

THE NEWER HYGIENE.

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Instruction in the nature of infectious diseases, especially in the means of transmitting these diseases from one person to another, is required by law in all our public schools. This law is of great value; for it is only through the intelligent co-operation of a well-informed public that hygienic and sanitary measures designed to control and stamp out infectious diseases can be successful. A wide diffusion of this knowledge will go far to make tuberculosis a thing of the past, and diphtheria and smallpox unknown.

In obedience to the legal requirement, there are taught, in our public schools, certain elementary facts regarding the nature of pathogenic bacteria, and certain facts regarding the ways in which these bacteria are transmitted from one person to another. These facts in themselves are of inestimable value, but they are insufficient.

The presence of bacteria within or upon the human body, the transmission of disease-germs from the sick to the well, is but one of the factors tending to cause disease. To acquire a disease it is usually necessary, not only to acquire the germs of that disease, but there must be a lowering of bodily resistance as well.

Every fourth person in this room is carrying daily in his throat or mouth virulent pneumococci. Yet he does not acquire pneumonia. And why? Because there is an efficient defense against this disease in the healthy human body. Some day this defense will be lowered and pneumonia develop. Most soldiers in the Philippines carry in their intestinal canals virulent germs of dysentery; and with no ill effects, till intoxication or dietary excesses lower the intestinal resistance. We daily inhale germs of tuberculosis. Some day, when our resistance is low, we will acquire the disease.

A knowledge of the body's fighting power against bacteria, a knowledge of the ways in which that power can be increased or decreased by hereditary influences and by modes of life, is therefore of hygienic importance. It should form part of the curriculum of every public school.

The body fights disease in many ways. It will be sufficient for hygienic purposes to teach but three of these ways: (i) the method of antitoxines; (ii) the method of antiseptics and (iii) the method of phagocytosis.

There are many diseases in which the symptoms are caused, not by the bacteria themselves, but by the poisons the bacteria manufacture. Thus, in tetanus, or lockjaw, the bacteria grow, perhaps unnoticed, at the bottom of the Fourth-of-July wound on the hand or foot; but the chemical poisons they manufacture, carried by the blood to the brain and spinal cord, cause the spasms and convulsions that characterize the disease. In diphtheria the bacteria rarely enter the body, but grow in grayish-white masses on the moist surfaces of the mouth and throat. The chemical poisons they manufacture, absorbed by the tissues, cause the paralysis and heart failure that characterize the disease.

The body has the power of forming substances that neutralize these poisons. To these neutralizing substances the name antitoxine has been given.

This fact is of hygienic importance for two reasons: First, because it is sometimes possible to assist the body in its efforts to form antitoxines, by introducing into it antitoxines artificially prepared; and, second, because the body's power to form these substances is modified by mode of life.

A horse that has been repeatedly injected with the poisons manufactured by the germs of diphtheria, grown on artificial culture media, develops enormous amounts of diphtheria antitoxine. A few drops of the serum of this horse renders harmless large quantities of diphtheria poison. Through the use of diphtheria antitoxine in practical medicine, the mortality from diphtheria has been reduced from the 24 per cent. to 40 per cent. it was, twenty years ago, to the less than 1 per cent. it now is, in well-treated cases. Overwork, insufficient clothing, improper food, alcoholic excesses, lack of sleep, and other factors, so lower the antitoxine-forming power of the body as to greatly increase the dangers from infection.

The second way of hygienic significance in which the body fights disease, is by the formation of chemical substances that, although they have no influence on the chemical poisons manufactured by bacteria, have an even more important property, that of killing the bacteria themselves.

The presence of antiseptic, or bacteria-killing substances in the blood and tissue juices is easily shown. One has but to mix bacteria with serum

and test from time to time, by simply cultural methods,* whether or not the bacteria are alive. Thus, in one experiment, there were mixed with human serum typhoid fever germs in such numbers, that every drop of the serum contained 50,000 bacteria. Two minutes later but 20,000 of these were alive; at the end of ten minutes, but 800; and in twenty-five minutes, they were all dead.

Not only can serum kill bacteria, but most of the secretions of the healthy human body are bacteria-killing as well. Gastric juice, vaginal secretion and nasal secretion, kill bacteria in enormous numbers. The hygienic significance of this is evident from the fact that these bacteria-killing substances, also, are modified by modes of life. Dietary excesses may so lower the bacteria-killing properties of gastric juice, and unsanitary conditions so lessen that of the tissue juices that susceptibility to infectious diseases is greatly increased.

The third way of hygienic importance in which the body fights disease, is by phagocytosis. In the body there are millions of white blood corpuscles, each having the power of independent motion and as one of its functions the faculty of eating and destroying disease germs.

It is found that the bacteria-eating power of white corpuscles is largely dependent upon certain chemical substances† present in the blood and tissue juices. Without these chemical substances the eating of certain pathogenic bacteria does not take place. With them, it is very active. It is further found that these chemical substances are influenced by modes of life. That they may be increased or decreased under different hygienic conditions. Phagocytosis, therefore, has also a place in popular hygienic knowledge.

One of the unfortunate results of the spread of knowledge of pathogenic micro-organisms is the formation of an unreasoning popular fear of disease germs. It is thought that a wide understanding of facts regarding bodily resistance will tend to replace this unfortunate germ-fear by a rational faith in the body's marvelous powers. That it may turn the tide of hygienic endeavor, from an exclusive fight against bacteria to a combined fight *against* bacteria and *for* bodily resistance.

* See Popular Science Monthly, Vol. 66, pp. 474-477.

† Opsonins.