Well-regulated life in the open and a well-balanced diet are yeoman aids to rest in the general treatment of tuberculosis. Moving, fresh air stimulates bodily functions and good nutrition improves them. Exposure to the wearing and damaging influences of weather and climate will likely prove disastrous, while forced stuffing with milk and eggs, beyond the demands of appetite and satisfactory gains in

weight on more normal diet, delays rather than hastens cure.

Rest is really a potent medicine, to be prescribed and "dosed out" only according to the requirements of each individual case and with discretion, by physicians who understand its use. Discipline, regulation of life, is really the keynote to success in treatment—with rest always the basis. Consumption *can* be treated successfully anywhere—anywhere where freedom from bodily and mental stress is possible and prevails. But, since rest and discipline and the means for ensuring these are more readily obtainable in special institutions or health resorts than in an environment of anxious, overcritical and perhaps suffering relatives and friends, sanatorium treatment is vastly more satisfactory and effective for the great majority of patients.

Many drugs are valuable in combating and relieving particular symptoms of lung tuberculosis: none affect it fundamentally. The various specific products of the bacillus—*tuberculins*—have done not a little good in one or two very special types of cases, *but only the thoroughly trained physician, experienced in their use, should administer them.* Sunlight and various other forms of radiation, in the hands of experts, are apparently exerting a very favorable influence in the more superficial types of tuberculosis; in lung tuberculosis they have yet to win their place. Yet drugs, tuberculins, and sunlight and irradiation would not show much effect if at the same time rest was not part of the treatment; that is, the patient

allowed to go his own way, with life unregulated and activities unrestrained, would in most cases "crumble" nevertheless.

Treatment by artificial pneumothorax involves the direct application of rest to the diseased lung. The injection of an inert gas, like nitrogen, into the chest cavity, under higher pressure than the lung can expand against, brings about a condition which compresses the lung, and fixes it and makes the rhythmic movements of breathing impossible. It is a measure to employ in selected cases, in which less drastic treatment, like bodily rest, has failed to arrest the disease. It has saved many patients, and ameliorated and prolonged the lives of many more. First suggested by an Italian forty years ago, and vigorously advanced by an American almost twenty-five years ago, it has, during the last decade, gradually won recognition as the one effective weapon against advanced pulmonary tuberculosis, which the period since the discovery of the tubercle bacillus (1882) has disclosed.

When the treatment of lung tuberculosis is successful, the foci of disease either disappear or are replaced by scar tissue, or they are surrounded by thick, globular envelopes of scar tissue, which prevent the egress of bacilli remaining within and make impossible the absorption of focal materials. In most patients who recover, the latter event very likely occurs.

As long as living bacilli remain in the body, in such walled-off tubercles, the possibility remains

that active disease can again flare up. And it is a lamentable fact that only too many who have recovered from one or more attacks of tuberculosis relapse.

Most break down again because they cannot withstand the strain of the life to which they return after treatment. They cannot or will not continue the regulated life that restored their health, and sooner or later they "crack."

This event is so common that the conscientious and wise practitioner insists upon the continuance of a modified treatment long after the patient has left his intimate care. He insists that the patient carry back to active life some of the maxims learned at the sanatorium; that he so regulate his affairs that he can always live with as little strain and fatigue as possible—for fatigue is his danger signal; that what is work for a normal man requires longer and more complete intervals of rest for him who was once a tuberculous patient; that overindulgence in any activity, while only fatiguing to the healthy, may precipitate the relapse of a former tuberculosis patient. Many patients, amenable to this advice, escape relapse. Most who are forgetful of it return—always a little worse off than before—to resume the "cure."

A man who has had active tuberculosis, who has recovered, and who returns to take his former place in society is "like a man with one leg trying to run a race with a man with two;" and he should arrange his life accordingly. A tremendous lot of the world's work has been done by men with tuberculo-

sis or by those who were often on the brink of active disease—by Spinoza, John Locke, Chopin, Keats, Sterne, Raphael, Moliere, Canova, Schiller, Laennec, Emerson, Cecil Rhodes, and a host of others. But most of these had to do one of two things: either "put all their eggs in one basket" and live by rule to fairly mature and even old age, or seize the passing moment and burn themselves out in youth to leave imperishable monuments behind them.

SPUTUM INFECTION OF CHILDREN

Sputum Infection of Children[1]

TWENTY years ago the discoverer of the tubercle bacillus stubbornly refused to assign to the bovine bacillus any significant part in the production of human tuberculosis. Since then enough unimpeachable study has settled definitely that the germ of cattle gets to man with a frequency and to an extent that make themselves felt. But what is more important, it has also made clear that by far the chief source of human infection is human sputum, and that, since sputum which contains the seeds of tuberculosis almost without exception bears these as human bacilli, it is the latter which infect and disable most of mankind.

This premise has earned its place in our scanty list of tuberculosis axioms. But it tells and means no more than it says,—that most human tubercle and tuberculosis are put into being by the human bacillus. It throws no light on the mechanism—the medium and method—of infection; the act or the countless acts of infection which are going on without end or let up. It is only information on this point which can lend scientific or rational dignity to any efforts at preventing tuberculous infection.

[1] Elaborated from an address, "The Course of the Tubercle Bacillus from Sputum to the Child," delivered at the Annual Meeting of the Medical Society of the State of New York, at New York City, March 25, 1920, and published in the *New York State Journal of Medicine*, March, 1921.

Such information as we possess is hazy and ill defined. And we can cite no better evidence of the metaphysical character of our knowledge of this phenomenon than the utterance of several hypotheses, all with eminent authority behind them and all contradictory one to another, which we have now and again been asked to accept. Among the more prominent of these are Cornet's, Flügge's, Aufrecht's and Calmette's.

First, Cornet's: The man with "open" pulmonary tuberculosis, that is, with ulcers in his lungs, spits abroad. His sputum dries and becomes part of the dirt and offal of the streets and the floors of home, workshop, railroad coach and auditorium. Traffic, indoors and out, grinds this into dust. Air currents waft this dust to innocent and healthy nostrils, far removed perhaps from the original careless spitter. Inhalation carries it deep into the respiratory tract, to the lungs, where dust-borne bacilli enter upon a new parasitic cycle in one who before was healthy and nontuberculous. In brief, infection is intermediate, the medium is dust and the method is deep inhalation.

Flügge and a score of competent associates spent ten years in a really astonishing amount of work to prove that the spread of infection took a very different course from that imagined by Cornet. What happens, they decided, is as follows: Whenever we cough, sneeze, talk loudly or laugh heartily—indulge in what they called "forcible expiratory acts"—we emit a spray of droplets from our mouths

and project this for a variable distance. If we are consumptive these droplets may carry tubercle bacilli, and if a person is within their range as they float suspended in the air he will inhale them. They then go deep into the lungs to set up foci of infection there. In other words, infection is direct, from person to person, the medium is a spray of freshly cast-out droplets before these have settled upon a surface, and the method, like Cornet's, is deep inhalation.

Flügge did not ignore the Cornet mechanism. He denied its prominence in the scheme of infection. Careful investigations had made it plain that tubercle bacilli are peculiarly sensitive to sunlight. Therefore, urged Flügge, one of the chief agencies concerned in drying the germs outside and converting them into dust would destroy them and make infection by them impossible. Cornet recognized the force of this criticism. He agreed that virulent infection from material out-of-doors was quite likely unusual: it was the house dust, protected from direct sunlight, which really mattered. *Tuberculosis, therefore, was an indoor infection.* But, retorted Flügge, it is not a house infection through the medium of dust. The ordinary, crowded homes are without the necessary air currents to convey the dust from floors and furniture to human nostrils. Sweeping and rug-shaking may perhaps spread dust in this way, but such practices are too special to account for the enormous aggregate of infected human beings. Infection of most people does

indeed take place indoors; but it proceeds from sick to well in direct contact with each other and then, as a rule, only after prolonged association. Besides, experiments with susceptible animals had abundantly shown that moist sprays containing tubercle bacilli were a hundred-fold more potent in setting up infection than were germ-laden dusts.

At any rate, we became so convinced that we made indoor infection a dogmatic article of our faith. It was not so long ago that high authority taught me that tuberculosis could not be contracted out of doors: for the germs of street-dust were dead and the casual reception of mouth-spray from a chance consumptive was of no moment.

Both Aufrecht and Calmette believed that vastly more infection followed the ingestion of tubercle bacilli than by breathing them in. Aufrecht held that contaminated material of any kind entered the nose or mouth, that the germs proceeded no further than the throat, and that here they lodged in the tonsil, whence they were carried along lymphatic channels to other parts of the body, particularly the lungs. The passage from tonsils to lungs was by lymph channels which ran directly from the former structures to the latter. The failure of any first class anatomical investigations to bring such direct paths to light and the repeated demonstration that vessels which carry lymph away from the tonsils follow an altogether different course weaken Aufrecht's view of what happens to the germs after they first enter the body.

According to Calmette sputum infection originates through the ingestion of anything that may have been in contact with tuberculous sputum. The germs may enter the body at any point in the digestive tract, by being carried through the mucous membrane of the mouth, throat or intestines. Most infections, however, arise from bacilli which get as far as the intestines and thence pass into the lymphatics. Lung infection develops, not from inhaled bacteria, but from those which have taken a circuitous route from intestines to lungs.

Here we have, then, four irreconcilable views of tuberculous infection. If any one of them is exclusively right, the others are wrong. Cornet and Flügge make infection take place indoors: Aufrecht and Calmette, anywhere, in or out of doors. Flügge's method is direct by the immediate contact of sick and well: Cornet's, Aufrecht's and Calmette's go on through the intermediation of inanimate carriers,—dust or any contaminated article,—and permit a wide gap between the diseased and the healthy. Cornet and Flügge look upon crude sputum as an insignificant source of infection: it cannot be detached from surfaces and blown about as dust or spray. Aufrecht's and Calmette's hypotheses are not so strict in their conditions: anything and everything that contains tubercle bacilli and passes human lips can set up infection.

To be even reasonably sound, any hypothesis must, of course, fit in with the actual conditions and

facts of everyday existence. To say that a thing *can* happen is not to prove that it does happen. We can, for instance, infect all susceptible animals, including man, most easily and most certainly by the method of inoculation into or beneath the skin; but so many facts at once suggest its absurdity that no normal intelligence would for a moment entertain this as the common, natural method of human infection. Similarly, that guinea pigs can be made to inhale moist sprays of tubercle bacilli deep into the lungs and that infection develops there and therefrom, of itself does not in the least point out that most human beings are infected in the same manner. There is no doubt that if guinea pigs were compelled to live in surroundings throughout which human sputum was lavishly disposed in other ways than as moist sprays, they would just as surely become infected. At any rate, any discussion of tuberculous infection, once the possibilities of infection are granted, must properly begin with the well-established facts of infection among human beings. Any reasonable hypothesis must satisfactorily adjust itself to these.

Possibilities of human infection which will no doubt be universally admitted may be set down summarily as follows:

1. Human beings can be infected in a variety of ways. Inhaled bacilli can enter the body through the upper respiratory tract, such as the throat, or through its lower part, such as the windpipe or lungs; or through the upper digestive tract, as the mouth or

throat, or the lower part, as the intestines; or through inoculation beneath the skin or into it, as well as into blood vessels, muscles, membranes of the brain and spinal cord, and chest, abdominal and joint cavities.

2. Tuberculous sputum can set up infection whether it be introduced in the form of a suspension, such as sprays, etc., or as inhalable or ingestible dust, or in its natural or crude condition as it might be attached to any particle conveyed to mouth or nose in any manner whatever.

The well established facts of human infection are few; but to-day none rests on better evidence than that *an early and rapid tuberculization goes on among all people who live under present conditions of highly organized community existence.* Whenever tuberculosis is introduced into advanced civilizations most of the population soon become infected. Any infection hypothesis which pretends to even a limited application to human beings must take account of this state of affairs. If it fails to square with it and to explain it, then it must be given up as a *deus ex machina* of human infection—and this altogether apart from success or inability to bring forward a satisfactory substitute.

An open mind will at once question whether this early and rapid tuberculization can be brought about by indoor association and by prolonged and intimate contact with tuberculous persons,—tuberculous persons who, to transmit sputum infection, would have to be, for the most part, "open" consumptives,

in relatively advanced stages of the disease. "Where," one will immediately ask, "Where are all the consumptives who strike such close contact with our children that, within six years after the latter's birth, one-half and more have been infected by them (or at least a third if, for the moment, we leave bovine tuberculosis out of the reckoning)?" The manifest pulmonary disease, tuberculosis, is common enough—appallingly common. But can it be so frequent as to set up so enormous a number of new infections among our young under the conditions of contact that have just been laid down? Certainly neither our best nor our highest available figures of disease would make it so. If infection must take place indoors, or if direct contact with a droplet-coughing consumptive is a *sine qua non* of infection, why is it so difficult to trace the source of infection in so many even very young children? Infection is, of course, promoted by contact. No one denies, or even questions, that investigations of the homes of consumptives will reveal that most children who dwell in them are infected. But it is just as true that most children who are *infected* do not live with people who suffer from manifest tuberculosis, nor can even their casual association with these be shown to have occurred.

Closer examination of infection charts serves only to increase our doubts as to the sufficiency or probability of the dust or droplet hypothesis in explaining the generality of childhood infections.

We may begin by making a composite chart from such investigations as those of Moro from Munich, Mantoux from Paris, Petruschky from Danzig, Ganghofner from Prague, Pirquet from Vienna and Hamburger and Monti from Vienna, Nothmann from Düsseldorf, Veeder from St. Louis, and Armstrong from Framingham. These various observations differ in certain details. The test methods are not always the same, the total numbers of children and the numbers in the several age groups vary, and there are slight fluctuations of positive reactions in certain narrow age groups. Yet it is astonishing how closely all these studies, made in many parts of the world, agree when it comes to the broad essentials of the question,—the question, namely, of the incidence of tuberculous infection among city children.

Roughly, about 10 per cent of children of the type who resort to city dispensaries exhibit infection by the end of their second year; at three years, from 15 to 20 per cent; by six years, from 50 to 60 per cent; and by fifteen, about 75 per cent. In other words, if we take 75 per cent, or three-fourths, of all children as our standard of infection at age fifteen, we find that during the first two years of life, 10 per cent of all children, or about one-seventh of the infected, receive their first infection; during third year, about one-seventh more; between four and seven, one-half more; and between seven and fifteen, one-sixth or one-seventh more. The significant feature of such an analysis is that during

infancy about two-sevenths of the infected receive tubercle bacilli for the first time; during early childhood (from four to seven years) about one-half; and during later childhood (from seven to fifteen) about one-seventh.

Were we to follow that line of reasoning which would make the thing to be explained fit an hypothesis, then, in accordance with the Cornet and Flügge ideas, we should be obliged to affirm that between four and seven years of age children are confined indoors more than between birth and three; that during the former period they are in closer and more intimate contact with consumptives; or that parents, relatives and close associates are more likely to have "open" tuberculosis when their child contacts are between four and seven years old.

We may dismiss the last contingency as trivial and unbelievable.

It should take but little reflection or observation to point out the falsity of the first predication. With perfection of locomotion and a widening of outside interests the normal child's range of activity expands enormously from three years on. It is just at this period of from four to seven when, able to run at large and not ready for the discipline of school, most children spend a larger part of their time out-of-doors than at any other period of their lives. Such are the facts of life which should be placed alongside the other fact that during this time an unusual proportion of children acquire tubercle for the first time.

It is the infant who is in closest confinement and physical contact, over a long period, with certain individuals. Fixed and helpless, it is, at first, a house animal. It does not escape the indoor dust that may be wafted about. With no ideas on the matter, it offers no resistance or aversion to the careless cougher and kisser. It becomes a floor animal and, creeping close to the floor, furniture and walls, establishes a more intimate, more prolonged and, in every way, a larger association with house dust than we can imagine for any other member of the family. At the same time, it is the infant whose diet is so largely and so exclusively of milk, perhaps cow's milk. Yet the total result of a shut-in life and unusual contact with milk, with dust and with people in the home, is an infection incidence of only ten to twenty per cent. This seems amazingly small; yet it probably comes near to the relative importance of dust plus droplets plus cow's milk in the scheme of tuberculous infection.

It is difficult to understand why the dust and droplet ideas, particularly the latter, have so dominated, and perhaps made misty, our views of tuberculous infection—difficult to understand, unless we remember that both were put forward to explain pulmonary disease at a time when pulmonary disease was synonymous with pulmonary infection, and when hardly anyone doubted that pulmonary foci were in every case the expressions of direct and primary infections from without. It was a time also when there existed slight appreciation

of the enormous extent of early infection. Both Cornet and Flügge labored hard to elucidate how and why adults acquire pulmonary tuberculosis through association with adult consumptives at home and in workshop, convent, prison, barracks and office. Their views were no doubt eminently satisfactory for a generation whose ideas of the latency of infection and the latter's early occurrence and facility of obscure spread throughout the body were vague or nonexistent. As they stand, these views fall far short of explaining tuberculous infection as we understand it to-day.

But can we do any better?

We cannot explain the mechanism of human infection scientifically—so much is certain. Except in the rarest instances, it is never given us to observe the actual event of infection; and these few cases are almost always inoculation (wound) infections. Few infections can be set in motion and followed as accurately in the animal of experiment as can tuberculosis. No other infection has a more solid and more scientific groundwork of experimental data than tuberculosis. Yet, because we cannot observe human infection take place, cannot detect the exact point of entrance of bacilli into tissues, and cannot trace, step by step, the latter's paths, our opinions of the mechanism at work must be largely speculative. They take on a more and more scientific tinge only as we bring together possibilities, wrung from experiment and stated above, with established facts of human infection, as just ana-

lyzed, and such factors of human existence and environment as habits, customs and material surroundings. Wherever these three determinants tend to converge the true explanation of human infection bids most fair to lie.

