How Infection Affects the Body

Continued from page 4

not only assist materially in maintaining vegetable and animal life on this planet, but "in the arts and industries they are as essential to modern economic life as are the ingenious mechanical inventions of men. Many secret processes now in use in the arts and manufactures are but devices to harness these natural forces. Thus in the manufacture of linen, hemp, and sponges, in the butter, cheese, and vinegar industries, in tobacco curing, etc., bacteria play an important rôle."

Bacteria for Every Condition

It naturally occurs that to meet the various conditions under which decomposing matter exists in nature there is a great variety of species of bacteria, each species being adapted to a special field of operations. These species are distinguished from one another by the shapes they assume during their growth, some being rod shaped (the bacillus), others spherical (the coccus), and others spiral (the spirillum) Under one of these divisions the various species are classified.

In these latter days of popular knowledge of scientific progress, but without precise information of details, bacteria are associated in the public mind with disease, especially of the epidemic form. While this prejudice is useful in stimulating the people to adopt and enforce preventive measures against conditions that tend to promote bacterial life in their homes and in their own persons, yet it should be understood that comparatively few of the great number and variety of bacteria are pathogenic, or disease producing, in man.

So throughout the animal kingdom we find that few are susceptible to a common disease; or, in other words, that the same species of bacteria attack with equal force several varieties of animals.

The explanation of this peculiarity is found in the variations of the quality or intimate nature of the tissues and organs of different species of animals. The same may be said of our own bodies,—the several organs vary greatly in their susceptibility to the attacks of the different iknds of bacteria; hence the latter are classified as specific and nonspecific, according as they cause specific or nonspecific disease.

The distribution of bacteria is limited only by the existence of plants and animals; that is, the existence of decomposing vegetable and animal matter. Though they are more abundant in the earth where such matter is found most abundantly, yet they abound in the air, the water, on plants, animals, and insects, on our own bodies, and in every cavity leading to the exterior. As bacteria are always searching for food, the number present is a sure indication of the degree of cleanliness of the thing, individual, or locality where they are found.

The movements of bacteria from one point to another are through the medium of some other mode of conveyance than their own bodies afford. Thus they are borne by the water, by vegetation, by animals of every kind especially insects, by the air on particles of dust. The typhoid bacillus borne in water and milk has caused innumerable epidemics of that dreaded disease.

The Deadly Tubercle Bacillus

The tubercle bacillus is borne on the air through the medium of particles of dust, and in cities where the victims of tuberculosis scatter these germs profusely in the streets, public conveyances, churches, and places of resort, in the act of coughing, sneezing, and spitting, the dust borne on the winds is a constant and most fertile source of infection of tuberculosis. In a city like New York thousands are annually infected by the dust borne tubercle bacilli, not only by inhaling them in the street, but even more certainly in the quiet of their homes, where the germ bearing dust accumulates in clothing, bedding, carpets, rugs, and upholstered furniture, and is daily forced into the air of the living rooms by broom and duster.

Foul as is the air of the unventilated tenements of the poor, it has been demonstrated that the dust which saturates the furniture, carpets, rugs, and hangings of the residences of the wealthy contains sixty per cent. of ordinary street filth.

An authority says, "The most widely distributed pathogenic microörganism (disease-causing bacterium) in the air is the tubercle bacillus, the cause of consumption and a large variety of other ailments, such as hipjoint disease, caries of the spine, etc. Over one hundred thousand persons die annually from consumption alone in the United States, and it is estimated that there are over two million people afflicted with the disease in one form or another. All of these sufferers are expectorating billions of tubercle bacilli daily."

How They Affect the Body

Considering the second inquiry as to how infection affects the body, we must constantly bear in mind that a bacterium, though a scavenger, is a conservator of nature. Its real function in the orderly processes of animal and vegetable life is to utilize waste for the preservation and promotion of animal and vegetable life on this planet where the conditions are so unfavorable to both.

Therefore, wherever we find bacteria in the active process of growth, that is, multiplication, we may be assured that they have found matter that should be rescued from waste and converted into useful food for plants. It follows that when we find a bacterium actively growing in any part of our bodies, it has found some form of decaying matter that is not only no longer useful to our bodies, but is in fact harmful and should be removed.

