

**BULLETIN NO. 3, VOLUME
V, ISSUED QUARTERLY BY
VERMONT STATE BOARD
OF HEALTH, MARCH 1, 1905**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649193936

Bulletin No. 3, Volume V, issued quarterly by Vermont state board of Health, March 1, 1905 by Various

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Issued Quarterly by

Vermont State Board of Health,

March 1, 1905.

Entered October 21, 1901, as second-class matter, Post Office at Brattleboro, Vt.,
under act of Congress of July 16, 1894.

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BRATTLEBORO, VT.

1905

TUBERCULOSIS AND ITS PREVENTION.

BY T. MITCHELL PRUDDEN, M. D.

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It is commonly neither wise nor necessary for people not professionally concerned to think much about disease, or weigh anxiously the chance or mode of its acquirement. But now and then conditions arise which demand general attention and instruction regarding certain diseases in order that a great threatened or actual calamity may be averted. Such a condition faces the people in all lands to-day in the appalling prevalence of tuberculosis. A disease which in mild or severe form affects at least one-half of the whole of the human race, and which causes the death of full one-seventh of all who pass away, killing about one-third of those who perish between the ages of fifteen and forty-five,—a disease which is most insidious in its onset, and often relentless in its course, and which may be largely prevented,—is one about which we cannot be indifferent, and should not longer be inactive.

For a long time there has been reason for believing that tuberculosis is a communicable disease. Its prevalence in certain families and communities, its frequent occurrence in those who have personally attended upon its victims, its onset in those who have occupied apartments vacated by consumptives—such facts observed over and over again abundantly justify the belief in its communicability.

Until a few years ago the cause of tuberculosis was unknown, and no definite data were at hand which could help us to make a feasible plan for limiting its ravages. But in these later years a great light has been thrown upon this and other kindred diseases.

Most intelligent people are aware that within the past two decades a new field in the domain of life has been opened and widely explored. It has been learned that in earth and air and water there exist countless myriads of living things so minute as to lie far beyond the limits of the unaided vision, and yet in the aggregate so potent in the maintenance of the cycle of life upon the earth that without their activities all life would soon cease to be, and the elements which for a short span fall under the sway of the life forces in all higher animals and plants would lapse finally and irrevocably into their primal state. These tiny organisms are called germs, microbes, or micro-organisms. One great and important group of them belongs among the microscopic plants called bacteria.

These bacteria as a class are so important in the economy of nature because they live for the most part on dead organic material—that is, such material as has once formed a portion of some living thing. Now the world's store of available oxygen, hydrogen, carbon, and nitrogen, out of which all living beings are largely formed, is limited, and if after these have served

their temporary uses, as the medium through which that mysterious potency called life alone can find expression, they were not speedily released, new generations of living beings could neither assume nor maintain their place in the great cycle of life. And so these tiny plants, year in, year out, by day and by night, unseen and mostly unheeded, are busy always in making possible the return of each year's visible vegetation and the maintenance of an unbroken succession of generations in man and beast.

Different groups and races among the bacteria have different habitations, and vary widely in their special powers. Complex and powerful as is the aggregate result which they accomplish in the world, the performances of the individual are comparatively simple. They are most liberally endowed with the capacity for multiplication, and each germ acts as a tiny chemical laboratory, taking into itself the organic matter on which it feeds, and resolving it into new compounds. Some of the latter are used in building up and maintaining its own body, while others are given off into the surrounding media.

We are but just beginning to peer in at the mysterious processes which go on under the influence of the bacteria in this underworld of life, and to realize that all the lore which unwearied toilers in the past have gathered in their studies of the visible forms of animals and plants makes but one of the many chapters in nature's story book of life.

But this new and stimulating point of view, toward which the studies of the past decades have led us, does not look so largely into the domain of the practical that it would greatly attract the majority of business- and pleasure- and ennui-ridden mankind were it not for one very significant fact which these recent studies have revealed. This is that among the myriads of altogether beneficent bacteria which people the earth and air and water there are a few forms which have chosen out of all the world as their most congenial residence the bodies of men. But even this would be of only passing interest to most people were it not still further unfortunately true that in the performance of their simple life-processes these man-loving bacteria, feeding on the tissues of their host, and setting free certain subtle poisons in his blood, each after its kind, can induce those disturbances of the body's functions and those changes in its structure which we call disease.

The diseases caused by the growth of germs in the body are called infectious. The germs causing some of the infectious diseases are given off from the bodies of their victims in such form as to be readily transmitted through the air to others, in whom they may incite similar disease. Such diseases are spoken of as readily communicable, though it is not actually the disease itself, but only the germ causing it which is transmitted. In other infectious diseases transmission but rarely occurs. Many infectious diseases are very easily communicated from the sick to the well under unsanitary and uncleanly conditions, which with proper care are very little liable to spread.