We would ask why formal infection hypotheses (except Volland's) have never given the most abundant immediate source of tuberculous infection its due. This source is raw sputum: not sputum dried and powdered into dust; not sputum coughed or sneezed out as droplets; but crude sputum, as it meets everyone's eyes, sputum recently expectorated, bespattering our streets and the floors and furniture of far too many homes.

Those who deny that our children are missing or escaping contact with it are simply speaking outside the facts. A floor animal at home, the child becomes a ground animal abroad. Out-of-doors, children engage for the most part in what we may call ground games—at marbles or at top-spinning, at rope-skipping, at hoop-rolling or at ball. And doing so, they cannot help attaching to their hands the offal of the sidewalks and the streets; and, with this offal, the sputum of many people. Children's hands are of varying degrees of cleanliness, but we may be sure that the normal child's are dirty most of the time. Few children develop a consciousness about putting their hands in their mouths. And one result of the reaction of our spitting habits on the activities and habits of the child cannot help being otherwise than that considerable raw sputum will

find its way into our children's mouths. The prevalence of oxyuris among children, with its repeated hand to mouth self-reinfection, should teach us that the child, if given the opportunity, is accustomed to do its part so far as putting contaminated articles in the right place is concerned. The opportunity for sputum transference—an abundant and ever ready source of infection—is always here, distributed broadcast, in every stage of potency and virulence, with its tubercle bacilli, its diphtheria bacilli, its pneumococci and streptococci, and what not.

So much for a source of tuberculous infection which is patent to everyone and will impress even the most inattentive, and which, whenever tuberculous, must be far richer in tubercle bacilli than sprays of droplets from the same person. The disclosure of a source is no more than a demonstration of one factor of a mechanism of infection. Observation and description of the habits and activities of persons concerned in infection and a correlation of these with the source can give us only presumptive evidence concerning other links in the chain. But it is the ordinary and usual manifestations of actual infection which will lend or belie plausibility to any scheme of infection which we may work out.

Our hypothesis derives its most telling support from the facts of clinical medicine. Among the common forms of tuberculosis is disease of the lymph nodes of the neck. Compared with other manifestations of the infection, it is infrequent

in infancy and adult life. It occurs more often in childhood, and even within this limited period it has a more or less special age grouping; for it is far more common between three and ten years of age than in earlier or later childhood.

Because of their location and their unique relations with the blood and lymph circulation, there may always be some question as to whether disease of the lungs is the primary effect of bacilli which have been carried there directly from the outside. But, except in the rarest cases, there is never any such doubt about the origin of neck node infection. It comes from bacilli which have entered the body by mouth or nose; and in most instances the probabilities are all in favor of the first-named portal.

All who are familiar with the subject know that the concepts "tuberculous infection" and "manifest tuberculosis" convey two very different meanings. The tubercle bacillus produces illness, but it also enters the tissues and rests there, living, silent and without noticeable effects. Infection engrafts itself on millions; manifest tuberculosis claims only its tens of thousands. The ratio of those with the seeds of tuberculosis to those with its blossoms is a hundred to one. In the case of every tissue or organ which is a favorite abiding place of the bacillus there are always many more concealed than outspoken infections. This circumstance is almost axiomatic as regards tuberculosis: the rule is particularly applicable to infection of the lymph nodes.

If, then, we are accustomed to meet with many

cases of frank involvement of the neck nodes, we may be sure that multiples of this number exist as dormant infections in others. Lymphatic tuberculosis of the neck is not only more frequent in children of three to ten years of age than at any other period of life: it is also the form that most often calls for treatment in these years, when there are fewer cases of bone and lung tuberculosis. We believe, therefore, that neck infections outnumber those elsewhere in the body in childhood and that entrance of bacilli by the mouth, with arrest of these in the mouth and throat, is the more usual route. Inhalation and food (milk) ingestion will not explain most of the infections of middle childhood. Hand to mouth transference of sputum will. An enormous amount of sputum is cast out upon the ground. Children do play upon the ground. They live much of the time with hands dirty with street refuse, not a little of which is sputum. They habitually put their hands into their mouths. All, then, that is needed is that sputum which they pick up be expectorated by persons with pulmonary tuberculosis; and that this condition is being repeatedly fulfilled has never been questioned. The results are matters of scientific record—a sharply mounting curve of tuberculous infection after age three and a preponderance of cervical tuberculosis in the middle years of childhood.

If this assembling of evidence is sound, it may cast some light on a phase of tuberculous infection which acceptance of hypotheses that make indoor

and close contact necessary has left obscure. In a preceding paragraph I mentioned that in a very great number—perhaps most—of the children who exhibit infection merely by reacting to the Pirquet test it is impossible to discover that any direct association with tuberculous patients has ever existed. It is, moreover, difficult to understand the early, rapid and almost universal infection that takes place, if we are to restrict its occurrence to those who experience this association; for it simply cannot be true that three-fourths of our city children live and move intimately among consumptives.

If a consumptive is dangerous only in his home or through his mouth spray, his range of infectiousness is relatively limited, and we should expect to find it reflected in a much more slowly rising curve of infection after infancy. Certain conditions must be fulfilled by the recipient of any infection, as well as by the donor and the intermediary mechanism. And I have already pointed out that the infant most ideally satisfies those of the recipient.

But indirect infection, through outside sputum, widens enormously a sick man's range of infection. Conceivably, a single mass, under proper conditions, would suffice for dozens or scores of recipients. It has been a favorite saying that the tubercle bacillus is ubiquitous. The maxim is open to dispute. The germ is certainly not ubiquitous if human infection is transmitted only indoors or by human contact. It can become ubiquitous through promiscuous spitting and through this means only.

In this way dark, obscure and unsuspected contact with infection may be struck.

It seems to me that out of our conflict of hypotheses and opinions several presumptions emerge, awaiting only the disclosure of controlled evidence to turn them into truths or falsehoods. Let us summarize them.

We human beings are open to tubercle bacilli of both bovine and human origin. Our chances of being infected are much greater from human sources. In most instances the original human source is sputum. This may come to us as part of the dust which we receive through nose and mouth, and in droplets of spray cast at us by the diseased and received by us as is the dust. It may be received with contaminated food and swallowed.

Children, arrived at an age which takes them outdoors to play, become peculiarly exposed to another source of infection. This is crude sputum, picked up by their hands and carried to their mouths. The result is a preponderance of infection and disease of the lymph nodes of the neck.

The indoor and direct contact hypotheses of tuberculous infection have been greatly overemphasized. They no doubt suffice in part. But there is every probability that outdoor, indirect infection,—through sputum,—makes up a large proportion of the total number; in children, perhaps the greater part.

ADULT TUBERCULOSIS FROM CHILDHOOD INFECTION AND ITS PREVENTION

Adult Tuberculosis from Childhood Infection and Its Prevention[1]

AN OUTSTANDING addition to our twentieth century tuberculosis knowledge has been the thoroughly complete and satisfying demonstration by biological experiment that there is such a thing as an immunity to tuberculous infection. No matter how much many features of the clinical course of the disease may veil and superficially confound it, the fact remains; and it is the easiest manifestation that the experimenter is called upon to prove.

All animals with tuberculous infection have a resistance to tubercle bacilli which is greater than the normal defense of noninfected animals: this is the gist of tuberculosis immunity. Further, infected animals are more resistant because of their infection: it is the latter which has made them so.

Now, most people who live our sort of life sooner or later become infected with tubercle; and most of these remain well because their infection never develops to a stage which will disturb their physio-

[1] Revision of an address, "The Prevention of Tuberculosis Based on the Relation of Childhood Infection to Tuberculosis in Adult Life," read before the Section on Child Hygiene, at the annual meeting of The American Public Health Association, New York City, November 17, 1921, and published in the *American Journal of Public Health*, February, 1922, and the *American Review of Tuberculosis*, February, 1922.

logical economy. No doubt, too, many remain well because their infections die out completely. It happens, therefore, that there are always millions of people in the world who, though tuberculous, are in perfect health, and who are more than normally resistant to infection as long as they remain tuberculous, and because they are tuberculous. The man whose special interests lie in the wellsprings of immunity tells the story in another way,—that there is no tuberculosis immunity without infection in the same animal.

Both as infection and disease, tuberculosis has the habit of cloaking its nature well. It is not given to frank and unequivocal disclosure of its deepseated effects. Commonly as not, it throws out surface appearances which mislead. For centuries, before the practice of the experimental method gave us clearer vision and straighter thinking, tuberculosis in the sick man always masqueraded as an odd sister in the family of infections. It dazzled us with every performance and byplay which we have learned to associate with nonresistance or lowered resistance; and thereby made us hopeless. It is small wonder, therefore, that we seized upon the fact of immunity with enthusiasm.

Into every dark corner of tuberculosis we began to push our new knowledge,—pushed it hard and far; until, in only a little while, we had pieced together a new and thoroughly topsyturvy credo. It wrenched the centre of the tuberculosis universe from the adult to the child. It proclaimed that we

grownups could move in mouth sprays and dusts and dirts, *as these normally exist*, with perfect security. Ordinary sowings of ordinary bacilli, so it affirmed, fell upon our tissues, our adult tissues, as on so much stone; for we already had our infection which long ago had put on our armor for us. How long ago? In childhood. Practically all little boys and girls take in tubercle bacilli. These infect them and make them immune to reinfection. A few soon fall sick, and die perhaps; but the others remain well, tuberculous, and immune to reinfection from without for the rest of their lives. How, then, and why do adults develop illness from tuberculosis? It is from their old infection, acquired in childhood, dormant, inactive and innocuous for years and decades, and meanwhile benignantly and bountifully protective. This takes on new vigor, new powers of life, and grows, or perhaps spreads; until, some day, it passes the shadowy line between latency and activity and makes its host feel that illness has come.

So impressed were many by such applications of the facts of immunity that statement hardened into assertion and assertion into dogma; and not a little impetus and currency were given the dictum that manifest tuberculosis of adult human beings, particularly that of the lungs, is in almost every case the fruition of infection acquired in childhood.

It is highly questionable whether available data will warrant so extreme a position. Most city children become infected, we grant; as will we that

simple infection may be notoriously persistent: yet opposed to these circumstances are the equally authentic ones that tuberculous infection is not necessarily permanent and that both experimental and clinical observation proves that foci may become sterile or thoroughly eradicated. That infection confers an immunity to reinfection is the very rock bottom of our new knowledge; but the latter comprises also the very important qualifying facts that this immunity is never more than relative, that it declines as foci are healed in and become, as a consequence, less susceptible to activation, and that, if complete healing does occur, it will disappear. Furthermore, the localization of pulmonary infection and disease of adults diverges remarkably from that which is the rule in children. The more peripheral occurrence of foci of later life at least suggests that these represent reinfections from without; and, if we hold the theory of pulmonary infection through inhalation, such a presumption is almost necessary. Finally, it would appear that not all writers have grasped the real significance of the experimental work which has made us familiar with immunity. This work has *not* proved that infected, immune animals cannot be reinfected. It has shown, again and again, that they respond to reinfection with a modified tuberculosis which is more localized and becomes more chronic than that resulting from the first infection of a normal, nonimmune animal. Highly immune animals will develop this type of tuberculosis, even though rein-

fecting bacilli be introduced in relatively small numbers. They will suffer a protracted and well controlled infection, which, though it be comparatively benign, is active tuberculosis none the less.

It is, at present, probably safer ground and better science to accept and teach that some adults develop manifest tuberculosis from recently acquired infections, while others become sick from infections laid down in childhood. We are not infrequently presented with estimates of the relative proportions of disease due to each type of infection, but the very nature of the case prevents such estimates from being founded on anything much more accurate than bias or imagination. We have no way of accumulating the evidence that would give them scientific weight.

It is quite true that we have become familiar with statistics of childhood infection. Yet charts of these, it must be remembered, show us only the numbers and proportions of the infected at certain ages: they do not tell us a single thing about how many infections are first infections and how many are reinfections. Only work of a totally different kind would teach us this, and no one has ever even attempted it. No one has yet kept careful records, from infancy to and through adolescence, of the ups and downs, or the appearance, disappearance and reappearance of the Pirquet reaction, our chief and readiest index of infection, in only ten of the millions of infected children. We may be sure that infection is of every degree and takes

place as such,—as the result of the entrance of ten or a score, a hundred or a thousand bacilli or more, and all numbers in between; and that the effects, as represented by tissue reaction (lesion) and immunity, will be similarly comparable in degree, intensity and persistence. It is anything but improbable that, for longer or shorter periods, we would find a large proportion of children exhibiting nonreactivity, and therefore noninfection, where reaction and infection had been shown before; and further, that many of these would later again give the test of infection,—in their case, reinfection.

What little has been done in the way of repeated and prolonged observation of the individual child's response to infection tests—and it is little enough—has been concerned with clinic children. Most of these have been taken in hand for infections which had become so well established and had developed to such a point that illness or abnormality was noticeable. We must admit that the possibilities of the subsequent course of infection in these children would be quite different from those of the very slight and presumably transient infections that might follow the almost negligible exposures which befall many others.

But all this is speculation, even though it attempts to take into account compelling consequences of scientific observation and social and family relations. It would indicate only one or two wide gaps of knowledge which must be filled in before we may become too dogmatic about the obligate or pre-

ponderate development of adult tuberculosis from childhood infection.

Yet numerous cases of adult tuberculosis do spring from childhood implantations. The primary outbreaks of clinical tuberculosis of later life frequently emerge from a background of years-old infections. Anyone who comes in contact with many adult consumptives needs no better evidence of this fact than good and thorough histories, pieced together after searching and adroit cross-examination. Scores of these will satisfy every requirement laid down by the most uncompromising advocate of the puerile genesis of adult disease. Physical examination will again and again bring to light anatomic proof of hidden, long mute and never suspected residue, and thus clinch the testimony of past history.

So much seems certain. And part of our task to reduce illness and death from tuberculosis must reasonably entail efforts to hold in check more and more infections of early life and prevent these from developing to the point of danger. Any successful measures must, of course, proceed from an understanding of what factors convert benign infection into manifest disease.

My time will not permit a citation and description of what we may call the determinants of active tuberculosis, and an explanation of the action of these. It must suffice to point out that there are no doubt influential agents of inheritance and certainly numerous decisive elements of environment.

Through their interplay, combination and balance, infection advances or retreats, comes to light as manifest disease or is dampened into obsolescence or smoulders in obscurity, for longer or shorter periods, indolently or fulminantly, continuously or haltingly. Since the wellsprings of inherited factors are largely beyond our control, these will receive scant attention; their effects are, moreover, modifiable by environmental factors. Therefore, within the limited compass of this paper I wish merely to enumerate a very few of many measures which would promise a reduction of that adult tuberculosis morbidity which develops from childhood infection, a few measures which would appear to be practicable to application.

These measures would take the incident of infection for granted and proceed with the sole purpose of preventing its development at any time, or restricting this to a minimum. It is fair to assume that if all early infection were kept thoroughly inactive throughout childhood it would become so sclerotic and well invested that practically no adult disease would result from it and that, what is just as significant, much more of it would completely die out.

It should hardly be necessary to point out that, taking any population, or portion of it, in the mass, whatever tuberculosis exists in it will respond delicately and definitely to customs, habits, modes of life, and economic and civic conditions, as these affect the housing, food supply, sanitation, working standards, opportunities for recreation and employment of leisure, etc., of a community. If all these

are comprehended in what we recognize as public hygiene, then we shall find almost inevitably that where this is good and effective tuberculosis cases and deaths are relatively few, and where it is bad or backward they are many. So true is this that among hygienists it has become an axiom that tuberculosis statistics accurately reflect the state of general public health and the standards of living of a people.

This universally noted circumstance points out the road which our efforts with children must take. I can blaze no new paths for you. I can only repeat what everyone of you has always known,—that the surest way to keep tuberculosis reasonably quiet and hidden in children is to maintain their general fitness at or near par. Not the par that is represented by the average with a decayed tooth or two, a pound or so off weight, an irritating error of refraction that goes uncorrected, and hypertrophied tonsils and adenoids; but the par that would come from the universal practice of decent and salutary habits,—habits of sleeping and eating, of play and study and work, of toilet and of bath. Here we put our finger on the child at home, and it is just here where our hard work is cut out for us. *The foundation of public hygiene is really personal hygiene;* and the former will be efficient only as the average sense of personal responsibility and practice of a citizenry rises to the problem. Like real education, so all public health work must begin at home. The technique of this part of your work I leave to you. I have no program. Perhaps the

nature of the case forbids a program. At any rate, whenever public health work through its trained professional agents comes in touch with the home, I always feel that it should enter with a world of sympathy and understanding and a mite of machinery and statute law.

Let us turn to avenues which are immediately more direct. Because the foundation is in existence, and much of the machinery is ready at hand, and there remain only details of execution to fashion and refine, it would appear that the schools, public, private and parochial, are the most promising media through which this type of tuberculosis prevention is to be accomplished. There is at present much in the air in the way of plans and program and design; much that is sound; but how widely do performance and execution fall short of what *could* be done! Almost every child still contracts measles; all children, frequent colds: and in most instances these maladies originate from exposure in school. Add to these the number of cases of preventable whooping cough and diphtheria and tonsillitis and sore throat which are passed around in school; and we obtain an enormous case aggegate of avoidable diseases. It is just these and kindred unnecessary affections which have a good deal to do with bringing out manifest tuberculosis—in neck nodes and in lungs, and thence to bones and joints and even meninges. It may well be that in thousands of children these intercurrent infections give renewed life to tubercle which was just about to die out.

