What Bacteriology Has Done for Sanitary Science.

By Severance Burrage.

Sanitation, the science of disease prevention, has been practiced variously and in varying degrees from time immemorial; but it was of little importance and remained in comparative obscurity and impotence until the birth of bacteriology in the latter part of the nineteenth century. The establishment of this new science by Robert Koch in 1881 marked a most important epoch in the history and practice of preventive medicine. Sanitation at once became transformed from a puny, uncertain, "hit or miss" science into one of the most important factors in modern civilization. The causes of many diseases being positively known, the possible causes of many others being inferred, the sanitarian had the most important key in his possession for the prevention of those diseases. In other words, he became much better fitted to practice his profession. Furthermore, each separate branch of sanitary science has received from the bacteriologist definite knowledge which has made it far more exact and practical, and correspondingly more efficient.

Take for example the subject of disinfection. This science in various forms has been practiced for many centuries. Ovid states with regard to it, that sulphur was used by the shepherd of his time for purifying wool from contagious diseases. At the time of Hippocrates sulphur was used as a preventive against plague. While good results were often obtained by pursuing these and other such practices, the exact reasons for the results were not understood. Today, however, the bacteriologists have shown by exhaustive and conclusive experiments that certain specific disease germs are destroyed by certain disinfectants under certain conditions. They have also shown that the spores of certain bacteria will not be killed by the same processes which destroy the vegetative forms of the same species. Thus they are able to tell us that some of the ancient practices were entirely useless, others were quite unnecessary, while still others were very efficient.

More than 400 years B. C., Hippocrates advised that all polluted water should be boiled and filtered before being used for drinking pur-

poses. Today we know what constitutes dangerous pollution, and the bacteriologist tells us precisely what the processes of boiling and filtering do to this pollution in the water. He can very readily detect a polluted water by analysis, and aside from showing the presence of pathogenic bacteria, he can show the presence as well of those bacteria which come only from sewage. Along this same line bacteriology is indispensable to the sanitary scientist in testing the efficiency of water filters, both large and small. In the matter of sewage disposal, he has shown the effects of the soil bacteria in destroying the infectious material in filth which is spread over the surface of the ground, or upon filter beds; and again, in the putrefying action in the septic tank, he has shown an efficient purification.

It is now known through the researches of the bacteriologists that the typhoid bacillus and other pathogenic bacteria can and do resist the freezing temperatures for many weeks. Hence the freezing of water does not necessarily purify it of all of its disease-producing agencies.

It has been shown that the changes which occur in milk are wholly due to bacteria. Hence the bacteriologist has pointed out the necessity of bacteriological cleanliness in and about the dairies. Oftentimes disease germs may be found in the milk, pointing to the need of inspection of dairies and the careful supervision of our public milk supplies.

Putrefactive changes in meat and other foods, due to bacterial growths, result oftentimes in the production of ptomaines. Therefore care should be exercised in the sale of meat and other foods. Fruits and vegetables are known to harbor germs on their outer skins, and, when handled by infected persons, may result in spreading disease. Undoubtedly this is the source of many so-called sporadic cases of disease. Experiments have shown that the typhoid bacillus may remain alive in the stomach of the living oyster for several weeks. Serious epidemics of typhoid fever have been spread through the agency of oysters which were fattened in sewage polluted waters.

The masterly researches of Pasteur, Tyndall and Lister resulted in the protection of wounds from infection, and made it possible to undertake previously impossible surgical operations. They simply proved the presence of germs in the dust of the air, and showed the necessity of keeping this germ-bearing dust away from the vicinity of the operating table.

Bacteriology assists materially in the prompt diagnosis of many of the contagious diseases, such as diphtheria and tuberculosis, making early isolation and quarantine possible.

The old idea that consumption was a constitutional disease has been exploded. Dr. Koch, in 1882, declared this to be a germ disease. Experience has shown that there are as many as two million bacteria in a single expectoration. It is undoubtedly through the medium of the sputum that most of the consumption is spread, and these facts point out the necessity and importance of precautionary measures.

There have been many recent discoveries made by bacteriologists showing that certain diseases are due, not to bacteria, but to animal parasites, protozoa. There are many cases in which these animal parasites appear to be carried through the agency of insects. An example of this is the carrying of malaria germs by the mosquito. This has led the sanitarian to make important crusades against the mosquito, destroying their breeding places, and in this way checking a spread of the disease.

Experiments with the common house fly have shown that these insects carry infected material on their legs and probosces. Hence the need of disinfecting all germ-bearing material which may come within the reach of the fly. Also the destruction of their breeding places so as to reduce as far as possible the numbers of these insects.

The discovery of antitoxic serums, the direct or indirect products of bacterial action and growth, have been a great advance in bacteriology and medicine, not only for the curing of disease, but, more important, for protection against disease as well. The use of protective serums is now in its infancy, and I look forward to the time when the bacteriologist shall have discovered or manufactured, with the assistance of the bacteria, a serum or mixture of serums with which we may be inoculated, and thereby protected against all diseases, perhaps throughout life. That would indeed be a great factor in preventive medicine.

These facts show briefly the great and incalculable assistance given to sanitary science by one of the youngest of the many "ologies." That the sanitary scientists have taken advantage of this aid is evidenced by the attention which they everywhere receive, and the importance which is now attached to their dictum and doings. They can now compel legislation to enforce safeguards against disease, and it is a benighted

community that does not respect these measures. These measures protect the state, municipality and the home; they affect schoolhouses, public buildings, foods, and street cleaning; in fact, there is hardly a phase of social or industrial life that is not reached by the arm of sanitary precautions. Further evidence is shown by a study of vital statistics during the past fifty years, wherein may be seen a marked reduction in the deaths from all preventable diseases. All of this has come about, and much more is yet to come, I believe, through this renaissance period in the science of sanitation, marked by the establishment of the germ theory of disease and the birth of bacteriology. From that time the bacteriologist and the sanitarian have marched hand in hand in their grand fight against disease and death.