

and produce these disturbances which we call disease. There are many diseases each one of which is due solely to the entrance into the body of one or more bacteria of a certain distinct kind. As long as these bacteria are kept out of the human system the corresponding disease will never occur, but whenever these bacteria enter into the body then the disease may occur. The remaining twelve figures of the above group represent some of the bacteria which produce disease, or pathogenic bacteria, as they are called. Each of these species of bacteria is distinct from every other, and although they have been cultivated under a great variety of conditions, it has not as yet been possible to convert one species of bacteria into another, and no matter through how many generations it has been cultivated, the last generation is as virulent as the first, and produces the same disease when inoculated in animals. It is possible, however, to render the bacteria less virulent. There are a number of species of bacteria which, when allowed to remain for months in the same culture fluid, suffer a loss of vital power, and when these weakened bacteria are inoculated into animals, they produce the definite specific disease in a mild form. Such inoculations render the animal more or less insusceptible to the disease thereafter, and this is the principle of preventive inoculation for disease.

Figures 4 and 5 represent the bacillus septicus and the micrococcus septicus respectively. The former is about 1.4 micromillimeters in length and 0.7 micromillimeters in breadth, and the latter is about 0.5 micromillimeters in diameter. Either of these bacteria injected under the skin of rabbits, birds and some other animals, will cause death in from sixteen to forty hours, with the symptoms and lesions of septicæmia, and in the blood of the animals thus destroyed are found many bacteria similar to those injected, and these bacteria can be cultivated outside of the body through many generations without losing any of their virulent powers. These two specimens will serve as examples of the bacteria of septicæmia, although there are other bacteria which will cause this disease. The bacterium causing pyæmia is

a micrococcus somewhat similar to those represented in figure 5.

Figure 6 represents the spirillum of relapsing fever, called the spirochæte Obermeyer's after its discoverer. These spirilla make their appearance in the blood a few hours before the fever, and increase so rapidly in number that during the height of the fever they may even exceed the red blood discs in number, and then disappear as the fever passes off. Although it is probable that the presence of these spirilla in the blood causes the fever, yet it has been impossible to cultivate them outside of the body, so that the experiment of injecting some of a pure culture of them into animals cannot be tried. The spirilla vary from 12 to 43 micromillimeters in length and are shaped like a corkscrew, exhibiting from four to ten turns. In figures 4, 5 and 6 we have examples of each of the great groups of bacteria—the bacillus, the micrococcus and the spirillum.

Figure 7 represents the bacillus anthracis—the bacillus of anthrax—the disease called splenic fever in cattle and sheep, and in man, malignant pustule. The bacillus has a length of from 3 to 6 micromillimeters and a breadth of a little more than 1 micromillimeter, and has been more thoroughly studied than any other bacillus of disease. In the bodies of animals this bacillus multiplies only by fission, but when cultivated or growing outside of the body it multiplies by sporification. The bacillus of anthrax introduced into the body causes first a local abscess, then a swelling of the neighboring lymphatic glands, and then the bacilli appear in great numbers in the blood and death soon results. Like all infectious diseases, anthrax has a period of incubation, which varies in different animals, seeming to depend in part on the size of the animal.

Figure 8 represents the bacillus tuberculosis, which are extremely thin rods varying in length from 2 to 4 micromillimeters. These bacilli are found in all tuberculous growths. In young tubercles they are especially abundant in the giant cell. In old tubercles they are found in the periphery, which is the part of most active growth. In the dried or caseous matter no bacilli, but