It is also important to understand that waste matter is found under a great variety of conditions, and that for its proper conversion into useful food for plants there must be a correspondingly large number of species of bacteria each having its special field of operation. It is due to this variety of bacteria that there are so many infective diseases; for each species of bacteria creates its own individual form of disease.

This statement requires the following explanation: *viz.*, a bacterium in a quiescent state is harmless; everyone has within his body innumerable bacteria, as the tubercle and typhoid bacilli; but they are inert, and hence innocuous. It is only when they find their proper food, decaying matter, that they begin to multiply, and in that act they secret a poison, toxin, which is absorbed and, entering the circulation, causes in the individual a special class of symptoms peculiar to that toxin, or poison.

These symptoms constitute a disease, the technical name of which is usually fanciful, depending on some feature of the symptoms, but explaining nothing as to its essential nature.

For example, the typhoid bacillus finds its food in certain minute glands of the small bowels. If these glands are in a perfectly healthy state when the bacillus enters the digestive tract, the germ will pass over them and disappear from the body perfectly harmless. But if the bacillus finds its appropriate food—dead or decomposing matter—in the glands, it at once takes up its abode in them and "begins housekeeping"; that is, it begins to multiply according to the method of fission of its cell and rate of multiplication, already described. During this process the multiplying cells excrete a toxin, which, being absorbed, creates a fever, the result of a true blood poisoning. This fever is called typhoid, because its prominent symptom, stupor, resembles that of typhus fever. The name, therefore, signifies nothing as to the nature of the disease.

Keep It Out of the Circulation

The poisoning of the body by the excreted toxin of the multiplying cells, which is simply plant food, occurs because it is removed only in part by the digestive organs, the circulation that conveys it to the other eliminating organs being efficient for that purpose. Could all of this toxin be removed as fast as it is excreted, and not enter the circulation, there would be no fever.

The termination of this process must be either the death of the colony from exhaustion of the food supply in the glands, or the exhaustion of the patient by the excess of toxins that accumulate in the body. As the activity of the bacillus depends upon the food supplied, the severity and length of the fever varies in different individuals. Some are immune because the glands that furnish the food of the typhoid bacillus are in a state of high health; others have a brief and mild attack, because the food supply is scant owing to a slight impairment of the integrity of the glands; but with a considerable number in every epidemic the food is ample to sustain the creation of an immense colony of bacilli which destroys the victim by an overdose of poison.

The final disposition of the typhoid bacilli after a course of fever, was believed to be by their elimination from the body through the various organs devoted to the discharge of waste products; but recent investigations have proved that the typhoid bacillus may remain in the body for long periods without apparently affecting the health of the person, but when communicated to another it will cause an attack of fever of the most virulent type. In one instance an outbreak of typhoid fever was traced to a woman who had the fever upward of fifty years ago. It was found that the excretions of her body contained immense quantities of living typhoid bacilli. She was a cook by trade, and it was found on tracing her history that wherever she had worked there had been epidemics of typhoid, beginning at the house where she was acting as a cook.

A still more remarkable feature of the life history of the typhoid bacillus has recently been made public. A typhoid epidemic was traced to a nurse who had attended cases of typhoid fever, but had never suffered from an attack of that disease, and yet was discharging large quantities of the bacilli. These cases can be explained only on the theory that these microörganisms find some place, possibly, as has been suggested, in the gall bladder, where they find food sufficient to keep them in an active state of multiplication, but where the conditions prevent the absorption of the toxins they excrete.

How far these curious incidents in the life of the typhoid bacilli are common to other bacilli is not known; but if it is true of other infectious diseases, the fact will explain the origin of those obscure and mysterious cases that occur without any known exposure to the infection.

Aims to Destroy the Body

In concluding this inquiry as to the nature of infection and its effects on the body, the following statement of a biologist as to the bacterium seems justified: "When it enters a living body, it aims directly at the destruction of the latter. It multiplies rapidly, tends to scatter its broods throughout the tissues, and all the while gives off the most powerful poisons. This agent is wickedly implacable,

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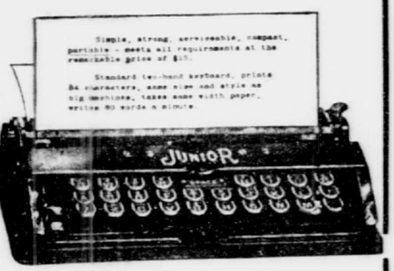

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