Because of them, many and many a focus, even though it were incapable of causing appreciable trouble in childhood, perhaps acquires a new stability which carries it along for years more, and into adult life.

It was perhaps inevitable that our laudable legislation to compel attendance at school should increase the opportunities for the spread of communicable diseases, and that the latter should outrun our efforts at control. But it is not so inevitable that we cannot catch up. Prevention of contagion—the means and skill to detect foci, the removal and segregation of carriers at the proper time, the keeping of weeds forever out of schoolrooms—means much more continuous and relentless attention to duty than periodic attendance on the sick. It requires much more and better medical service, much more honest and enlightened officials and much better informed public opinion than now exist in most places. To keep five hundred school children reasonably free from preventable and transmissible diseases might well require the full time of a capable physician. A political hack or favorite, such as the everyday run of doctor-politician, where he exists, a man, as a rule, of uncertain income in practice and of little skill in the detection of disease, cannot and does not look after ten efficiently. The time is coming when this work of school physician is going to be done by only the very best men who are specially trained for the task, who give all their time to it, and who, as a corollary, are going to be

paid accordingly. This is the goal which every public health body should aim at, the end that it should speed—this, and the awakening of the public to the fact that even in our political system the administration of public health affairs has an inherent right to be nonpartisan, nonfactional and beyond the reach of the liquidation of political debts. Let us get together and work harder than ever to do away with this endless succession of preventable minor—and major—disabilities which stir up tuberculous infections in our children. It will mean big future dividends.

There must be something in our manner of life which is producing the enormous incidence of diseased teeth, and hypertrophied or incompetent tonsils and adenoid growths in the nasopharynx in our children. At any rate, few reach ten years without some one or all three of these affections. Mouth and throat irritation or infection has, as has long been observed, a peculiarly intimate effect on the lymph nodes of the neck. These nodes adjoin and drain the mouth and nasopharynx, the two major portals of entry of tubercle bacilli. They are the most frequent sites of manifest tuberculosis in children. They are infected with tubercle several times as often as they exhibit frank tuberculous disease. Any tuberculous infection within them is directly and even markedly affected by any disturbance of their normal functions. Once we grasp the full force of all these relations, we begin to realize how much healthy mouths and throats may

mean in fending off active tuberculosis and in giving whatever infection may exist in neck nodes a chance to die down. To attain maximum mass prevention in this respect we have again no better medium than organized prophylactic efforts in the schools. And my formula once more would be more school physicians, on full time, and paid in a way to attract and hold the best talent; and, from the point of view of tuberculosis, a thorough appreciation on their part that the contributory excitant of tuberculosis in children is often a diseased or abnormal mouth or throat.

Children are peculiarly prone to the milder and more or less masked phases of clinical tuberculosis. This is fortunate for them. It is also our opportunity to prevent later and graver outbreaks. Many children come to our clinics with minor eye affections, usually phlyctenular conjunctivitis. Sometimes it antedates the appearance of tuberculosis of lymph nodes or lungs, while at other times it occurs during the course of these. But in a good many it may exist as the sole ailment, and our experience leads us to believe that an underlying tuberculosis is the causative factor,—an opinion which is gaining wider and wider currency.

It is not unlikely that some types of undernutrition are, instead of being a "pretuberculous" state, really minor manifestations of tuberculosis, and perhaps the only evidences of it. More comprehensive and searching studies may disclose this definitely, as clinical observation has long suggested it.

There are, besides, other children who may display their infection, for a time at least, only by skin eruptions, of which several are now satisfactorily determined as of tuberculous origin.

All this has become the knowledge of the man who sees a great deal of tuberculosis; but it has not yet entered the general ken of the practising physicians who see many children. Their better instruction in these phases of tuberculosis and an appreciation that sore eyes, or underweight, or rashes, even though they exist alone, may be the first warning signals of tuberculous infection, will undoubtedly bring about a better therapy and ward off many later and more serious manifestations. Such cases will be treated for their tuberculosis and not merely locally for their eyes or their skin or their digestion. Taken in time and put under a modified tuberculosis regimen, they respond well and escape frequently the clinical evidences of more advanced infection. Treated thus, and not allowed to go their way upon the application of ointments and powders, they will in many cases fall out of the ranks of future consumptives.

The prevention of adult tuberculosis which quasi-therapeutic institutions like the open air schools, or schools adapted to the peculiar needs of delicate children, can do is incalculable. Their beneficial effects have been called into question; but the criticisms thus far have not savored of common sense. There are no doubt matters of detail in their practice and management which will bear correction and

improvement; but if ever a method of "preventive therapy" were right in principle that of the open air school is. It, and similar measures, will repay any amount of development.

There is every reason to expect much good from such movements as the Modern Health Crusade. It may be impossible to estimate just what children assimilate from the instruction given them here. But the conclusion is inescapable that thousands will carry precept and practice, even though imperfectly, through childhood and into later life, and will translate into action and habit practices which on occasion will turn the scale in favor of the continuation and permanence of the inactivity of long-standing infection.

ANTITUBERCULOSIS MEASURES

Antituberculosis Measures[1]

SEARED and battered as few other epochs of the world the twentieth century is only completing its childhood; and let us hope that its survival from maladies that only yesterday seemed mortal presages a sturdy and productive maturity and a mellow senescence. Were we required to characterize with a word the point of view,—the spirit,—that animated most of us with the birth of 1900 I believe that not a few would select "comfortable." Comfortable we were and comfortable we expected to remain. During the last two decades of the nineteenth century the conveniences of life had developed and multiplied to such an extent that what had once been the luxuries of the opulent, or had even been beyond their reach, had become every man's necessities. And as the twentieth century added to its years, as its step became more certain and it began to reach out and grope for guidance into the mists of the illimitable future, it did so with far steadier hand perhaps than had ever drawn along any of the children of Time. For were we not at last masters of our environment? Had not the curse of our

[1] An address delivered under the title, "Some Aspects of the Problem," at the general meeting of the New Jersey Joint Conference on Tuberculosis, Perth Amboy, New Jersey, November 23, 1918. Reprinted from the *American Review of Tuberculosis*, December, 1918.

first parents lost most of its sting? Labor we must, yes,—and we must look forward ever to continue to labor. But we were to labor in a world such as our progenitors never even dreamed of. Electricity now carried us to our shops. To press a button was to light our way into our homes when we returned at night. A turn of the switch in our living-room, and heat began to radiate through the house. Every home boasted of arrangements that made for cleanliness, and therefore health,—arrangements that were not available for even the regents of man of fifty years ago. Almost everyone of us could sit in his easy chair and talk with his friend at the other end of the city. From our ashes we made us dyes of a variety and beauty that far surpassed those of the plants and beetles of the sleepy Orient, and we were led to develop our taste for ornament and for clothes; and possessing more than a necessity of clothes we were led further toward cleanliness and health.

Kindred examples might be multiplied at length. But what we would emphasize is that, if the tremendous increase and widespread distribution of comforts and conveniences made for any one specific thing, they promoted leisure;—leisure, which in its enormous aggregate must have a not inconsiderable influence on the mass-manifestation of many human diseases, and particularly on such maladies that owe not a little to stress and strain to bring them to light. Among such diseases tuberculosis undoubtedly takes its place. It is not my intention to discuss this

phase of the situation to-day, except perhaps to refer to it occasionally in the course of my address. But before leaving it entirely I cannot refrain from calling attention to the large part that customs and modes of life, operating over long periods, changing slowly, almost inappreciably and yet very definitely, if we consider sharply outlined economic epochs, must play in influencing the morbidity and mortality of a disease like tuberculosis. It will not hamper the student of tuberculosis if he is also familiar with the history of civilization.

By 1900 we had achieved a degree of physical comfort that was before unthought of, and I do not think it an exaggeration to venture that we were approaching a comparatively stable state of comfortableness in our mental concepts. In morals? Well, every age is certain of the absolute rectitude of its moral aims, even though a comparative reading of Marcus Aurelius, of Machiavelli, of Bunyan, of Pepys, and of Wesley, leaves the infant mind a bit confused. In politics? At no time were we white men more certain of our God-given function of "benevolent assimilators" than in 1900. In economics? Capital, and we are all capitalists at heart, was never surer of its complete altruism,—things moved only because we of the dollars at great sacrifice hazarded our dollars to put the wheels in motion and save those of no-dollars from starvation. In applied science? Man had embalmed the human voice to resurrect it at will. He had begun to fly in the air and to sail his craft in the depths of the ocean.

He was building cloud-piercing edifices to house a small city's people in a block. He was recording actual movements and actual colors in snap-taken pictures. And so on. Man could do anything. In medicine? Deep-lying structure revealed on a photographic plate; the disabilities of the human heart transcribed in peaks and waves on a film; the provocative causes of hitherto obscure infections discovered by the dozens; totally new and unfamiliar conflicts brought to light in the humors of the body; —all these and many more achievements accumulated to convince us of our mastery over the forces of Nature and to give us a comfortable sense of security as we faced the future.

And tuberculosis? Tuberculosis also caught something of the universal and contagious complacency. Becoming enthusiastic because of several remarkable discoveries made in rapid succession we began to make claims. Made bold by unexpected successes we began to predict. We could cure tuberculosis. We knew its cause—the tubercle bacillus. We were also sure of how the tubercle bacillus came to us. We could, therefore, choke it off at the source and prevent tuberculosis. Indeed, so flushed were we in the first days of our new knowledge that we set the date for the disappearance of tuberculosis, and few of us are so young that we cannot remember the banners that flaunted, "No tuberculosis by 1915!" Unmindful of the many disappointments of the past, careless of the one outstanding fact that is so familiar to the student of

tuberculosis, namely, that almost every new discovery, almost every penetrating ray of light, once its full significance was appreciated, had never failed to indicate how much more complex was our problem than we had imagined, we pressed boldly on and made up our antituberculosis program.

This program was simple and it was direct. Based on the several plain facts that I have just outlined it was thoroughly logical and understandable. It is familiar to you all and may be summed up in a few words: institutions for the sick, the detection of disease at its very beginning, and the control of the sources of infection.

Has it worked? I am told almost daily that it has not. But I always feel that the man who asserts that it has been a total failure and that it has contributed nothing to the salvation of the race is speaking altogether outside the facts. I know many men alive and highly productive to-day, who had the good fortune to become consumptive in the early nineteen-hundreds rather than in the eighteen-seventies. Thirty years before they would have been doomed to death, and most of them would have died. I also know many "trained" consumptives who have fought their disease to a successful issue, and who have done this with their healthy babies around them, yet who fifty years ago would have sent many of these babies to scrofulosis and to death, and passed the blame therefor to their inherited taint. There can be no doubt that our program of control and our vulgarization of information have

saved countless human lives and have prolonged ten times more. They have thus contributed tremendously to the potential and actual wealth of the world and have just as surely paid back to the people every penny they have ever received from them. A week's "sociological" inquiry will convince any unprejudiced person of these facts and should be sufficient to silence any caviling critic of the organized antituberculosis movement. But criticism there will remain and criticism there must remain, if our work is to keep from stagnating and if our methods are to be kept so elastic that they can take advantage of the newer concepts that fresh contributions to knowledge are continually introducing.

Thoroughly convinced that the organized antituberculosis movement has exerted a tremendously salutary effect and just as certain that every man who is interested in any way whatever in the conquest of tuberculosis should wholeheartedly and unselfishly work toward a common end through one organized body, I nevertheless do not consider it conclusively proved that our organizations have always made full use of the more advanced knowledge of the day or that they have adopted all this newer information to themselves and applied it in all its implications and ramifications, no matter where these led. For a while there were a certain fixity and nondevelopment of the original plans, first bruited about the beginning of the century. These plans, as I have said, were comparatively simple

and direct. Few will disagree that they laid an overwhelming emphasis on the dangers of infection and on the necessity of paying attention to the sources of infection. In other words, they only followed the leading thought of the day, which was the outgrowth of the tremendous bacteriological bias that Koch and his followers saddled upon preventive medicine. They were formulated at a time when common opinion held that tuberculous infection and manifest tuberculosis in all adults were almost simultaneous occurrences. And, if this appreciation of the tuberculosis situation had been a true one, I believe that as a public health body our National Tuberculosis Association would have made far more progress in combating the disease than the steady strides it has already taken against a problem of almost incredible difficulty.

Our awakening began almost so gently that most of us refused to be stirred up. We may date the dawn of this new day to the Pirquet test. This simple manoeuvre, put forward at first to aid us in diagnosis, to detect the consumptive even before he is aware of impending trouble, did not fulfill its original purpose. It did not point out who were tuberculous enough to be treated and who were not; and, viewed from this angle, it was a failure and exhibited a striking parallel to the fate of Koch's original attempts at the prevention and cure of tuberculosis. But never did a failure lead to more significant results! After several years,—after much grist had gone through the mill,—it was found that

the Pirquet test and all that it may mean had taught us many things that most of us would not have believed a decade before. Indeed, so multiform and far-reaching are its implications that it is my own opinion that with Laennec's promulgation of the unity of phthisis, Villemin's discovery of the infectiousness of tubercle and Koch's revelation of the bacillus, it makes up the quartet of really great episodes in the history of tuberculosis. And in some respects I consider the era of ideas,—ideas, many of which are still relatively embryonic and formless,—that it ushered in as the greatest of all.

It made absolutely certain what a very few sturdy souls had previously suggested and what still fewer admitted, namely, that the generality of mankind that lives in close association with its fellows harbors the tubercle bacillus; that is, that most of us become infected comparatively early in life. Try to think now of all the implications that this one bare fact conveys. What a vista of the ubiquity of the tubercle bacillus it at once opens up,—a ubiquity such as even the early bacillus-hunters from Koch to Flügge never even dreamed of! Where then shall we begin in our search and control of sources of infection? Why, with the man of "positive" sputum, of course. Granted;—and that too would be relatively easy; but where shall we go next? Why, to the manifestly ill who may not be emitting bacilli. Let us go even further and refine our diagnostic methods and attempt to ferret out those who are not yet ill but who are

about to become ill. We won't quarrel over whether this is possible or not: we shall set out to do it. Yes, and where then?—for we have thus far accounted for only the veriest fraction of the human race that is carrying tubercle bacilli abroad.

But,—you protest,—what difference does it make if nine-tenths of the harborers of tubercle bacilli, all healthy men, do carry with them the seeds of consumption? They are "safe" men. They are well and are not distributing bacilli among their neighbors.

Yes, they are "safe." But they are "safe" only so long as they are "safe;" and who is there anywhere so endowed that he can detect the moment, the day, the month, yes, in some cases the year, that they pass from being "safe" neighbors to a menace? And in this period of dawning disease, this indefinite time of diagnostic uncertainty before the patient seeks medical advice, how many cycles of infection, think you, can the patient initiate? It has always been my impression that by the time a very average and a very large number of us come to our physician because of our tired feeling, or our cough, or our lack of endurance, we have already fairly thoroughly tuberculized most of those who move within our range of intimate contact.

The Pirquet test gives us a method to make epidemiological studies such as is possessed by the students of no other disease. Equipped with it and its modifications we can roam the world and make observations on man and animals everywhere

and, with an error that is surely less than ten per cent, detect who is tuberculous and who is not. And when we observe infection among the very young, whose voluntary range of contact is quite limited, we should more than once be led to the detection of previously unsuspected sources. Epidemiological studies have been made, but all have been too limited and too sporadic. And we await the day when the state, or men of vision and large resources, shall make it possible for us to have ideas that are definite and well grounded because they are based on sufficiently broad observations.

How significant becomes what the Pirquet test now teaches us! If most of us harbor the tubercle bacillus and if at the same time but a small percentage of us ever falls sick with tuberculosis, then nothing can be more certain than that the development of manifest disease, the efflorescence of a "safe" man into a menace, depends not so much upon the mere presence in us of the seed,—in other words, upon infection,—as upon some other factor or factors that enter into our experience. Not all these factors are by any means familiar to us: indeed, we probably are acquainted with very few of them specifically. But I do not think that we generalize too rashly, if we are not too "scientific" to refuse to learn from clinical experience, and say that a large proportion of the outbreaks of manifest tuberculosis are attributable to nonspecific bodily effects that are brought about by what we may in general call "strain." Here we might classify the

circulatory changes that are set up around old, unknown and quiescent foci by such events as pregnancy and labor, intercurrent disease, sudden intense or prolonged and more moderate physical effort, emotions such as anger or worry, abnormal habits or dissipation. Though its *modus operandi* is disputed, most men to-day agree that strain is an all-important factor in bringing tuberculosis into the realm of consciousness; and, if this be granted, it must be equally true that its opposite, that is, relief or comparative relief from strain, will operate toward keeping quiescent tubercle in abeyance. It must therefore be perfectly certain that anything that leads to an amelioration of the general habits and conditions of life of masses or classes of people will work toward a subsidence of tuberculosis, epidemiologically speaking. And you will at once catch the drift of my remarks at the opening of this address, that in appreciating the significance of the ups and downs of tuberculosis as a folk-disease we must also have some comprehension of the civilization of a people at any particular period that may be under consideration.

Our statistics, particularly those of the earlier decades, are anything but satisfactory and complete. Nevertheless, they bring out one thing clearly. This is that the tuberculosis mortality rate began to decline in practically every country that was advancing industrially, and was therefore increasing in wealth, as early as 1850 and for perhaps ten or twenty years before. This, remember,

was thirty years before the discovery of the bacillus and when the disease was universally regarded as having a diathetic basis. In other words, tuberculosis began to abate its terrors before man intentionally applied a single measure to combat it. This fact must be familiar to you all and I shall not go into further detail concerning it. Personally, I can see only one reason for it, and this is the gradual bettering of the conditions of labor and living of the mass of the people that was ushered in markedly a little before the middle of the last century and took on a tremendously accelerated impetus after 1880 and proceeded at an ever-progressing rate with only one or two brief interruptions (from 1893 to 1897 and in 1907) until the release of Armageddon in 1914.