I need not here put on parade the whole uncanny list of germ diseases, in which tuberculosis stands foremost, followed by pneumonia, diphtheria, typhoid fever, and the rest. Nor need I call to mind the means by which our

growing knowledge in this domain has day by day been laid under tribute for suggestions of hope and safety for the stricken. It is a record of brilliant conquest in nature, and already of far-reaching beneficence to man.

But the great fundamental advance which signalizes the past decade is the lifting of this whole class of fateful germ diseases out of the region of the intangible and mysterious, and their establishment, on the basis of positive experimental research, in the domain of the comprehensible and definite. The things which cause them are no longer for us mysterious emanations from the sick, or incorporate expressions of malign forces against which conjurations or prayers could alone promise protection. But they are particulate beings, never self-engendered, never evolved in the body, always entering from without—things which we can see and handle and kill.

Let us now glance at the germ called the tubercle bacillus, the germ which causes and which alone can cause tuberculosis. It does not exist in the body of men or animals in health. Without the entrance of this particular germ into the human body from without, tuberculosis cannot develop in it. Without the transmission of this germ in some way or other in a living condition from the sick to the well, tuberculosis cannot spread. In the life story of this tiny germ lie both the potency for mischief which we deplore and the secret of our release from its bondage.

The tubercle bacillus is a little colorless rod-like plant, so small that even many thousands of them piled together would make a heap still far too small to be visible to the naked eye. It cannot move about, nor can it grow without moisture, nor at a temperature much above or much below that of the human body. The material on which it feeds must be very nicely adapted to its requirements, and it has no lurking or growing places in nature outside of the bodies of men and a few warm-blooded animals. It can be cultivated artificially in the laboratory, and we know more about its life and peculiarities than about almost any other germ. While it can remain alive in a dried state for many weeks, it is readily killed by heat, by sunlight, and by many of those chemical substances which we call disinfectants. It does not flourish equally well in the bodies of all human beings.

When once it gains lodgment in a body suited to its growth it multiplies slowly, each germ dividing and subdividing, taking from the tissues material for its growth, and returning to them certain subtle poisons which it sets free. The action of the tubercle bacillus is peculiar in that it stimulates the cells of the body, wherever it may lodge and grow, to the formation of little masses of new tissue, which we call tubercles. These tubercles are, as a rule, short-lived, and, if the disease progresses, tend to disintegrate. If the tubercles have grown in such situations as make this possible, as in the intestinal canal or the lungs, the disintegrated and broken-down material, often containing myriads of the living germs, may be cast off from the body. In tuberculosis of the lungs, or consumption, this waste material is thrown off with the sputum. While almost any part of the body may be affected, tuberculosis of the lungs is by far the most common form of the disease.

It follows from what has been said that the only way in which we can

acquire tuberculosis is by getting into our bodies tubercle bacilli from tuberculous men or animals. The only animals liable to convey the disease to man are tuberculous cattle, and these through the use of either meat or milk. The danger from the use of uncooked meat or the unboiled milk from tuberculous cattle is real and serious, but it will not be considered here at length, because the great and prevailing danger of infection comes from another source.

Almost as soon as the significance of the tubercle bacillus was established, a series of studies was undertaken on the possibility of the spread of the disease by the breath or exhalations of the persons of consumptives. These studies at once showed that the tubercle bacillus cannot be given off into the air of the breath from the moist surfaces of the mouth and air passages, nor from any material which may come from them while it remains moist, nor from healthy unsoiled surfaces of the body. The establishment of this fact is of far-reaching consequence, because it shows that neither the person nor the breath of the consumptive is a direct source of danger even to his most constant and intimate attendants.

While the discharges from the bowels in persons suffering from tuberculosis of the intestinal tract may contain many living bacilli, the usual mode of disposal of these discharges protects us from any considerable danger from this source.

It is the sputum after its discharge from the body on which our attention must be fixed. While the sputum is moist it can, as a rule, do no harm, unless it should be directly transmitted to those who are well by violent coughing, or sneezing, by the use of uncleaned cooking or eating utensils, by soiled hands, or by such intimate personal contact as kissing or fondling. But if in any way the sputum becomes dried, on floors or walls or bedding, on handkerchiefs or towels, or on the person of the patient, it may soon become disseminated in the air as dust, and can then be breathed into the lungs of exposed persons. This germ-laden material floating in the air may be swallowed, and thus enter the recesses of the body through other portals than the lungs, but these are the most vulnerable and accessible organs.

The wide distribution of tubercle bacilli in the air of living rooms, and in other dusty places where people go, is due partly to the frequency of the disease, and the large numbers of living bacilli which are cast off in the sputum (sometimes millions in a day), and partly to the fact that many of the victims of consumption go about among their fellows for purposes of business or pleasure for months or years. So each consumptive, if not intelligently careful, may year after year be to his fellowmen a source of active and serious and continual infection.

