THESIS.

Bacteria of water.

O. P. West. 1896.

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B A C T E R I A O F W A T E R.

The world of bacteria was first discovered in the latter part of the sixteenth century. Not withstanding its vast importance and extent, no especial attention was paid to it for years after its discovery. No one was able to see any use to which these minute organisms could be put, neither could anyone comprehend any damage they could possibly do. So long as this was the case science was willing to let them exist, merely, as curiosities.

But some bold thinkers, becoming dissatisfied with the explaination of the causes of certain deseases, argued that these microbes might be looked to as a source of many maladies This idea was first received with considerable opposition, but it gradually gained favor,year after year, and today nearly all scientists are ready to accept it.

It would, however, be altogether wrong to desire the destruction of all bacteria. Indeed, it is claimed that they are more beneficial than harmful. As they are necessary to plant growth, their destruction would be ours as well.

Bacteria may be defined to be single-celled microscopic plants. It is rather difficult to think of a plant's being able to move about from place to place, but many of these plants are as motile as any of the members of the animal kingdom. In size they vary very much, but none are visible

without the aid of a microscope. There are many species for which a square inch of surface would be ample space for six hundred million of the germs.

These little plants may be found almost everywhere that life can exist. A handful of soil, a breath of air, or a swallow of water may contain millions of them. There are, however, a few places where they have never yet been discovered. It is claimed that they never intrude any considerable distances above or below the surface of the earth. The atmosphere of mid-ocean is also said to be free from them.

The classification of bacteria is done in a variety of ways. Some are known by their form, others by the material from which they derive their sustenance, others by their motility or non-motility, others by their ability or inability to produce desease, and still others by their behavior in certain culture media.

The principal basis of classification is according to their form. There are three recognized forms, viz: The globular, or micrococci; the rod-shaped, or bacilli; and the screw-like, or spirilla.

The behavior of bacteria in different culture media is a favorite method of analysis to which the bacteriologist resorts. This method enables one to detect many characteristics which could not be determined in any other way.

Of the bacteria procured from the various sources, none

perhaps, are more interesting to study than those found in water. The microbes which cause the dreaded deseases of typhoid fever and cholera are disseminated by means of drinking water. River water produces a bacterium which produces a beautiful violet color and which will change solid geletine into a liquid form. There is also a bacterium which changes water into a red colored material. A microscopic examination of this variety shows it to be very active. It darts across the field from side to side, as though it were trying to escape from some devouring foe.

On July 17th, the investigation of a waterbacterium was commenced. An ordinary agar plate-culture of some drinking water was made. To make a plate-culture a glass plate is placed in an iron box and this is put into a dry-air-sterilizer. The sterilizer is kept at a temperature of 170 degrees centigrade for one hour. The object of this process is to kill all bacteria which might have been on the plate. A moist-chamber, which consists simply of a glass dish with a cover, is then procured. This dish should be about six inches high and fifteen inches in diameter. The next step is to place a glass bench into the moist-chamber. Upon this bench, the sterilized glass plate should be placed. The agar, having been previous put into a sterilized test-tube corked with a cotton plug, it is then melted by means of a water-bath. The medium is afterwards inoculated with the

water by the use of a sterilized pipette. The mouth of the test-tube is then sterilized by rotating it in the flame of a bunsen-burner. When the mouth of the test-tube has sufficiently cooled, its contents is poured upon a glass plate. The moist-chamber is then covered and the bacteria are left to develope their colonies. Glass plates and benches may be arranged one above another in such a way that three cultures may be made at the same time.

On July 22nd, the plate-culture had developed several thrifty looking colonies. Two of these colonies were especially conspicuous, one being white and the other of a brown color. They were both of a circular form and each was about one-fourth inch in diameter. It has been found that all the bacteria of a colony are the offspring of a single microbe, so the members of each individual colony must all belong to the same species. The bacteria of these colonies were compared under the microscope and it was found that there was no perceptible difference between them. They were both micrococci. Thus it may be seen that the color of colonies can not always be depended upon as a means of classification.

On the same day a pure culture was made by transplanting some bacteria from one of the above described colonies into some glycerene agar. This material is prepared by adding glycerene to ordinary agar. It was contained in a sterilized test-tube. To transplant the bacteria, a sterilized platinum

wire fused into the end of a glass rod was used.

The pure culture was examined the next day and it was observed that the microbes had been busily at work. They had formed several colonies and had changed about one-third of the glycerine agar from a solid to a liquid form.

A hanging drop examination showed these germs to be slowly motile. It took them over an hour to distribute themselves evenly through the drop. They seemed to have a tendency to move about in pairs, though a few single ones were observed.

To prepare a hanging drop for examination a small drop of distilled water is placed upon the center of a cover-glass. The drop is then inoculated with a specemin to be examined. A concave slide is procured and vaseline is smeared around the edges of the concave surface, for the purpose of holding the cover glass in place. The cover-glass is then inverted over the concave surface and the specemin is ready for examination.

A petrie-dish culture of some river water was made on July 20th, These petrie dishes are made of glass, they are circular in form and are about one-half inch thick and three and one-half inches in diameter. The cover laps down over the sides of the dish in such a way as to prevent the bacteria from entering it when the cover is in place. It is necessary to sterilize the dish before using it. After having

prepared and inoculated the culture medium the same as for a plate-culture, it is poured into the petrie-dish. Care should be taken to have the medium evenly spread over the bottom of the dish. The culture medium used in this culture was glycerine agar. Five days after the preparation of the culture it had developed several colonies. From one of these colonies a pure test-tube culture was made. The colony selected for this purpose was of a yellowish color, circular, and about one-sixteenth of an inch in diameter. Glycerien agar was used for the culture medium. By the 27th, of July the culture had developed a large number of white colonies and a considerable amount of the medium had been liquified.

A microscopic examination showed these bacteria to be bacilli. The ends of the germs were rounded and they were about one and one-hald times as long as broad. By means of a hanging drop examination they were shown to be very active. Nearly all of them were constantly moving some kept whirling round and round, while others were darting about and appeared to be busily searching for something. It may be that they were especially fond of the glycerine agar from which they had just been removed, and that they were exploring their new field in quest of some of that material.

The above described organisms are only a few forms of the myrids of bacteria which infest the water. This subject contains material for many volumes. It can be hoped of this brief article, merely to call to the readers attention that some of the commonest materials about him may be a field for a most interesting study.