Public health men have on occasion not been slow to seize upon this phenomenon and to throw it into the teeth of our antituberculosis boosters and boasters that figures showed that our own efforts had contributed nothing to a lessening of the greatest of all plagues, but that this was brought about by forces that were intangible and over which we had no control. But truth is, that to speak thus is to argue, let us not say unfairly, yet nevertheless on a pinpoint. Such an assertion can be made to return like a boomerang upon the declarant. And, if we wish to draw comparisons and take a broader stand on the matter of infectious diseases in general, then, following out the same line of argument, we should come dangerously close to a negation of the effect of public health work in general.

If we examine vital statistics we find that, of the infectious diseases, a decline in the death rate that began before what we may call the bacteriological era was not confined to tuberculosis alone. This is true of a number of diseases that we may call endemic in this part of the world,—of scarlet fever, of measles, of whooping cough, and of the enteric infections. We do not know the provocative causes of scarlet fever and measles, and cannot therefore combat them by specific measures. Yet scarlet fever has shown a marked decline, both in incidence and malignity, since about 1870. It must be obvious that as the habits and modes of living of a population change there must be many balancing and opposing forces set in motion which make both for and against the occurrence of infectious diseases. On the one hand we should expect that the enormously accelerated condensation of population and the unexampled development of the means of communication that have been going on in the United States during the last thirty years would, if they were unopposed by contrary factors, favor the spread of many infections. But against such forces we may put the high development of home and office and factory sanitation, the better and more equable house-heating brought about by central heating systems, the tremendously increased interest in out-door play and sports, the reduction of the hours of labor, the more general enjoyment of vacations,—in short, anything and everything that contributes to the amelioration of social and domestic life.

We now take our enormous office buildings as a matter of course. We have seen architects erect the impossible and we have long passed the time when anything that is built can elicit an expression of amazement from us. Yet we seldom stop to think that, even though we were in possession of all the secrets of the assembling of structural steel and even though we could install our present-day elevators, it would be perfectly impossible to use these great buildings, to bring together myriads upon myriads of people on the ground-space of an acre, if we could give them no better sanitary appliances than those that were in vogue as recently as thirty years ago. Our great buildings depend just as much for their erection on latter-day plumbing as they do upon the development of the elevator and the structural steel industry. And, when we assemble people together as we do to-day, we are doing this under conditions that, as regards many infectious diseases, are relatively healthful compared with those that obtained only a few decades ago; and these physical conditions originated not in the minds of sanitarians and public health officials, but in that greatest of all stimuli for the betterment of man,—industrial ambition in its quest for wealth.

It must also be self-evident that as a community like that of Manhattan Island, in its necessity for growth and expansion, reclaimed and built up the vacant stretches and waste areas of land and erected buildings upon these, it unconsciously, with no thought whatever of public hygiene, brought about

conditions that were unfavorable to the development of several infections. Malaria would be one of these; endemic typhoid fever another. We might go on and develop this phase of the subject indefinitely. But I have already taken up perhaps too much of your time with it; and I have brought it in to illustrate that not all betterment of health conditions need be due to the intentional efforts of sanitarians, and to give point to what I feel, namely, that the public health official and "scientific" investigator, who now and again calls upon us to demonstrate mathematically the net results of our efforts and who seems inclined to dislocate credit from us to other broad and more or less intangible forces, had better analyze honestly just how many endemic infections he has, *by intentional intervention and by this alone*, diminished or subdued.

I am conscious of the enormous part that public health has played in making our residence on earth livable. As an outsider, I have always been proud of what our more enlightened and untrammelled executives have sought to do and have actually accomplished. But I also feel very strongly that, as a body and as an arm of the public health service, our own National Association has never stood second to any in tangible results, that it has had as much definite information at its command as is at hand to combat any contact infection, that in the main it has used this well, and that because of its personnel it is unique and works with far more "motive" than any other aggregation of public

servants in the world. For remember, the vast number of us are those who, having tasted, having felt, and having gained a personal and individual victory, have now enlisted in the most disinterested service. There are few of us who are in this fight for gain; still fewer for fame. But most of us work on because we have been taught by a great disciplinarian and because we would render back some of our mortal hours to the cause that gave them to us. And lest you think that I have now struck the level of sentimentality and that I am indulging more in oratory and in poetry than in fact, let me say that not so many years ago I expostulated with some heat with a man who has stood as high as any in our antituberculosis movement. I tried to point out to him that it was time wasted to spend so much of his precarious strength in public addresses and organized efforts to fight tuberculosis. And he replied that the movement initiated by Dr. Trudeau had given him back his life, that he owed everything he was and had to tuberculosis, and that the least he could do in return was to give up to it every minute he could spare. These were the words of a "lunger." And there are many others like him.

To come back to the disclosures of the Pirquet test. Let us ask how they square with the basic measures of prevention and control as these are embodied in our present program. Let us also seek to discover whether they teach us anything of value that might profitably be employed to supplement our orthodox efforts. But let us first run over

briefly the chief weapons of defense that we now employ.

The institutional care of the tuberculous sick has proved its worth and has come to stay. It is yearly rescuing thousands of souls from an early grave or adding to their years. Fundamentally, the principles that gave it birth are sound and will withstand any amount of shallow criticism. It has never yet been given a complete test, for the simple reason that no community has as yet seen fit to appropriate enough money to take care of every one of its tuberculosis patients for a proper length of time. But, even though this could be done throughout the entire nation, there is not the shadow of a doubt that institutional care *of itself* would not solve the tuberculosis problem. It would not solve it because infections would still be taking place,—infections that planted the seeds of potential consumption. And infections would continue to take place because it is unthinkable that more than a moiety of patients would be detected before they had reached the "bacillary" stage, clinically speaking. Therefore, before entering sanatoria a large number will have tuberculized many with whom they live and associate. Properly speaking, institutions for the care of the tuberculous have but small place among the measures of prevention and control. They furnish abodes for reconstruction, education and rehabilitation, and should be looked upon as such. From the point of view of preventive medicine the greatest argument that can be brought forward for them

is one of reasoning by analogy,—of comparing them with the lazar-houses that so successfully combated leprosy during the middle ages. But the analogy is not quite apt for reasons that would take us too far afield to discuss. We will here content ourselves with pointing out merely the differences of infectiousness between the two diseases, the differences in onset, and the differences in termination between two diseases, one of which goes on inevitably and in the main progressively to death, while the other is eminently a disease of "self-arresting" periods intermingled with relapses, progressions, and retrogressions, that no man can accurately predict, and not too many appreciate.

Even though it could be shown that, under certain happy hypothetical conditions which so far as I know have no counterpart on earth, the incarceration of all consumptives would be eminently a preventive measure rather than one of reconstruction, its complete success would be of necessity absolutely dependent upon making a diagnosis in every case of tuberculosis in a stage that precedes the emission of bacilli. This I do not consider even quarter-way possible or practicable. After reading certain discourses on early diagnosis, one would get the impression that the ordinary case of tuberculosis originates with the definiteness and abruptness of measles or the semi-obtrusiveness of typhoid fever. But I am confident that there is not a clinician here who will not agree with me that if there is any one feature that only too commonly characterizes

the onset of tuberculosis it is that it comes on in such a way that for a considerable time the patient has not the least idea that he is an ill man. He has symptoms, it is true; but what are they? Only too often the same slight disabilities that he has frequently suffered before, and which he more than once shook off. A normal man, unaccustomed to introspection, to hypochondriasis, and to unnecessary self-worry, will not run to a physician because of the slightest indefinite pain or lapse from full efficiency that oppresses him, and it is notorious how often we encounter these symptoms in people in whom we can find no organic basis for their complaints. It is just as notorious how often vague, indefinite and masked symptoms,—deviations from health that do not seriously interfere with a man's pursuit of his occupation,—usher in the full expression of tuberculosis. And it is no less notorious how far a tuberculous process may progress anatomically before it addresses itself more eloquently to the patient. All this is so well recognized that I would hesitate to hazard even a guess as to the mean length of time that elapses between the first manifestation of illness and the seeking of medical advice in the ordinary patient who begins his tuberculosis career as a case of chronic or indefinite onset. I only know this,—that I have seen a prominent pediatrician present himself to the phthisiologist for the first time twelve years after his cough had begun. And he arrived with both lungs "riddled" and sputum loaded with bacilli. I have seen an emi-

nent judge first ask for advice thirty-five years after his disease had given out its first warnings. And he came with cavitation in both lungs and a sputum count that might have caused Gaffky to create a new classification: yet he was a supreme court justice and had lost but few days of a busy lifetime from his labors. I also know of a pathologist who for eight years had the symptoms that we classify under the cardio-gastric type of onset, who at last had râles that came and went, and who finally went on to bilateral disease; yet although under constant observation by the best men he was not declared tuberculous until bacilli appeared in his sputum after nine years. The day of his first manifestation of bacilli must of course forever remain unknown, as must the damage that he did between the first "show" of bacilli and the time of their detection.

These cannot be exceptional instances. And they must make us wonder that, if such things are so, what then is going on among the more uninformed. We can only speculate: and I do not believe that the most florid imagination will over-daub the canvas. But, if a large number of patients will not seek medical advice until some time after the first manifestation of symptoms, and if the diagnosis of pulmonary tuberculosis can offer insuperable difficulties to the best physicians,—and I do consider that both these provisos are actualities that complicate the tuberculosis situation,—then it is manifest that even though every medical man in the

world possessed a degree of diagnostic skill that is at present unimaginable, there would still be ample opportunity left for a fair saturation of the world and the people who live therein with tubercle bacilli. And this statement of necessity carries with it the corollary that, as a measure of control and prevention, early diagnosis must ever be a limping sister. Early diagnosis can be made, but in practice the early diagnoses, actually made, will always be disappointingly below the ideal.

No, to be *of itself* an adequate preventive method we should have to imagine that the following grotesque approach were workable, namely, that every man, woman and child submit, not monthly, but weekly or even daily, to physical examination and questioning by a competent clinician,—by one who has "tuberculosis judgment." I say not monthly but weekly or even daily, because tubercle bacilli that have been turned loose can get to many harbors in the space of a month. I use the term "competent" advisedly, for reasons that must be apparent to all of you.

Whenever I think of early diagnosis, I think of it, not as a preventive measure essentially or as one of control, but, like institutional care, a salutary measure. And I am never tired of emphasizing that the more physicians there are or will come after us, who from a proper adjudication of history, symptoms, and signs can arrive at an appreciation of the earliest manifestations of clinical tuberculosis, the more human beings there will be who will be

snatched from the ravages of the tubercle bacillus. Early diagnosis will reduce somewhat the chances of infecting others, but, if we honestly face all angles of the situation, the rôle it can play in limiting infection must be as a drop in the bucket. Nevertheless, because it is a life-saver, it must ever remain the keystone of the clinical arch of tuberculosis.

We come now to the matter of infection. And here I must pray that I be not misunderstood.

As nearly as I can determine, infection has been the shibboleth of the antituberculosis campaign. Now and then I go to a tuberculosis exhibit. I see posters everywhere, portraying what we must avoid in this everyday life of ours if we are not to gather to ourselves the tubercle bacillus. I see very visible sneezes and coughs projected toward innocent bystanders. I see clouds of dust cast up by the sweeping broom to the nostrils of anyone who happens to be in the way. I see Susie using Johnny's tooth-brush. I see a pale, though heartless, mother imprint the kiss of instinct, but here of death, upon her baby's lips. All this and much more. And the implication is always plain. This dust, this mouth spray, this vicarious tooth-brush, this kiss, is the cause of consumption.

But is it?

I don't believe it is. It may propel into us the tubercle bacillus. It may even start the anatomical reaction of tubercle. But the number of times that it goes straight on to consumption is negligible,—so negligible that I don't think that we need concern ourselves overmuch about it.

Why should we concern ourselves about the *mere presence* of the tubercle bacillus in our bodies? The Pirquet test has taught us that all who take their places in normal society have it engrafted in them. Yet the workers of the world go on, creating and undoing, and amassing and dissipating, all infected, yet few invalided. Considered by itself, therefore, mere infection is hardly worth paying attention to. It is the normal lot of man. The pessimist, upon first hearing of the universality of tuberculous infection, will throw up his hands and exclaim, "What's the use?" The optimist will throw up his hat, and declare, "It can't be so bad after all. Everyone has it, yet few are sick."

We should take a far firmer hold on this fact than we have done heretofore. We should spread it broadcast. We should drive it home to every man that before adolescence tubercle is more common than hair on the face, and after forty more common than hair on the head; and in a great proportion of instances not so troublesome, unless he makes it so. In 1900 it was infection that we were interested in; and naturally so, for it then meant disease. But to-day it is again consumption and its prevention that are our province, for we have learned of how little moment mere infection really is. Yet we should continue to cry out, as eloquently as ever, the dangers of infecting others; for, in the vast majority, the train of consumption is laid by the careless and negligent consumptive.

I have thus far not dwelt upon one phase of the antituberculous movement that organized effort has

always made more than one-half of its program, and which must ever remain its chief function. This is education, so called.

But what is education? Whom shall we educate? And what information shall we impart?

In propagandism we speak much of education. Only too often we seem to imagine that its beginning and end are the dissemination of information. Yet real education is vastly more than this. To scatter broadcast and aimlessly what he knows is wasted time for any teacher. The process of education presupposes that besides being given our information is received, understood and assimilated. Only too often we teachers cast our pearls before swine. Only too often, too, we consider our function fulfilled when we have thus delivered ourselves of a weighty homily. And much of the education of health associations has, to my way of thinking, often proceeded in this haphazard fashion. Therefore, when I am told that to-day the people and the medical profession are already "educated" as regards tuberculosis, I react with a gesture of scepticism and unbelief. That tons of literature have been scattered to the four corners I do not doubt. But that pounds of what is really worth while have sunk in I do doubt.

The remedy? Why, teachers: teachers who can make their point, who can inspire and who can direct. If it be desirable to instruct youth how to take its place in the world and make its living, how much more important is it that it be taught

how to preserve its life! Under the patronage of the state a highly organized body of unselfish men and women are preparing our sons and daughters for the duties of life. And had I my way I would see to it that we of the National Association would select a great corps of the most elect of mankind, of teachers, and send these out to tell their fellowmen how they may preserve their lives. I should attempt to have these teachers trained in all the essential particularities of tuberculosis and of public health. I should send them to the people and I should send them to the physicians. And what would I have these told?

Much more than I can here take up to-night. But I would have emphasized that consumption, a gaunt, manifest upheaval of pulmonary infection, has its birth, not so much, if you please, in an erstwhile localization of the tubercle bacillus, but in any and every event that makes man unhealthy. I would have them told that to be spat upon or coughed upon by the man with the "common cold" does not upset me because I might merely acquire a cold quite so much as that this cold might fan my quiescent pulmonary tubercle into phthisis. I would have them told that the delicate woman who was about to fulfill her grandest function should be handled just a little differently from the sturdy one, —that her labor should be shortened, that her lactation be directed with the possibility of manifest tuberculosis kept ever in mind. I would have them told that over-strain, whether physical or mental, or that dissipation was to be avoided, not *because it laid them*

open to infection, but because it supplied the oil to a wick that was already present. I would have the emphasis laid on the behavior of the human being and not on the bacillus. And I should thereby be contributing not only to a solution of the tuberculosis problem, according to the best information available, but also to that larger problem, that of public health in general.

After all, there are only two conceivable short cuts to the eradication of tuberculosis.

The first is the universal use of a remedial agent that would cure any and every type of disease without harm to the patient. We would presume that such a preparation would be bacillicidal. If it were capable of curing every case of manifest disease and could at the same time sterilize all tissues we would presuppose further that it could free from bacilli all foci that lay concealed in those without manifest disease. If, therefore, we were in possession of such a potent medicine, we could at any given time, by edict or by common agreement, administer it to all people and to all animals that are susceptible to the tubercle bacillus and at one grand stroke wipe out all tubercle bacilli that were in parasitic association with tissues. And this would undoubtedly mean the end of tuberculosis on earth.

The second short cut would be to administer to every nontuberculous person and to every newborn susceptible animal over a period of several generations a something that would immunize them in a way that they would be secure from any tubercle bacilli that attempted to gain lodgment in their

bodies. This, manifestly, would be a more leisurely method than the first; for with only this weapon in our armamentarium, before the bacillus disappeared, we should be obliged to wait until the present myriads of victims,—our phthisical grandfathers and our tuberculous children as well,—squared accounts with their unwilling and ungrateful guests,—obligations of a kind that are never adjusted with finality till Death, the only nonappellate arbiter, comes between. The more halting of the two, this procedure would, none the less, also spell the end of tuberculosis.

Neither of these short cuts is in sight, nor can our generation hope to take the journey. Meanwhile, I would stress that the prevention of tuberculosis is for the most part a prevention, not of infection, but of manifest disease; and that all our efforts should be directed to a supplementary reëducation of physician and layman alike, and to the study of every factor that makes infection disease. And, at the risk of unnecessary repetition, I would also point out anew that there is no one shining beacon to lead us to the control and prevention of tuberculosis. The very complexity of the situation forbids this. I would not abate one jot or tittle of any tested method that we have employed. But I would take advantage of what the last decade has brought to us and lay the onus on the human individual rather than on the infecting microörganism.