This, then,—the dried uncared-for sputum of those suffering from pulmonary tuberculosis,—is the great source of danger; this the means so long concealed by which a large part of the human race prematurely perishes. Let but this discharged material be rendered harmless or destroyed in all cases before it dries, and the ravages of this scourge would largely cease. This is not a theoretic matter only, for again and again have the living and virulent

germs been found clinging to the walls and furniture and bedding and handkerchiefs of consumptive persons, and in the dust of the rooms in which they dwell.

A malady whose victims far outnumber those of all other infectious diseases put together, sparing neither rich nor poor, seizing upon life while it is as yet only a promise, but most inexorable in the fullness of its tide—this malady can be largely prevented by the universal and persistent practice of intelligent cleanliness.

We have learned in the past few years one fact about tuberculosis which is of incalculable comfort to many, and that is that the disease is not hereditary. It is very important that we should understand this, because it seems to contradict a long-prevalent tradition, and a belief still widely and sorrowfully entertained. Bacteria, and especially most disease-producing bacteria, are very sensitive in the matter of growth and proliferation to the conditions under which they are placed, and especially to the material on which they feed. So that a germ which can induce serious disease in one species of animal is harmless in the body of a different though closely allied form. More than this, different individuals of the same species, or the same individual at different times, may have the most marked differences in susceptibility in the presence of disease-producing germs. What this subtle difference is we do not know. Whether the body at one time affords a congenial soil to the invading germs and at another does not; whether its marvelous and complex powers of resisting the virulent tendencies of disease-producing bacteria at one period or in one individual are more vigorous than in another and vary at different times, we do not certainly know. This, however, we do know, that certain individuals are more likely than others to yield to the incursions of the tubercle bacillus. This vulnerability in the presence of invading germs we call susceptibility, and susceptibility to the action of the tubercle bacillus is hereditary.

It is not the disease, tuberculosis, which comes into the world with certain individuals or with successive children of the same family, but the aptitude to contract it should external conditions favor.

However much the child of tuberculous parents or a member of a tuberculous family may be predisposed to the disease, he cannot acquire tuberculosis unless by some mischance the fateful germ enters his body from without. What has been regarded through all these years as the strongest proof of the hereditary transmission of tuberculosis—namely, the occurrence of the disease in several members of the same household—is, in the new light, simply the result of household infection—the breathing of air peculiarly liable to contain the noxious germs, or their entrance in some other way into the bodies of persons especially sensitive to their presence.

I do not mean to imply that under no conditions can the tubercle bacillus be transmitted from the mother to the child before its birth. In a few instances this is believed to have happened. But its occurrence is so extremely infrequent that it may be regarded as accidental, and of no serious importance from our present point of view.

But it will perhaps be said: "If the tubercle bacilli are so widely diffused, why do we not all acquire tuberculosis, and why was the world not long since depopulated?" In order to explain this matter I must ask the reader to look with me for a moment at some of the body's natural safeguards against bacterial and other invaders from the air.

It has been found that a person breathing in germ- and dust-laden air through the nose breathes out again air which is both dust- and germ-free. The air passages of the nose are tortuous, and lined with a moist membrane, against which the air impinges in its passage. On these moist surfaces most of the solid suspended particles, the germs among them, are caught and held fast, and may be thrown off again in the secretion. In breathing through the mouth this safeguard is not utilized. Again, the upper air passages leading to the lungs are lined with a delicate membrane of cells, whose free surfaces are thickly beset with tiny hairlike projections. These projections are constantly moving back and forth with a quick sweep, in such a way that they carry small particles which may have escaped the barriers above, up into the mouth, from which they may be readily discharged. In this way much of the evil of breathing dust- and germ-laden air is averted. But in spite of these natural safeguards a great deal of foreign material, under the ordinary conditions of life in-doors or in dusty places, does find lodgment in the delicate recesses of the lungs. The body tolerates a good deal of the deleterious material, but its overtaken toleration fails at last, when serious disease may ensue.

When ordinary forms of living bacteria get into the tissues of the body, a very complex cellular mechanism, not fully understood, usually leads to their destruction and ultimate removal. In the presence of the tubercle bacillus the body cells are often able to build a dense enclosing wall around the affected region, shutting it off from the rest of the body. This is one of the modes of natural cure.

The body cells are sometimes able, if sustained by nourishing food and an abundance of fresh air, to carry on, year after year, a successful struggle with the invading germs, so that the usefulness and enjoyment of life are but little interfered with. Finally, a certain proportion of human beings seem to be endowed at birth with some as yet unknown quality in the cells or fluids of the body which naturally unfits them for the life uses of the tubercle bacillus, and so renders the individual for longer or shorter periods practically immune. Others, on the contrary, are, as we have seen, from birth unusually susceptible.

This inherited susceptibility to the incursions of the tubercle bacillus, should this find lodgment in the body from without, by no means always reveals itself in any apparent lack of vigor or robustness of the body. Still, any habit or mode of life which diminishes the bodily vigor, whether in those predisposed to this malady or in the apparently immune, and gives it a leaning toward disease, diminishes, as a rule, the chances of a successful contest with the bacillus.

This it is that in spite of the wide distribution of these fateful germs in