The opportunity for service in antituberculosis work is tremendous: so tremendous as to appall the

individual who for the first time casts his eye over the fields to be made over and the roads to be travelled. The opportunities for philanthropy are no less great and in no human endeavor will money spent yield more certain and rich returns. We must have a goal and this goal must be the complete taking over of the tuberculosis situation throughout the world. We must cry for money and money and still more money, and never cease until the mass of mankind realizes the situation and is responding to it. Then and then only can we say that we are in a position to wage a real battle against tuberculosis. An effective fight would presuppose an organization, the spirit and model of which could be found only in the religious orders of medieval times. Our sisterhood, made up of thousands who have given back their lives to tuberculosis, would live among the sick and bring them back to a measure of effectiveness. Our friars would go up and down the land instilling the people with the truth,—the truth of the universality of the tubercle bacillus, the truth of the magnitude of its mortal effect, the truth of the inciters of the tubercle bacillus to action, the truth that everything that makes for the internment of the tubercle bacillus within ourselves makes for better living and higher efficiency and that everything that makes for better living and higher efficiency makes for the internment of the tubercle bacillus. Without rest, without interruption or let-up, we must keep all this before the people, while our priors and our abbots are busy in recording the peculiar habits and

characteristics of the enemy and the responses and reactions of the body to it. Acquisition of all information, broadening, intensification, growth, and development, must never cease in our plans of campaign. Apologetic we need not be and dare not be; and no real worker should be obliged to approach the shrine of wealth with hat in hand to ask for a pittance for the cause. It is the glory of mankind that it has always been responsive to necessity; and real information that brings about an adequate appreciation of the necessities of the situation will always loose the purse-strings.

Nor is there room in the antituberculosis movement for a single note of discouragement. The pessimists among us can be only those who are deficient in grasp and breadth. Civilization and tuberculosis are cotemporaneous; the number of the tuberculous and the number of civilized beings are almost coequal: therefore, to despair of tuberculosis is to despair of civilization. A graft that is as much a part of us as is the development of our ethical sense cannot be lopped off in a day; but it can be kept from flowering and bearing fruit. And, until we can wage direct warfare on the germ, to keep it in the seed should be our main purpose.

THE TUBERCULOSIS PROBLEM

The Tuberculosis Problem[1]

EVERYONE knows the score of tuberculosis: an intolerable evil, because of its millions of preventable deaths; an enormous waster, through its withdrawal of millions more of people from productive life, its economic wrecking of innumerable homes, and its tax on us for the relief of the disabled and impoverished; an ever-menacing peril, obscure and furtive in attack and development, and deceptive and treacherous in its course.

As long as the weight of opinion documented tuberculosis as an affliction which was inescapable for its victims and transmitted from parent to child through a constitutional vice, society could afford to be indifferent to every one of the countless tragedies and disasters with which tuberculosis splotched its multicolored fabric. Indeed, society had no other way than to survey with folded hands the ravages of the disease, as the members of society were wont to examine nervously their family trees and take comfort or alarm therefrom.

The moment that the scientific world accepted Villemin's demonstration of the infectiousness of

[1] An address delivered under the title, "Solving Tuberculosis, a Many-Sided Problem," at the open meeting of the ninth session of the Mississippi Valley Conference on Tuberculosis, Columbus, Ohio, September 12, 1921. Reprinted from the *American Review of Tuberculosis*, December, 1921.

phthisis, the identity of scrofula with tuberculosis, and the relationship of the pearl disease of cattle with human tuberculosis, the attitude of society began to lose something of its passivity. It awakened to the fact that it could resist. And when, a few years later, Koch placed before men's eyes the actual cause of the disease, society turned to fashion the weapons of defense.

Not even the wisest seer can ever comprehend the full importance or ultimate effect of the most insignificant discovery. Truth discloses itself grudgingly and never, at any time, more than partially. Little by little it comes to our senses and, variously interpreted, takes its place in consciousness; and, if the past teaches anything, this is that every new secret wrung from Nature makes necessary a revision of our conception of its last revelation. At the same time, we are prone to use the truth according to our prejudices and habits of ratiocination;—habits laid down through all our ages of ignorance. To us, tuberculosis would seem a perfectly hopeless and insoluble human burden, if we believed it wholly, or for the most part, to be on an inherited basis. Yet, to at least one of Villemin's opponents, the idea of contagion made the situation one of utmost despair. Pidoux, of the French Academy, was no doubt wholly sincere when he attacked Villemin's experimental proof with the following sentimental broadside:

> "What a misfortune if things should turn out in this way! Social economy, private and public hygiene, prophylaxis, medicine —all condemned beforehand in their aspirations and their efforts! The poor consumptives sequestered like lepers! Family affection at war with fear and selfishness, against a disease whose protracted course and homicidal atmosphere bid fair to wear out devotion! If phthisis is contagious, we dare not say it aloud."

From that day to this we have said it aloud; in tones which would seem vociferous to Pidoux; in terms, however, which have shifted with increment of knowledge and have been revised and readjusted to fit in with each new bit of information. Meanwhile, families have held together; and medicine, prophylaxis, and private and public hygiene have flourished with renewed vigor.

All of you are again familiar with how hard the road has proved to be since Villemin's and Koch's time. I imagine that to the enthusiasts of thirty and forty years ago it suddenly broke into view straight and direct, an open path across the maze of existence. There was a disease, consumption. Many adults, but few children, had it. It was contagious,—in somewhat the same sort of way as diphtheria was contagious. People came in contact with other consumptives, at home or abroad, inhaled the germs and, not long afterward, fell ill

with cough, fatigue and fever. Their physicians now had an easy method of discovering tuberculosis in them: a sputum examination would tell the tale. Brehmer, Dettweiler and Trudeau had shown how remarkably consumptives responded to measures of treatment.

The tuberculosis problem was made up of a few simple elements, all easy of attack. Detect consumptives by examining their sputum. Treat them in sanatoria and cure them. Their constantly diminishing number will in time remove the sources of infection. Only consumptives have tubercle. Therefore, clean up every consumptive's surroundings and cook animal food, for these are the only sources. And, while Bayle in 1810 had called attention to quiescent tubercle in those in whom it was never suspected during life, and Laennec had warned of the dangers of false convalescences, or relapses, most men had forgotten this.

To drag into the light the truth about tuberculosis, to make still more simple the problem, to find the cure and the preventive, and to cut off infection, workers swarmed to its study. Events crowded thick and fast. And, while the specific and the preventive and the cessation of infection yet remain to the achievements of the future, few diseases have been so fruitfully and profitably studied. In a short time we have gathered a body of knowledge concerning tuberculosis that, despite unanticipated difficulties in its pursuit, is singularly authentic, and exceeds perhaps that of any other major disease.

It has taught us more about the etiology of tuberculosis than we may affirm about our common, transitory, self-limited infections, which should apparently be much easier of solution. It has refined diagnosis of a disease of protean pathological manifestations to a point which is unique in infections: nor would we here, without argument, except the case of syphilis. It has made possible the detection of infection at a time that is long antecedent to its manifestations. It has given us peculiarly exact standards for the accumulation of epidemiological data. It has provoked the contrivance of prophylactic measures which public hygiene in general is using with telling effect.

The trouble is not, as some would have it, that we do not know enough about tuberculosis. We cannot know too much about any menacing condition that confronts society: and we surely do not know everything about tuberculosis. So much is certain. But to me it seems rather that our present predicament, if (as some assert) there exists one, proceeds from a jumble of uncrystallized, unassimilated and imperfectly applied knowledge. We suffer from an excess of wealth which calls for better bookkeepers than our feverish quest of the lodestone has given us time to train. Bent on stumbling upon the nugget, we have been blind, only too often, to the meaning of the finer grains that have come to hand. Yearning for formulas, for concretes, for catchwords even, we have not got down to nor encouraged the sifting of basic prin-

ciples from masses of conflicting data which have grown to discouragingly enormous proportions.

For in no single phase does tuberculosis present as simple an aspect as imagined by the pioneers. As concerns its social relations, its place in nature, it is time to stop looking for simples in tuberculosis. Every new fact during the last forty years has all the more loudly called out the warning for us to beware of the man who can perceive only one method of infection, one cause of onset, one diagnostic sign, one infallible test of prognosis, one method of prevention, one factor of resistance, one means of cure of tuberculosis. The bases of tuberculosis are almost as broad and large as its effects; its own *mise en scène* as variegated as that of the world in which it plays its part and which it reflects. Its effects reproduce its causes; and give birth, as well, to many nonspecific and apparently unrelated conditions which in turn propagate more tuberculosis.

Gradually we pushed back the onset of clinical tuberculosis from the observation of germs in the sputum to the detection of certain signs in the chest. We made the ferreting out of the early cases of tuberculosis the centre of our combat against it. As a first step, the physician had to be taught a new mechanism of diagnosis and its meaning. In time, however, we learned that many undeniably healthy people presented these infallibly diagnostic signs, and not long afterward became aware of the widespread incidence of infection in those who were not

in the least danger of falling ill with tuberculosis. Diagnosis and etiology began to take on new values. When is a man ill with tuberculosis? Is it his signs, his symptoms or his history that should send him to the sanatorium? Physicians will still disagree on these two questions, but the old dictum of the earlier the diagnosis the better the chances of lasting cure remains unimpaired.

Appreciation of the universality of infection made inevitable a more critical examination of our views of infection and etiology. It was hardly credible that everyone had been in direct and intimate contact with a consumptive—the idea of infection twenty years ago—or had ingested infectious cow's milk. Only a more catholic view of the possible methods of infection could fit the facts.

For most of us, ordinary single and isolated incidents of infection are likely of slight moment. The etiology of manifest tuberculous disease is more and more regarded as bound up in two factors, namely, unusual opportunities for repeated infection and unfavorable environment after infection. What constitutes an unfavorable environment is, in general, understood accurately and in detail: and, just as it may swing the balance in the arrested case toward relapse, so it determines disease in the harborers of infection who, in better surroundings, would keep their infection quiescent. What proportion fall ill because of repeated infections and what proportion because of debilitating environment cannot be estimated; but all signs point to the latter as the more active influence.

Thus the facets of our tuberculosis problem have continued to expand and to multiply: we could go on, and cite instance after instance of the light of new discoveries throwing its rays upon new and unexpected contingencies. We now reëmphasize what has become an old story. Infection, of itself, is relatively unimportant—broadly speaking. The problem of preventing the outbreak of frank disease in the legions of the infected is the crux of the programme of prevention; and, in the whole scheme of tuberculosis, yields first place to only the pressing duty and necessity of providing means to restore to health those already ill.

It is when we come to follow this phase of tuberculosis that we gain some realization of the true place of tuberculosis in our daily affairs and the delicate interrelationships between it and society. More or less poverty in a community will mean more or less tuberculosis: so will more or less crowding and improper housing, more or less unhygienic occupations and industry, more or less occurrence of other diseases, particularly respiratory infections, etc. Under the circumstances our duty, our program, is plain and permits of no equivocation. It is to contribute to the attainment of civic decency and cleanliness; of light, space and food enough for all; of a rational proportion of working and leisure hours for those who cannot dispose of their own time; and of the reduction of preventable infections to a minimum.

The solution of the tuberculosis problem is, therefore, partly dependent on the removal of other

evils and inequalities which constitute, no doubt, a more fundamental social problem than does tuberculosis itself. We may not at all times be able to fall in with the propaganda that aims to arouse man to the accomplishment of apparently remote objects which would undoubtedly have a direct, though unintended, effect on tuberculosis. Time and again, in the welter and narrow provincialism and chauvinism of issues, I certainly cannot. Yet there can be no question as to what direction our sympathies and activities as tuberculosis workers should take. They must ever be enlisted in whatever makes for equality of opportunity, intellectual and material: they must strike at civic neglect and pillage: they must bring home to the people how inevitably is tuberculosis the child of their dirt and darkness and deprivation of the comforts of life: all this after individual responsibility is given its place; and all this, too, with the strict proviso that as a health organization we dare never become involved in politics or in class conflict. It is for us to point out the way as concerns tuberculosis: it is suicidal to our cause to allow our devotion and enthusiasm to outrun our whole responsibility to mankind. I may, for instance, look upon tuberculosis as a terrible evil, yet I should regard the abrogation of certain fundamental Anglo-Saxon rights or the disruption of some features of our social and economic structures as far greater catastrophes, even though it could be shown me that the latter would surely bring about the abolition of tuberculosis.

We have been going ahead. With never a thought about tuberculosis, society has contributed to its decline. If you doubt its decline, read the mortality returns for the last few years. Bunyan's designation of consumption as "the captain of the men of death" no longer holds—in this country at least—and we speakers on the subject have thus been deprived of our thriller of an opening phrase.

Without reckoning on tuberculosis, society has slowed its sweep in many ways. The demand of city dwellers for better and cleaner streets, for parks, for public utilities within the reach of the poorest, for public schools which make your and my old ones seem like pesthouses, for medical inspection of schools—in short, for something in return for their taxes; the revolution—for it cannot be called less—in factory and office architecture and in plumbing for every purpose; the remarkable suburban development of our cities; the new principle and policy of vacation periods for wage earners; the unparalleled vulgarization of good dressing and many changes of clothing, with its attendant cleanliness and psychic uplift; the astonishing increase in popular amusements, with a coincident diminution in household "chores" and labor; the extraordinary expansion of private and industrial insurance, which has mitigated economic shock for millions of dependents: all this, and much more besides, can have had no other effect than to aid in fending off tuberculosis. It has more than balanced provocative factors, such as the ever growing trend of the popu-

lation from country to city, the immeasurably better facilities and the cheapening of the means of communication, and the far greater speeding up and strain of modern industry.

It is plain where our duty and our work as tuberculosis campaigners lie. It must be evident to all of you that increase of comforts, of leisure, of food, of space, of the individual means to obtain these, can come only from increased wealth which, whether we approve or not, results only from increased productiveness. And, while attempts to push production may, *per se*, involve the very strains and hazards that bring on tuberculosis, it is for us to get behind and encourage every ameliorating factor at the same time that we are trying to reduce the unnecessary friction that enters into the supplying of our necessities. Develop whatever is at hand, which you know serves your purpose: in this way you will come to a task that becomes ever lighter. Cease hankering after the hypothetical and the untried, that is, if this means your apathy and the destruction of what is known to have some good in it: for remember that tuberculosis has always shown itself to be almost uncanny in its use of actual conditions and opportunities.

There are not a few men who have been so impressed by the decline of tuberculosis, which parallels *in time* the birth and development of our industrial era, with its marvelous expansion of wealth and comforts, that they will allow nothing to intentional efforts to reduce the inroads of tuberculosis. It is

only fair to say that mathematically we can no more refute them than they can prove their point: and, since they cannot prove it, it would seem little to our purpose to attempt a refutation. Yet it does seem curious that our larger life insurance companies which can have not even a sentimental interest in the organized tuberculosis movement, provided we have merely been beating the air, are continually calling attention to the reduction in mortality *that has been brought about by organized endeavor*. I leave the mathematical calculation of spatial relations to their own trained statisticians, with more confidence than I would have in my own ability or that of our sceptics to interpret the meaning of figures.

At the moment a chart of the death rate from tuberculosis in New York City lies before me. It shows that in 1900 the total death rate was 280, made up of a rate of 237 for pulmonary tuberculosis and 43 for other forms. I think it will be conceded by all that, in the twenty years that have elapsed since our pre-National Association days of 1900, we have made some progress in diagnosing tuberculosis and a marked advance in reporting deaths from it. There are to-day not nearly the ignorance and concealment of tuberculosis as a cause of death that existed then. Yet the chart shows a total mortality rate of 126 for 1920, the resultant of 109 for pulmonary disease and 17 for other forms. It is simply unbelievable that so remarkable a decline represents merely the reflection of social and eco-

nomic betterment on tuberculosis—through a period which suffered a war, several years of unusual pneumonia mortality and an unexampled scourge of influenza.

Without our sceptics and apostles of negation we would no doubt lapse into flabbiness, smugness and inertia. We should welcome them; yet we must always insist that they prove their case, for I cannot recall a single important measure, undertaken by the organized antituberculosis movement, which was not based on the best scientific information available at the time. It is all very well for the man with mind centered on the biology of the germ to tell us that we are all wrong. It is his privilege; but he must have something better than dreams and speculations to make us turn from due and proper attention of the victims of the germ. It is again within everybody's province to toss off a sweeping condemnation of sanatoria as places for the relief of tuberculosis: we might even aid and comfort him with statistics, got up in a certain fashion. But we must ask whether he understands the functions of sanatoria and whether their limitations are inherent or are merely phases of a situation which society has neglected to meet and which are beyond the control of the sanatoria.

I mention sanatoria advisedly, for the reason that I find myself reading more and more about their uselessness. Now, anyone with a taste for numerical literature and hardened in the reading of sanatorium reports, will soon appreciate two outstanding

facts about sanatorium patients. The first is that they do extraordinarily well while in sanatoria. The second is that, by about twenty years after they have left the institutions, most of them have died of tuberculosis.

To me this combination of circumstances proves only two things, namely, that sanatoria are excellent places for consumptives and that the world outside of them is the very reverse. It indicates, moreover, that if we had more sanatoria, enough to keep patients for a much longer period than the customary six months of residence, many more would survive the shocks of everyday life to which they return. For the last twenty years no one familiar with sanatoria has imagined that the ordinary patient, obliged to return to home environment and in many cases contribute to family support, can be "cured" of tuberculosis with even the remote expectation that he stay "cured." Few would venture the opinion that a well managed sanatorium ever harmed a consumptive; but there are thousands of former consumptives who would testify that sanatoria had saved their lives, thousands who experienced a return to health during their stay in the institutions and who, favorably situated afterwards, avoided relapse by following out the precepts learned in them.

That many, perhaps most, sanatorium patients ultimately die of tuberculosis is no fault of the institutions or the principle that brought them into being. It signalizes a gap, and an important one,

in our present methods of solving the tuberculosis problem. It points out the need of some helping hand, some adjuvant, for discharged patients; to lift them over the rough places and make easier for them those three or five most critical years that follow a first arrest of clinical tuberculosis. That Doctor Pattison of the central office of the National Association is at present working out plans to meet this need, as reported in the August *Bulletin of the National Tuberculosis Association*, is one of the most heartening pieces of news that we have had in several years. Better care and supervision of old patients is a situation which must be met and will be met. Its returns will be large: a reduced ultimate mortality, more complete records and control of our vast shifting tuberculous population and many more returned to industry will surely result.

We have thus far touched upon diagnosis, the development of phthisis, the reduction of mortality, the prevention of infection, sanatorium treatment, and the supervision and rehabilitation of arrested and treated cases as elements of our tuberculous problem. The reduction of mortality, the development of phthisis, the prevention of infection and the rehabilitation of treated cases present the major complexes for solution. Of these, the reduction of mortality is perhaps the most important, because it is at any time the most immediate and pressing problem, involving, as it does, the care and treatment of the positively tuberculous.

We attack the problem of mortality from several angles. We aim to restore to health those who have fallen ill; and here enter our problems of treatment. We know to a certainty that the earlier a case of active tuberculosis is detected, the greater are its chances of arrest and cure: here crop up our problems of diagnosis, of medical education and of bringing home to the lay public the possible significance of the more common symptoms of tuberculosis; for the all too frequent failure to start patients early enough on the road to treatment is due quite as much to their own disregard and neglect of first warning signs as to the ignorance and slackness of physicians. Most deaths from phthisis occur, not at the end of a continuous illness, but after a protracted up and down course of alternating periods of comparative well-being and relapse: the solution of our problems of so called after-care and of adjusting the consumptive to his environment is, therefore, bound to be as necessary as any, and I am confident that it will be worked out. Since there would be fewer deaths if fewer people fell ill with tuberculosis, the problem of mortality is intimately related to and dependent upon that of the development of phthisis.

I should say that at present the last named major problem, that of the development of phthisis, ranks second only to that of mortality. Broadly speaking, it should take first place, for it is the heart and kernel of the whole tuberculosis situation. We can certainly reduce our death rate most effectively and

economically by preventing illness. I imagine that if we could have accurate and adequate records before us, we would find that the proportion of mortality reduction brought about during the last half-century through the broad influence of social and economic changes has depended largely on the fact that fewer people are falling ill with tuberculosis. Several men, now well along toward seventy, have mentioned to me that it is their impression that consumption is not nearly the common disease it was when they were younger. Allowing for errors of diagnosis and the contracting circle of friendships and acquaintanceships of advancing age, it is nevertheless probably true that consumption,—advanced pulmonary tuberculosis,—has undergone a notable reduction of incidence.

The problem of the development of phthisis is our most complex one, and goes deep—deep into our most involved knowledge of pathology, infection, resistance and heredity, and deep down and through our social and economic structure and the habits, customs and activities of man. It cannot here be gone into with any detail: and only a few observations must suffice.

The occasionally expressed opinion that there has been less tuberculosis or more benign forms of it during the last hundred years, because during this period universal infection has been bringing about the natural immunization of human beings will hardly bear serious analysis. As a major cause of

death and illness tuberculosis has been taking its toll for thousands of years. The situation as regards infection in cities, in homes where consumption existed, and in ordinary traffic and intercourse must always have been worse than it is to-day. For centuries tuberculosis had apparently maintained a level of "saturation" throughout Europe, and began its noticeable decline with the dawn of the universal lightening of man's labor by machinery and a consequent enormously accelerated multiplication of wealth. There can be no doubt that infection confers a measure of specific immunity; but it is difficult to understand why this immunity has been operating through only the last fifty or a hundred years. As a matter of fact, the major part of the people of Europe must, for centuries, have been infected and as immune as they are to-day. In 1913 the inhabitants of Europe were surely as immune as they were in 1910 or are to-day; but along came a war, and active tuberculosis increased by leaps and bounds, to levels that had not been recorded for decades. Wherever the sum total of prolonged stress and deprivation was greatest, there tuberculosis made its greatest gains. This fact will serve to give us some insight into what brings on tuberculosis and what stays its hand.

This phase of the tuberculosis problem and public hygiene are peculiarly interdependent. Both are advanced by ceaseless effort to better conditions under which we live and work, and by educational propaganda. Slow and long-continued medical

observation of delicate school children and special schools adapted to their physical needs are bound to prevent the outbreak of many cases of tuberculosis in both childhood and adult life, as well as nip in the bud many others which may be developing. The popular education of children in tuberculosis and public health and the organizing of them into "health clubs" have only lately begun. Both cannot help having a decidedly salutary effect. It is safe to say that, where one child knew something about tuberculosis ten years ago, a hundred do so now. But it is not in personal application where we must expect the greatest effect: it is in familiarizing coming generations with tuberculosis and its results, in such measure that the citizens of the future, with sympathies and interest long before awakened and maintained, will be all the more accessible in giving their support to the warfare against tuberculosis. No matter how slight or vague may be the immediately direct and apparent results, we should keep at this education of the children incessantly.

Were every physician alive to the contributory effects of many other diseases in bringing on tuberculosis, and the conservative and special therapeutic measures to be taken in the circumstances, many cases of frank tuberculosis would undoubtedly be prevented. Similar appreciation of the masked and minor manifestations of tuberculosis, particularly in children, would avert many a later catastrophe of more serious disease. It is here again, therefore, that the proper education of physicians and medical students enters into the problem.

There is scarcely any doubt that in a certain number of cases the development of phthisis hinges on unusual exposure to infection—either wholly or in part. The primal problem of the prevention of infection loses, in consequence, none of its point, even though newer concepts of infection and disease have latterly altered our views of the prevention of infection considerably.

We no longer regard *ordinary* natural infection as a determining factor in producing manifest disease: indeed, there are some who hold that ordinary infection is a safeguard. At any rate, most natural infections are so slight or are of such a character as never to inconvenience us in the least. Notwithstanding this benignity, it would be surely our duty to prevent all infection, if we could. But the naked fact is that at present the distribution of tubercle bacilli enjoys such a wide range that we cannot. It is common experience to obtain positive infection tests in people, in young children, for whom the slightest and most transitory contact with bacilli cannot be established: and we have no other recourse than to assume that viable germs lurk in the most unexpected and out-of-the-way places.

Now, most of these must come from some spitting or coughing consumptive. And every consumptive, trained or "policed" into the proper disposal of his sputum, lessens the sources of infection by just so much. We should, therefore, become more militant in our antispitting campaign and arouse a more or less complacent public to its enforcement.

As to the danger from the careless consumptive who insists on grossly infecting his environment, and as to the measures to be taken to minimize it, there can be no two opinions. Such a man becomes, by virtue of every consideration of public safety, a case for the police. My own general point of view is such that I would probably be the last man to invoke too readily the enactment of legislation or the arm of the law to solve our health problems. I believe that popular education and sympathetic persuasion will in the long run accomplish more, and this in shorter time. But it will usually be found that the thoroughly refractory consumptive has something of the imbecilic or vicious about him which may yield only to force.

But by far the greater number of consumptives' homes need the light of sympathetic instruction, not the tug of the strong arm. And, throughout the world, one of the most effective antituberculosis measures, once it is properly developed, will be home reconstruction, on the basis of a case of infectious tuberculosis in the house, which will follow in the wake of the reporting of the case to the public authorities. Once reporting is thorough and complete,—and this will mean still more education of physicians,—and once every city has an adequate staff of home visitors, of the right sort, whose function is to extend aid and to inspect and instruct, our morbidity and mortality declines will in time become still more marked than they have been.

Solving tuberculosis in any community means, of course, that we proceed effectively along all lines. To emphasize one while we neglect another may be merely to balance factors, or like adding pluses and minuses. Some localities have developed one or several plans of attack to an unusually high degree and, in particular respects, have furnished us with models; but no one community has tasted of the rewards that would follow a completely rounded campaign based on our present knowledge of tuberculosis.

During this recital it must have occurred to you more than once that the bases of our attack on tuberculosis are all broad facts and generalizations gathered from medical observation and research. And it may be ventured that, granted that our information is correctly applied, we will approach the final solution of tuberculosis problems as we advance in our knowledge of the nature of the disease and its effects. In fact, the only basis which any intelligent tuberculosis campaign may have is one grounded on medical science.

It follows, therefore, that underneath all our efforts to fight tuberculosis must be the most active spirit of study and discovery. This and its results, and these alone, will ultimately solve tuberculosis. If society is to make notable progress against tuberculosis it must encourage research in it. The marvel to-day is not so much the vast body of information that has been accumulated, as the fact that this has been done with meagre resources.

We can only hope that the future will disclose more generous provision for the pure study of tuberculosis; for it deserves lavish backing, both on the score of the magnitude of the problem and on the record of past performance of investigators of the disease. We must have permanent foundations, affiliated with teaching hospitals, which, in addition to ample facilities for experimental work, will enjoy the advantages of a wealth of clinical material, will be in a position to instruct both medical student and physician, and, most important of all, can offer careers of sufficient influence and dignity to attract the most promising of our young graduates. Make tuberculosis a major subject of medical teaching and study, and superior men will flock to the field.

Hardly less important are the interpretation and orientation of our knowledge and its dissemination. We need more critics and commentators—bookkeepers, as I said before—men of the broadest experience and knowledge and vision who will give of themselves to the cause. Nothing will continually enliven interest in tuberculosis quite so much as intelligent discussion. We need also compilations and digests of all related published work, and easily used reference indices, available to all serious writers and teachers on the subject. All this has been appreciated by the authorities of the National Association, to an extent that it has provided with unusual liberality for a beginning along these lines.

Then there is the machinery of the warfare on tuberculosis. We can dig out the ore and sometimes fashion the tools, but you, the tuberculosis apostles who work among the public, must adapt them and erect the machinery to apply to the task. When applied to matters that merge so intimately into human relations as tuberculosis, the word machinery strikes a chord that sends out a repellent timbre. Nevertheless, something like it is necessary in our efforts at solution, whether we call it machinery, scheme, organization, or what not. No matter how high-minded our intentions or how profound our understanding of the situation may be, we become effective only as we proceed with well matured—and, may I say, elastic—system. I venture "elastic" because, as I conceive it, the tuberculosis situation is bound to differ in detail in every community; and in every place well-tested methods must be modified and moulded to the actual local conditions: besides, I sometimes get the impression from what I read that antituberculosis measures are in some quarters looked upon as rigid and immutable methods of procedure. Again, as in every other human pasture, so in the intensely human one of tuberculosis work, personality counts vastly more than technique; and this is the first lesson that the field worker, who wishes to help to solve and not to complicate further a supremely difficult problem, should take to heart.

I haven't a very exact idea of why I was asked to speak to you on my particular topic. I cannot per-

suade myself that your executive officer looked to me to tell you anything new about the tuberculosis problem. The organized tuberculosis movement in this country has become so alert and responsive to the significance of everything that may relate to tuberculosis or contribute to its conquest, that, after years of unrelenting work, it may now fairly be said to have vulgarized and popularized the subject. It has surely brought home to you—long ago—every phase of the problem which I have touched upon and every key to its solution—and much more besides.

I have therefore not tried to tell you anything new; for, to be truthful, I cannot. But, even though all of us agree on the nature of the many elements that might enter into the formation of a highly complicated whole, every one of us, if we are honest, will undoubtedly view the relationships existing between the several elements, and between these and the whole, through different lenses: we will weigh them on balances which will vary in scale: for we see through the eyes of our individual experiences and score our ponderables accordingly. I have therefore thought it best to restate the problem, and, more or less at random, and in detached fashion, set before you to-day's views, based on the trend of tuberculosis work of the past, and likely to change to-morrow with any readjustment which new contributions may make necessary.

Yet, there is one central thought concerning tuberculosis which I think will stay with me through

whatever changes which the future may evolve in my point of view. This is that tuberculosis is not an isolated phenomenon in human existence, to be regarded solely by itself: we must come to appreciate its relationships with all human affairs and its interactions with these. And, if you will apply to tuberculosis what I am about to quote, you may understand better what I mean. In an editorial on a subject remote from tuberculosis, I recently read in *The Manchester Guardian* as follows:

> "The theory of the web of life is the keynote of modern natural history, and we are always gathering new instances of infinite and unexpected connections. To kill a wagtail may be to bring disease to a flock of sheep. Who drives out bees drives flowers from his land. In exactly the same way social reform is distorted by rigid analysis. The problems of society merge in a single complex of moral and economic adjustments. By building houses we empty hospitals; prosperity slackens the pressure on the prison; schools and schooling tilt the balance against the police court."

THE ELEMENTS OF AN ADEQUATE TUBERCULOSIS PROGRAM

The Elements of an Adequate Tuberculosis Program[1]

WE MAY consider adequate that tuberculosis program which will continuously and progressively cut into the death rate of tuberculosis. It does not matter a great deal whether we accomplish this result by frontal attack or by indirection. So long as we are planning, are designedly out to "get" tuberculosis, and it keeps on showing more and more palpable evidences of losing its grip, we are doing something worth while. Then is the time of all times when we should refuse to swap horses. Then it is that we should rather keep a sharper eye on the old nag, and take better care of it: comb off the dust and burrs, cut out the calluses, trim the tail and mane, and, above all, feed it and feed it. Then perhaps its tired head will lift itself a little higher and higher, and the rein pull more lightly in our hands.

After many years of rumbling and clanging, punctuated by the piping that keeps stiff the upper lip, sweet music is beginning to delight our ears. As tuberculosis has become a reportable disease to

[1] An address delivered at the Annual Meeting and Conference of the Pennsylvania Tuberculosis Society, Harrisburg, Pennsylvania, January 24, 1922. Reprinted from the *American Review of Tuberculosis*, April, 1922, and *The Journal of the Outdoor Life*, August, 1922.

more and more health boards, as physicians have grown in accuracy and conscience in recording and returning causes of death—during a period, in other words, when perfection of machinery would transfer tuberculosis from the categories of debility and inanition and bronchitis and what not as the mark of mortality and should therefore raise our tuberculosis figures—these figures have been falling. Indeed, they have latterly been tumbling. Such glad news is too good to keep or to be modest about. And since the United States Public Health Service, our life insurance companies and the boards of health of all our states and larger cities have, in thoroughly unsentimental way, assured us that it is true, there has appeared no lack of claimants, to tell us how they did it or, sometimes, how the other fellow had nothing to do with it.

It was quite natural for the public to expect a noisy blast from us. For had we not announced for years that we were out to slay tuberculosis? The public has not been disappointed. Our platforms are ringing with stories of wonderful work performed and promises of more to come: and last month we seized upon the mortality charts of the last few years and used them for what the business man would call our best "selling argument" in the Seal Sale.

Reference to my past addresses will, I think, acquit me of any imputation that it is my habit to indulge a blind and undiscriminating enthusiasm. This observation may or may not give point to an

avowal of my own belief that the program launched by that little band of tuberculosis pilgrims in Baltimore in 1904, under the auspices of what they chose then to call the National Association for the Study and Prevention of Tuberculosis, a program based at the time on the best available scientific knowledge and throughout the intervening years expanded, refined and always readjusted to reflect the changing face of medical and social science,—that this program has had much to do in beating back tuberculosis,—and much more besides. The everyday man of 1922 goes to his work, refreshed by the night air that breezes through his bedroom, because the tuberculosis program made sleeping with open windows normal and fashionable. His babies are using milk which the tuberculosis program has made cleaner and cleaner. His children are eating with hands less dirty than his own when a boy and are brushing their teeth oftener, because the tuberculosis program has instructed and supervised them in school. The effects of the tuberculosis program on tuberculosis at last bid fair to become calculable. Its effects on public health in general are, in my opinion, no less, however indefinable they may appear to the maker of statistical estimates.

Until we learn something new and entirely unexpected, it does not seem to me that, *so far as its plan and technique go,* there is much criticism or fault to be found with the present program. The elements on which it is grounded are treatment of the sick, detection of active cases, prevention of

manifest disease by promoting all health-conserving conditions, prevention of infection by discovering sources and breaking contact with these, economic provision for needy dependents of the disabled, and economic and social readjustment of patients who have regained a measure of working capacity. All these elements should be so well-known to you as parts of the plan as not to require enumeration. The National Tuberculosis Association and its constituent and subsidiary organizations are at work on every one of them, every minute of the day; adding here, discarding there, yet always testing and striving to strengthen and perfect. And it is not working in aloofness: it is ever planning and acting in full and willing coöperation with every other reputable and effective organization which is concerned with better public health. I am not here as an emissary of the National Association. I mention it as I do because I am convinced that antituberculosis work in this country cannot be discussed with intelligence unless the part of the National Association in it is given its proper place.

Now, these elements seem simple enough to grasp, and their recital rolls off the tongue glibly. But think of what effort they involve: the construction and equipment of hundreds, perhaps thousands of places for the afflicted; the making over of countless homes for the same purpose; the special education and training of thousands of physicians and nurses to attend these unfortunates; the continued instruction of the entire practising medical profession in

the detection of early phthisis and the proper appraisal of active tuberculosis; the arousing of every man and woman to the real condition of affairs; the enormously difficult—and often discouraging—task of breaking through their prejudices and having them put aside age-long habits and customs; the introduction of the masses to new standards of living and—what is just as important—the adaptation of these to economic and social conditions; the establishment of sympathetic relations—those of minister to body, soul and perhaps purse, in hovel, cottage and mansion; the devoted study and investigation of tuberculosis—in the even quiet of the laboratory, the grim reality of the bedside and the hurly-burly of the affairs of man; sanatoria, preventoria, dispensaries, clinics, schools, physicians, nurses, field-workers, students, laboratories, streets clean, homes spacious and light, milk without seeds of disease, cattle healthy, an informed and reformed public intelligence and conscience: all these are but a few of the countless details that enter into the elements of a successful tuberculosis program: all and many more must be devised and tried and applied and fitted each in its proper place. The imagination leaps to the program: it must at the same time be appalled by the magnitude of the demands of the program. Yet courageous souls have struggled along, unafraid, with heart and eye set only on the goal. Once in the illimitable distance, this goal has begun to take on something of finiteness: the brave spirits may have put us on the way to touch it.

Don't you see what *motif* runs all through the program that is solving tuberculosis—from beginning to end, no matter how numerous, how complicated, or how far removed the variations may seem? Don't you know what is getting the grip on tuberculosis—now and always? It is EDUCATION—KNOWLEDGE. The bacteriologist, the pathologist, the chemist, learns something at his workbench; the practising physician observes the ways of tuberculosis at the bedside; and they, the fountain head and the foundation rock of every tuberculosis program, think out and prove what their scraps of information mean and pass the tidings on. They tell their students and lo, each discoverer speaks with a hundred voices. They put their work in print and bring light to thousands.

This army of disciples and readers takes the torch and turns its rays into the obscure crannies of the world outside. They come to learn how far it throws its beams and in the labor find that it may be capable of many uses, for each of which it must be handled in a particular way. They then teach in their turn and, for effectiveness, plan and band together; and they send their trained battalions out into the world to come in contact with every man and tell by word of mouth and with the magic contact of hand with hand what they have imparted to groups.

In the closing years of the eleventh century an obscure monk, a hermit monk, conceived a great idea. It came from his heart. The dark deeds of

the Turk put into his soul a passion that sent this son of Amiens up and down the sparse and wretched highways of Europe to tell an illiterate and shut-in populace the wrongs done by the black infidels of the East. An unquenchable and contagious fire went out from Peter to them. Peter went to Rome and taught Urban; and then returned to France to marshal his disciples and send them up and down the land, that not a soul in Europe might live in ignorance of the Turk. Urban sat before his bishops and noble laymen at Clermont, and with them laid down the plan to recover the Holy Cross. And Jerusalem did come into the hands of the Christians.

You may say that preaching and the sword recovered the Cross. Nevertheless, it was education—the most spectacular proof of the might of education the world has seen,—the most potent sign since the Man of Nazareth walked the shores of Galilee.

In respect to education man has not changed. He enters this world, this stage of stimuli innumerable, with the same uncharted tracts of plastic brain, ready for the stylus to grave its record, like his ancestors of one and two thousand years ago. He, too, will learn and take to heart, and act upon the impulse of mind and soul, whatever we—*those of us to whom he looks for light*—elect to teach him. Indeed, he will act only according to what he knows and feels. He *will learn only as he respects our efforts.* And, although a desired effect may be immediately forthcoming, I submit that, unless

their nonoperation sets in motion circumstances which inflict injury upon innocent persons, it is thoroughly unscientific, immoral and in the long run politically dangerous to *force* upon any individual rules of conduct which are beyond his understanding.

Underneath, therefore, and running all through our entire tuberculosis program is this matter of education. Every leader in tuberculosis work has always recognized the fact: every worker must grasp its full significance: any adequate program is predicated absolutely, almost wholly, in fact, upon adequate education about tuberculosis,—upon the full light of truth for all. We ride the same old steed: we must put and keep him in prime condition. What does this "conditioning" of the faithful old animal mean?

After we have laid down the stethoscope,—as we look the man in the eye and say, "You have tuberculosis—consumption;" and the anxious patient appeals, "Doctor, what must I do to get well?" —then, if we are honest and if a look at the patient tells us that he can stand the walloping truth at once, it is well to say, "You have a long and hard road back to health and your disease is tricky. To fight tuberculosis successfully takes money and character, and the more important of the two is character. Money is perfectly necessary: you will need a good deal of it; but if you have only money, you are still in great danger. Money used by you with character will make your cure immeasurably more likely."

The case with stamping out tuberculosis in the mass is not a whit different. Just as surely as a person needs money and character to heal himself just so inexorably will tuberculosis at large yield only to money and spirit—collective character.

The tuberculosis field is no arena for the exercise of talents of belligerency, jealousy of prerogative, intrigue for position and place, and indolence. Petty quarrels, Achillean aloofness, selfish scramble for recognition, perfunctory and rule-of-thumb performance of work in laboratories, sanatoria and dispensaries are just so many barnacles on our boat. They invite no passengers to embark; they impel many to cancel passage; they give the craft a dangerous list. Above all—and take this to heart—they help to save no lives and do seriously hinder the extension of vital aid to many. In none of its phases has the erection of the tuberculosis machinery contemplated the creation of places for those who simply want jobs or a place of refuge. Not a soul should be in the work who is not interested wholeheartedly in saving life and assuaging one of life's harshest scourges. A game such as we are fighting will be won only by enthusiasm, devotion to cause, tireless industry, willingness and ability to learn and to work together, sacrifice, patience, and open-eyed acquiescence in the price involved.

No moneyed man in his senses and no appropriations committee will contribute to a work which is open to the suspicion of disharmony or self-interest among its exponents. But a good and necessary

cause, well presented by devotees who ooze and radiate earnestness, high purpose and a concrete knowledge of what is needed, never fails to loose the purse strings.

Spurred to redoubled energy by the falling death rate we must train our leaders, and more and more of them, and send them to the haunts of wealth. We must have them educate, with much more fulness and intensity than heretofore, the men who can give and those who direct legislative disbursements. All this presupposes or stipulates no dark or sinister approach. It means that we have become alive to the fact that money, in amounts undreamed of ten years ago, will, if intelligently applied, cut down tuberculosis toward the vanishing point. It means that we must pick out our best workers to prove this fact in a telling way to the public. It means that a populace thus informed will demand its public funds from its lawmakers, and will get them—when it begins to understand the advantages of no tuberculosis as well as it now comprehends the importance of education for all. It means, at bottom, just what we have been doing for years: the plan is the same; its execution must be enlarged and perfected.

It all sounds so easy, in the telling of it, that it is a pity to insist upon the enormous size of the job ahead of us. But it must be done; and it will seem impossible only to those who cannot think in terms of the past or whose memories retain nothing but rebuffs and failures. Last night a few feet of wire,

a coil and a needle touching a crystal made a circuit which picked voices and music out of the dead silence of the crisp night air and conveyed them to my ears. Ten years ago, in my ignorance of things electrical, this occurrence of last night would have been as impossible to me of conception as is a grasp of infinite space and time, which, again I am told, exist. I am neither a financier nor a budget maker, and my acquaintance with their ways is slight; but a comparison of the personnel and expenditures of boards of health of 1920 with those of pre-Kochian days or even of ten years ago makes me certain that the leaven of education is working fast, and will result in future appropriations for health work which will surprise the flabby pessimists of to-day.

My friend, Donald Armstrong, is one of the men who keeps my feet on the ground by putting me in touch with figures, and who sees to it that I don't forget the kindling influence of cold dollars and cents in this world. As you all know, Doctor Armstrong's talents were put to striking and effective use in the Framingham Demonstration; and it has sort of become his job to tell us how much health we'll get for ten cents per community head, or for twenty or thirty cents, and so on; or, rather, how much disease we're likely to worry along with, if we aren't willing to buy fitness for such and such a price.

Doctor Armstrong has worked it out—and capable authorities agree with him—that most communities in the United States appropriate out of public funds

not more than ten or twenty cents per person for tuberculosis work and a maximum of fifty or sixty cents for all kinds of health work. His investigations have taught him that no average American community can expect adequate public health service of all kinds for less than from two to three dollars per person, an amount which would mean fifty or sixty cents a head for adequate tuberculosis work *now*, if the present ratio is proper and is to be maintained. For Pennsylvania, it would mean a total of from about fifteen to twenty-five million dollars for all public health work, of which roughly four to six million dollars should be used against tuberculosis in the field. Will Pennsylvania spend this money? Can she afford to? Well, at any and every time she has probably eighty thousand persons disabled, wholly or partially, by tuberculosis. Let us go easy with figures and put their loss or diminution of earning—and, therefore, buying—capacity at five dollars a week per person. Then do a little simple multiplication: four hundred thousand dollars a week, one and a half million dollars a month, over twenty million dollars a year lost to Pennsylvania in the form of wages alone! I am a Pennsylvanian by birth and grew up in the state, only twenty-five miles from here. In my boyhood I gazed with awe on orators who sobbed and broke down completely as they told the angry and perspiring multitude how the wicked minions of Grover Cleveland and his kind were about to bring the grand old Keystone State to ruin and the work-

ingman to rags as his wages slipped from under the benevolent workings of the G. O. P. Tariff. Well, all sentiment aside, right here, in the tubercle bacillus, we have a busy little pocket-picker that makes Free Trade or Tariff for Revenue Only seem puny. Why can't we make strong men, who blubber and cower and quail before the iniquities of the low tariff bogey, just half as emotionally responsive to the real terrors of tuberculosis?

Those who have had it will see the point. And I would emphasize strongly that just as the active front-line workers in tuberculosis are almost without exception men and women who have had the disease themselves or have had it brought home to them in their families or friends, so the entire tuberculosis movement should be to a great extent built around old patients or relatives of patients. In any community, they are the first persons to be enlisted in active work and organized; and personal efforts should be made to find them all and give them their tasks. They are our best exhibits: in the average community their story is known to all: and they do come to us with the most living and intelligent interest in our purposes and plans.

The real burden of my theme has been money. Money to educate. Money to educate everyone from the lowliest of mortals to the scientist in his tower. Money to train and to organize. Money to put to work more thoroughly and effectively measures that we know will work. Money to put execution equal with plan and design. Our program

is as sound as what we know can make it. Money will speed it and send it along; but it is the spirit —your spirit and mine—which must give it strength and say to the people, "Here is a thing which is worthy of our money."

SOME PROBLEMS OF MEDICAL EDUCATION IN TUBERCULOSIS

Some Problems of Medical Education in Tuberculosis[1]

AN INCREASINGLY active interest in tuberculosis has brought about a marked improvement of medical education over conditions which existed only a very few years ago. The Trudeau School, the pioneer institution for formal instruction of graduate students, is only five years old. The need and demand for it and its usefulness may be estimated by the fact that applications for enrollment far exceed accommodations, and by the establishment and plans for establishment of similar schools in a number of other localities. The Massachusetts and New York plans of consultation and itinerant clinic services have been notably successful, and enlightening and stimulating to general practitioner and tuberculosis expert alike, and will bear copying and development everywhere. Those in charge of the tuberculosis activities of the Army and United States Public Health Service have been alive to the educational possibilities presented by a wealth of clinical and autopsy material, and have been quick to turn it to effective use. The number

[1] Read *in absentia* before the Clinical Section at the Seventeenth Annual Meeting of the National Tuberculosis Association, New York City, June 16, 1921. Reprinted from the *American Review of Tuberculosis*, November, 1921, and the *Transactions of the Seventeenth Annual Meeting of the National Tuberculosis Association*, 1921.

of inquiries which one receives from medical schools concerning methods and courses of instruction in tuberculosis is becoming impressive and is, one may hope, highly significant of future development.

Many indications, therefore, point out that we are already well along,—further along, perhaps, than we think. It is, at the same time, only too apparent that many changes, something of the nature of a reconstruction—of methods, of standards, of values —must be brought about before we may admit that we are making the most of our opportunities or that we are teaching tuberculosis with anything approaching complete effectiveness. There should be little doubt that a standard of perfection should always be our model; nor, for this reason, should I be inclined to defend any ideas which I may present against the criticism that they comprehend a standard of perfection. Appreciative of all that has been done in the way of education in tuberculosis, I am vastly more interested in whatever will make tuberculosis an object of productive study and teaching wherever the physician comes in contact with it.

Individual ideas of what constitute problems of education in tuberculosis are likely to be colored by two prejudices. These arise from the personal attitude which everyone of us has formed toward the age-long controversy over the purpose and direction of education in general, and from those particular interests in tuberculosis which your or my

study and practice of it have brought out and developed.

Any one of you may intuitively disagree with whatever position I may take on whether the general purpose of education should be to fashion personality or to perfect machinery—to spread before the plastic intelligence the accumulated stores of all sowers and reapers of the past, or to take the twig at its first budding and incline it in a definite and special direction. The question will never be settled; and, after all, why need it be?—for the pathfinders, the seers, the geniuses, the "self-educators," resisting all discipline, conforming to no rules or systems, whipped on by irresistible impulse and spurred to colossal industry, will lay at our feet what our planned endeavors with thousands have failed to produce.

For the moment I forget who it was—perhaps it was Kant—who said that in teaching he was concerned only with average men, inasmuch as there was no hope for fools and geniuses would take care of themselves. We may or may not subscribe to this view. Yet it is quite likely true—or at any rate practical—that, when considering the persons to be taught, we should keep our eyes fixed on the needs of the average man. As a routine procedure, it would be as foolish and mistaken to prepare banquets for Louis Pasteurs as alphabet noodles for our Sabbath entertainer, Mr. McNutt.

Any educational plan requires that we give earnest attention to something more than the needs

of the student. This something is comprised in the best interests of the subject to be taught. And, although the needs of the student and the best interests of the subject may not be capable of dissociation, it is my diffident opinion that, in approaching the matter of education in tuberculosis, we are under far greater obligations to think and act from the point of view of what may be best for tuberculosis—what will ultimately advance the knowledge and science of tuberculosis—than to any course which may promise to be immediately practical, enlightening and advantageous for the student. I have no doubt that, in our life-time at least, students will come and go while tuberculosis will maintain its rôle of the poor in our midst. I have just as little doubt that the more quickly and more securely tuberculosis takes a higher rank among the scientifically-pursued branches of medicine, the more it will attract a larger body of able students and investigators. As I see it, the best interests of all concerned—patient, student and practitioner—demand that the lines of tuberculosis study and practice be tightened all around, that requirements for both the latter be raised and made more difficult, not simpler.

I am constrained to state this for two reasons. The first is that I am continually being reminded that the average internist does not entertain a particularly high opinion of the medical knowledge and ability of the professed practitioner and student of tuberculosis: and, while you may say that we

reciprocate the feeling, this retort does not alter or amend the situation. Besides, it is our own knitting that we are primarily concerned with.

The second reason is the free and easy—I almost said, irresponsible—conception of tuberculosis teaching which many seem to hold. If I have understood them correctly, I have gathered from not a few contributions on the subject that, by playing the stethoscope over certain infallible areas of the chest for an hour or two a day throughout a week or two, yokels are converted into diagnosticians of tuberculosis; or that a few easy tricks with the fluoroscope and the acquirement of a catchword or two will open up the realms of pathology, etiology, diagnosis and prognosis; or that fifteen minutes with motion pictures will accomplish what formerly "took twenty-four lectures of one hour each;" or that a demonstration of how to stain the tubercle bacillus and how to inoculate it into a guinea pig makes an investigator out of a novice. Now, all this may be true; yet I can't believe it. Perhaps the fault lies with me, as I am led to survey my own deficiencies and inefficiencies as a drill master. Yet I am encouraged to take heart as I reflect on the possibilities that might arise out of a case, up for opinion, before Webb and Minor and Brown and Hamman and Baldwin and Miller:—when I consider the six different histories, the six different exercises with the stethoscope, the six different X-ray plates,—and then the weighing of all the evidence in the balance of six individual experiences,

—and finally the opinions as to diagnosis, and after diagnosis as to what is to be done with the case, and then—all important perhaps, for the patient and his family—the prognosis. I verily believe that, if what many have told us about the short cuts to a knowledge and practice of tuberculosis is true, the event would show that these six eminent practitioners had flagrantly abused their opportunities to learn or had been singularly refractory to newer, sureshot methods.

Now, tuberculosis should and must be taught to medical students, to medical practitioners, and, perhaps, even to patients; and it is our job to devise ways and means to teach all three, practically and effectively, while we at the same time send tuberculosis along as a developing and attractive subject. It takes comparatively little wit—or conscience—to set down on paper comprehensive and ideal courses. I have already done this several times and expect again to commit the same misdemeanor before tuberculosis and I finish it with each other. It is easy to pass resolutions, even with one's self; but discouragingly hard to make them work, no matter how embellished they may be. At the present time I shall put aside the temptation to reissue a program of instruction. I had rather point out problems which may confront the practical working out of programs.

Let us consider, first, the case of the undergraduate student. What would you have him do?

Throughout the literature there is distributed an enormous amount of gloom over the new graduate's inability to make a diagnosis of pulmonary tuberculosis. But is it justified? I'll grant that a fourth year student who fails to detect the disease because he does not know how to find bacilli in a positive sputum, or who "misses" the cadaverous consumptive who is so plain that his lay home associates have no doubt that he "has the bugs," has been inefficiently instructed or is a numskull. But to expect him to proceed in a business-like way to make a diagnosis of a difficult or questionable case of lung tuberculosis is as irrational as to trust yourself to him for the removal of your appendix or your brain tumor. Beyond their veriest rudiments the technique and judgment of tuberculosis diagnosis can no more be acquired by the average undergraduate student than can surgical technique and judgment. If tuberculosis—in any of its phases—were so easy as some would have us believe, it would not have long ago become a special branch of internal medicine. Everyone of us here has sweated—and is still sweating—to gain what little he knows about tuberculosis—throughout the long years devoted exclusively to tuberculosis. Then why be so hard on the undergraduate or so contemptuous of his training? The quicker we appreciate that physical diagnosis cannot be learned from didactic lectures, or parallel columns of signs, but that competency in it can be attained in only the same way as a proficiency in operative surgery, that is, by assiduous observa-

tion at the autopsy table and practice on the living patient—just as Laennec erected its foundation—the sooner we'll be in line to formulate plans for the most effective instruction in pulmonary tuberculosis, especially for undergraduates.

It has no doubt happened, not infrequently, that Professor X., new head of the tuberculosis department, animated with all the enthusiasm that wholehearted devotion to his subject can give him, has entered the faculty meeting which is to plan the curriculum for the coming year. Passionately determined to see it through, he sits down with a course of instruction in tuberculosis which he is convinced represents the minimum that a medical student may be given before he may be turned loose upon the public. Around the same table are a dozen or score of other heads of departments. Professor A., of genitourinary diseases, hasn't the least doubt that a medical student who cannot cystoscope a man with comfort and profit to the patient is unfit for graduation. Professor B., of pediatrics, considers that graduate a menace to society, who, when first called in, might confuse chickenpox and smallpox. Professor C., of laryngology, insists that, since adenoids, enlarged tonsils and other nasopharyngeal affections are the most common disabilities of human beings, he must have a full third of the student's time to impress the latter with his responsibilities. Professor D., of ophthalmology, makes out a strong case when he points out that the normal human eye exists only in the textbooks and that the

least he can expect of the student is his taking a full course in refraction: he may waive instruction in minor complaints like pink eye and leave this to the pediatrician. And so it goes—from anatomy to X-rays—with the professors of the two major subjects of medicine and surgery silent and wondering how they are to squeeze in an occasional hour to tell the student how to treat a headache or a boil on the neck.

The result is a compromise; or once in a while, if you will allow vulgar but expressive terminology, a "freeze out." Professor X., if he has his wits about him, is brought to see that medical education to-day is concerned with a great deal besides tuberculosis, and that, in a school of medicine, there are even some reasons for looking upon a tuberculosis department as exotic and a luxury. I bring up this particular situation as a problem because it is a most real and practical one, yet one which most homilies on what should be taught undergraduate students in tuberculosis have overlooked.

Problems of another nature arise when we attempt the tuberculosis education of graduates, who are usually general practitioners. We have long been aware that many of these men were clamoring for a better appreciation of our most common affliction: and in response to an insistent demand it has become fashionable to organize schools for "intensive" instruction of tuberculosis. These schools pretend or essay to range the field at large, and in six weeks at the longest place before the student the totality of

our knowledge of tuberculosis. Tuberculosis in children is covered in an hour or two, while the larynx, the bones and joints, the genitourinary system, the meninges, the peritoneum and intestines, receive as much or less attention. One morning will generally "clean up" the bacteriology of the bacillus, and another morning the pathological reactions to the bacillus. There are demonstrations and drills on signs and symptoms, with fleeting interludes on institutional management and the social phases of tuberculosis. The paper plan of some of these courses is almost a transcription of the table of contents of Cornet's book, and if anything is missed I have failed to detect its absence. All this in six short weeks and less!

I would be the last to dispute that in experience and judgment the man who has practised medicine has a very definite advantage in assimilating knowledge over the immature undergraduate. Yet I consider it arguable whether this advantage may not be offset by the enthusiasm, the plasticity and the quickness of perception which are more common to younger minds. And I seriously question whether this cramming process of "intensive" instruction of graduate schools is serving the best interests of either student or education in tuberculosis. A student with a fair knowledge of tuberculosis can no doubt profit much by the course and have his ideas orientated and crystallized. But the student without such preliminary knowledge—and he is one of the majority who take these courses—must

run the danger of stepping from the crystalline atmosphere of ignorance to a murky one of intellectual fog. I had rather see the average graduate student put on one case and on one sputum and one cadaver or pathological specimen and one infected guinea pig and one culture until, with his instructor, he had exhausted the possibilities of each, than continually transferred from one sketchily presented subject to another. I believe that this method would turn out wiser and more effective men. It might look less showy in the prospectus and appear less popular to those unfit and unprepared practitioners who were accustomed to *gaze upon* the wealth of Vienna clinics: but effectiveness in education must be estimated, not by the mass that is presented to the intelligence, but by the growth which the intelligence has assumed.

Four years ago I spoke at an annual meeting of this Association on *Undergraduate Instruction in Tuberculosis*. Before leaving for Cincinnati I read my address to Doctor Theodore Janeway, a man of broad experience and vision. I was in the midst of reciting apparently essential details for the proper training of medical students, and among other necessities came upon the phrase "an able and enthusiastic teaching force;" when Janeway interrupted with, "Ah, that is the heart of the whole problem. Where and how are we going to get the able and enthusiastic teachers?"

Since then my time has been continually and exclusively occupied with tuberculosis work, much

of which has had to do with the education of students, both undergraduate and graduate, and of the public. Perhaps no part of it has been so beset with what seemed to me unsolved difficulties and problems as this one of education. And in reflecting upon them I usually find myself coming back to Janeway's query, "How and where are we going to get able and enthusiastic teachers?" To me "able and enthusiastic teachers" mean men who before they essay to teach are thoroughly grounded in tuberculosis; men, also, who are making of it their life study; men capable of conducting investigations, and with the time at their command to do so.

Our potential sources of tuberculosis teachers would seem to be the medical schools, the sanatoria and the small body of practising and consulting physicians who are making of tuberculosis—usually pulmonary tuberculosis—a specialty. To the uninitiated it might seem a simple matter to call upon men from all three sources and put them to work at teaching tuberculosis. But a very incomplete survey of conditions as they exist at present will at once bring to light many handicaps which would hobble any efforts to build up a strong body of men who are to devote their lives to the teaching and scientific pursuit of tuberculosis, both of which occupations are in my mind, inseparable requisites for real effectiveness.

So far as medical students are concerned, you will no doubt grant that their instruction must proceed in the medical school or under its auspices.

Our newer and more solid ideas of infection, immunity, symptomatology, diagnosis, latency and activity, therapy, etc., point out with increasing emphasis that tuberculosis is a subject which comprises vastly more than the diagnosis of its pulmonary phases and the treatment of special classes of these. Only in medical schools connected with large general hospitals can we expect to come in touch, even approximately, with tuberculosis as a whole. The function and the opportunities for observation in almost all sanatoria are, after all, very limited and very special. Almost all their inmates are referred patients, with diagnosis already made, and represent usually a few selected more chronic types of disease. A man may spend a lifetime at a sanatorium, be looked upon as an expert in tuberculosis, and yet never called upon to make what is now and again the most difficult of diagnoses, namely, that of acute tuberculous pneumonia or miliary tuberculosis in a previously healthy adult. Yet this is the common contact of the general hospital ward with pulmonary tuberculosis, and brings into play diagnostic qualifications which the *average* sanatorium resident has not had the opportunity to acquire.

The X-ray department of a large general hospital will make observations on as many as twenty thousand plates a year, depicting every variety of pathological abnormality occurring at every age. It is to be expected that the same man will gain a much broader and a more exact idea of the roent-

genology of tuberculosis in a general hospital than in a sanatorium; and the fact that in the former his impressions will quite often be tested by an autopsy will contribute to his poise and carefulness of interpretation.

The question of tuberculosis as against other affections comes up daily in the children's clinic, and now and then you will be fortunate enough to observe the clinical disease develop under your eye in children whom you have previously had under observation for measles, pneumonia, etc. The masked phases of tuberculosis, as they present themselves to the dermatologist and ophthalmologist, call for thorough investigation from the point of view of foci elsewhere in the body. More marked manifestations, which come to the attention of the orthopedist, the urologist and the general surgeon, present the same opportunity. The tuberculosis dispensary has its own unique problems of diagnosis and treatment; while the hospital pathologist will show you tuberculosis where it was never suspected during life and no tuberculosis where you had positively proclaimed its presence.

Now, with all these opportunities to study and teach tuberculosis as a whole—and this is the only truly effective way to handle the subject—there is not a single medical school or university in this country which has shown itself fully alive to the possibilities of developing the scientific side of tuberculosis. There is not even a single adequate, *permanent* foundation in tuberculosis. The result

is that there is no inducement for the better class of men to go in for a career in tuberculosis, with the further result that we can develop few able teachers in the subject.

What attracts eager, young minds with a passion for study and investigation to enter upon a scientific medical career? It is, besides the facilities and opportunity for work, the possibility of ultimately attaining a position of dignity and influence in their chosen work. This is, and always will be, the incentive: the opportunity to make money, to "cash in," will always be subsidiary; and, when it comes and is grasped, it usually plays havoc with a man's usefulness as an investigator. Without the incentive I have mentioned we can look forward to but little advance in real tuberculosis education; for we will not be in the position to train teachers of the same grade, say, as those who now occupy our chairs of medicine, surgery, pediatrics, etc.

Let me put the case a little more pointedly. I direct a department in tuberculosis. Its primary object is research. In it is also a dispensary, and it teaches students by clinics, lectures and first-hand demonstrations of patients. It has, moreover, desk facilities for the laboratory training of a few students.

Now, suppose a man comes to me, fired with the idea of devoting his life to the study of tuberculosis. He wishes to train under me. What, in all honesty, am I to tell him? Why, I must talk to him something as follows: "You are welcome to every

facility that is here and I shall give you every aid. But I really don't know what to do with you if you make good, if you gain a mastery of your subject and show talent for furthering it. On the other hand, I don't want you if you are going to fail: and, if I knew or thought that you will fail, I should not take you. Yet, if you do make good, where is there a position for you? If you should go into medicine or surgery or gynecology or pathology or any one of a dozen other branches, there are a full score of decent professorships in each, any one of which may in time come to you, provided you play the game and make the most of your abilities and opportunities. Now, I have watched you and have thought that you may have a special talent for tuberculosis work; yet at present I really can't see what's ahead for you except my own job and it is not on any too secure a basis."

I have made this kind of a speech, not once, but several times within the last few years: and I have made it with a gripping at the heart. I have turned men away, have seen them lost to tuberculosis, simply because I could not see ahead for them an adequate career in tuberculosis. Almost any other branch of medicine was open to a display of their talent,—but not tuberculosis. And remember, please, that I am in a peculiarly favored position.

This situation would change over-night if we had foundations—departments of tuberculosis—in our medical schools: it will not change until we do have them. I should say that in medical schools like

those at Columbia, Harvard, Pennsylvania, Chicago, Johns Hopkins, etc., an adequate foundation would require resources netting $50,000 a year.

This is, indeed, the very heart of the problem of tuberculosis education. With permanent tuberculosis foundations, investigators and teachers would soon spring up. Many would come over from pathology, bacteriology and clinical medicine. Many scattered phases of tuberculosis in general hospitals would be coördinated and harmonized. Above all, students would be taught tuberculosis as a whole. It surely should not be necessary for me to detail what all this would mean to tuberculosis. Suffice it, that tuberculosis would take its place as a branch of medicine, acknowledgedly on a scientific and productive basis.

If we go to the sanatoria for our teaching and inspiration, what do we find? In trying to answer the question I wish to be particularly honest and fair, and trust that I may not be too lavish in either praise or censure.

As I see it, there are invested tens of millions, supporting hundreds of institutions, taking care of thousands of patients who offer a most fruitful field for the study of tuberculosis which is hardly cultivated. The apparent apathy and lack of interest manifested by the medical staffs of sanatoria in the study and investigation of tuberculosis must be the despair of the well-wisher for tuberculosis. Here are hundreds of men, surrounded by a wealth of clinical material, yet real study of it is so uncom-

mon that a sanatorium resident who publishes a paper now and then, at once and because of the fact, is regarded as an unusual man.

I have asked many why this lack of initiative and investigative morale exists in the sanatoria; and have received various answers. Some men tell me that the present organization of the average sanatorium and the duties of its medical staff leave little time for study and thought. If this is true, then the quicker we bring it about that the resident physicians are relieved of the responsibilities of business managers and stewards the better it will be for institutions, for patients and for tuberculosis.

Others tell me that the very location of many sanatoria and the usual method of recruiting their medical staffs work against the development of lively and active interests in study and discovery. For very good and sufficient reasons, sanatoria are frequently placed in isolated places. Their medical staffs are thus cut off from that close association with their confrères which is so stimulating and so necessary, if intellectual stagnation is to be avoided.

Again,—so they say,—many, many sanatorium men are physically weak and medically weak. To be physically weak, within certain limits, does not necessarily mean that a man cannot do good work; it does not mean so, if within him there burns the passion to develop those talents of mind and soul which physical weakness quite often gives unusual chances for exercise. Somewhere in one

of George Gissing's essays, there is a phrase that runs something like this: *that the man of thought is almost of necessity a man of impaired health.* And our own Trudeau, or Kant, or Florence Nightingale, or Charles Darwin, or a host of thousands of others of the world's great in all ages, bear witness to the eternal truth of Gissing's statement.

I am not so sure that a general indictment of "medical weakness" against our sanatorium staffs could be sustained. Nevertheless, it is noticeable that many of our residents, before taking sanatorium positions, have had no more training in general medicine than that afforded by an undergraduate course, and that frequently this has been interrupted because of illness. Personally, I think that, if too many men of so little preliminary training hold posts of responsibility in sanatoria, it cannot be otherwise than bad for tuberculosis. There are, of course, exceptional men who will come through despite every handicap and deficiency of background; but, as a general thing, I am inclined to question seriously the voice of authority in tuberculosis which has assumed eloquence because of a superstructure of sanatorium experience on a cornerstone of an ordinary or crippled medical course. Too exclusive an attention to pulmonary tuberculosis with little or no acquaintance with general medicine is bound to give us a false tuberculosis; which might be worse than the ignorance of tuberculosis that would mark the general practitioner who shuts his eyes to tuberculosis as a phenomenon to be reckoned with.

Wherever the trouble may lie, the fact remains that too little study is going on in our sanatoria and too little solid work is coming from them. And if anyone were to ask me how the situation might be bettered, my instinctive reply—and I hope Lawrason Brown will pardon me and allow me to make it—would be, "Go see Lawrason Brown." For I consider that in ten years of residence at the Adirondack Cottage Sanitarium, under conditions which I know were not always rosy or ideal, Brown demonstrated what can be done with sanatoria as centres of investigation and development of tuberculosis. Further, I cannot see why Brown's example in this respect cannot be followed in scores of institutions throughout the country, yet the list of sanatorium men who have attempted to use their institutions as places for *sustained* and productive study is lamentably small.

A man who is not interested in study is not a fit teacher; or, if this statement is too extreme for you, then a born teacher, who develops tastes for study and investigation, becomes an infinitely better teacher. Teaching consists of something vastly more than unbosoming your knowledge to the student. It demands that you have within you that interest and passion in your subject which will inspire your student and goad him on to self-development: and this interest and passion can be kept alive only by study and investigation.

Such then, sketchily and imperfectly presented, is the situation as I see it. I have tried to go to the root of things and discuss what appear to me as fundamentals. This has no doubt made me censorious, and indulge a spirit which is furthest from my intention. Let me remind you, though, that my own life's work is wrapped up in this matter of tuberculosis instruction, that I have tasted of its possibilities, that I too am beset with difficulties which are far from solution, and that I am trying to find a way out.

The sum and substance of my own view of present problems of tuberculosis education are that (1) we should not expect too much from instructing undergraduates, because of the great diversity of topics which now occupy their time, nor should we lay too much stress on physical diagnosis in particular, since an expertness in this cannot be acquired from facilities now open to students; (2) short courses for the common run of graduate students require great simplification, elementary thoroughness and concentration on several—perhaps a very few—particular objects; (3) the heart of the problem is the building up of a body of able teachers; and (4) it is doubtful whether, with relatively few exceptions, able teachers in tuberculosis can be recruited from either medical schools or sanatoria under existing conditions.

If you ask me for solutions, then I would reply that I have none ready. Yet I believe that with definite objectives before us of what we wish to

correct and achieve, with no illusions as to the time or trouble that it is going to take us to accomplish our purposes, and, ever hopeful and thick-skinned against discouragement, with a long and strong pull working all together, we can arrive at satisfactory arrangements and send tuberculosis far.

We should at once begin to take measures to plan departments of tuberculosis in medical schools and to raise requirements for medical internship in sanatoria and for sanatorium management, the last object of which means that a medical director should be engaged with medical matters and with nothing else.

We should decidedly get more general medicine into sanatoria and more tuberculosis into general medical schools. I can see nothing to prevent working arrangements for fortunately situated institutions, whereby sanatorium residents may spend part of their time in general hospitals, while hospital residents and medical students similarly put in a month or several months a year at sanatoria, and whereby the several institutions may exchange teachers and laboratory workers.

I have rather grandiose visions of the possibilities of sanatoria in education, just as soon as the morale of their staffs is uplifted and tightened all around, and their functions are broadened as I have attempted to point out. I hope to see them centres of investigation and of solid instruction in tuberculosis to physicians roundabout. The time is almost ripe for sympathetic bodies like the

American Sanatorium Association and the National Tuberculosis Association to undertake an exhaustive and constructive inquiry into how the scope of tuberculosis sanatoria may be broadened and improved, especially from the point of view of education and scientific activity; for, with the millions invested by the people in sanatoria and in the face of a growing murmur that sanatorium functions are very limited and that the institutions are not giving results proportionate to value received, it is inevitable that if we do not make the survey, if we do not take hold of the reconstruction, less charitable interests will demand the right to do so.

And, as a parting observation, I would point out that tuberculosis, as an attractive and interesting field for study and training, will appeal to physicians and students alike in a measure that is directly proportional to the devotion to study and productiveness in investigation which those at any time identified with tuberculosis exhibit. The animal man, the general public, is just so "cussedly" constituted that the business of resting on one's oars will not excite him: he delights in and is enthused and motivated by action. The moment a reputation becomes static, that moment it enters upon its descent to obscurity: growth comes only through feeding and strength through exercise.

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