

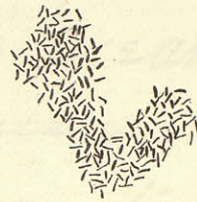
*Influence of Micro-organisms upon
Civilization.*

by Victor I. Sandt, '94.

Bacilli termo.
in rotten meat.



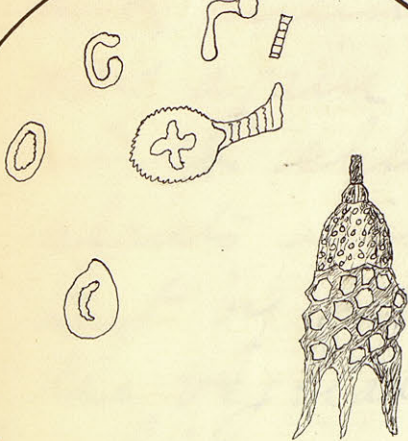
Typhoid bacilli.



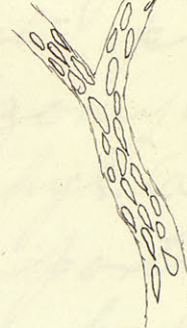
Micrococci in rotten apple



Fossils in chalk



Tuberculosis in lymphatic
system.



Synopsis.

The following article treats micro-organisms in a general way, first as builders, second as scavengers, and third as disease producers.

To have a good, clear understanding of the following article it will be necessary for one to know just what is meant when the term micro-organism is used. I shall therefore define it as follows - Micro-organisms are simple celled, organized, beings, either vegetable or animal, which are insufficient in size to be discerned by the unaided eye. While this definition may not be true in the strictest sense of the word it will however do for all purposes in the following article.

Micro-organisms are divided into two great classes, namely, vegetable and animal. The vegetable organisms may again be divided into plants with chlorophyll (schizomycetes) and plants without chlorophyll (alga). But by far the greater portion of the vegetable organisms belong to the schizomycetes, while most of the animal organisms are of the infusoria type. In treating this subject I shall speak of these

minute bodies in their three great-spheres. *viz.* Micro-organisms as builders, Micro-organisms as scavengers, and Micro-organisms as disease producers and their effects on man.

In the discussion of the first head let us look at the distribution of these diminutive bodies. Where they are found. And in what-quantity. To the first - I must say, above the earth, on the earth, and under the earth. Every breath of air we draw into our lungs contains them in innumerable quantities; every drop of water which we drink, and that which we do not drink, is infected; every particle of food which we eat contains them; every foot of earth contains countless thousands; the saliva and elementary canal swarm with these minute organisms. Every thing, living and dead, organic and inorganic, is infected.

As to numbers, it is simply

impossible to conceive the quantity of these minute beings in even a single cubic yard of dust taken from the streets of some of our large cities. From what has been cited above it may be possible for us to draw some conclusion as to the abundance of these small beings. Then we should not be surprised when we find that in the ages which have passed, they, by their remains, have built structures which far surpass the Egyptian pyramids in size and the marvellous buildings of Greece in beauty. In fact these works are themselves made of the very stone which were built-up by the remains of minute organisms.

The chalk cliffs, which gave England her first-name, were formed by the deposit of microscopic shells, the remains of infusoria. These cliffs have been estimated to be five hundred

feet in thickness and covers the greater portion of England and Wales, also the western part of France, and a small portion of Norway and Sweden. And when we are told that Ehrenberg estimated that one cubic inch contained forty one billion of these shells we will begin to have some idea in what countless numbers these beings once inhabited the earth. But we must remember that it took ages and ages to accomplish all this and that they may be as numerous today as they were millions of years ago. In fact there are deposits of these small beings forming in our own time. At the bottom of the sea there are deposits many feet thick of these small remains, and when time shifts the ocean bed to some other portion of the globe these deposits will harden and form shalk beds like those of old England.

There are also many other deposits of these small beings as the muds of Africa which some of the tribes use as food. This mud is almost wholly composed of micro-organisms as is also the "mountain meal" of Wauca which is mixed with flour and eaten. Even the plaster on our walls which makes our houses comfortable is composed of these minute bodies. And the bit of flint was an absolute necessity for our forefathers comfort. From it they struck the tiny spark upon the tinder and so kindled the fire which cooked their food and gave warmth to their bodies. It also tipped their arrows and spears; and later they fastened it upon their trusty rifles with which they obtained the necessary subsistence to sustain life, and protected their homes and those dear to their hearts from the cruelties of the savage red man; and with it-

they fought-for and obtained the freedom which we now enjoy.

This stone is now known to be composed of the siliceous remains of the diatoms, a microscopic form of alga. The finding of these remains in rocks which show no fossils of any other forms of life would lead one to think that these minute forms were the first-inhabitants of this globe and such has actually been proven to be the case, by all the eminent-Geologists and scientists.

We are now ready to turn our thoughts in the direction of our second head *v. i. z.* micro-organisms as scavengers. It was observed many years ago by some of the learned men that-Whenever a bit-of meat, or some other organic substance, was allowed to lay for a few days it-literally swarmed with minute animals and vegetable life. It was long supposed that

these little living bodies were produced spontaneously. Even the Greek philosophers believed in this theory and (Plato?) gave some receipts for spontaneous production of mice; he says "Take an iron pot and place some corn in the bottom, stuff the pot full of old dirty linen cloth and in a few days the corn will be gone and in its place will be from one to six full grown mice. These mice are often different in color and of different sex and often more than one species." Another gives the following receipt - "Take a brick and hollow out the middle, put in some corn meal and place another brick over it; put the whole in a damp place, and in a few days the meal will be changed into a full grown centipede."

But as the sunlight of knowledge dispelled the dark

mists of ignorance the people of course gave up these extreme ideas; but the theory of spontaneous production had many firm believers and supporters even in the beginning of this century, and was not entirely routed till Louis Pasteur and several other scientists showed where they came from and how they came. But to return to the subject of the meat. How did these living beings get there in such immense numbers? and what are they there for? What deceived the people was the fact of so many of these individuals being in the meat. They could not understand how they could come from the air or the earth in such vast numbers. The fact is that probably only one individual alighted on the substance, but it immediately reproduced itself

by cell division and these new individuals in turn divided; and when we consider that it only takes a few minutes for these beings to reproduce we can see that in a very short time millions and millions of these organisms would be there eating up the meat: Yes they are there for the sake of the nourishment which it affords and as they eat up the meat so they devour all other organized substance.

When we go into the quiet woods we little think that on every hand there is a great banquet taking place; but such is the case. Banquets which feed millions and millions of individuals and thousands and hundreds of thousands of generations. Every old dead tree is one of these feasts spread out to these tiny beings. One generation passes up and partakes of the food and passes

away while their posterity
take their place and so on and
on till there is nothing left
of the old tree but the dark
rich humus from which other
plants spring forth and grow.

As in the woods so on the
prairie and elsewhere; these tiny
organisms eat up the waste, we
might say, and so make it possible
for man and other organized
beings to live on this earth and
enjoy life. Did I say make it
possible for man to live? Yes; for
without these micro-organisms
nothing would decay, but would
remain in a state of perfect pres-
ervation. Imagine then, if you can,
all the trees, grasses, leaves, and
the bodies of animals that
have lived since the earth was
created. All these would be piled
up on top of each other, every
which way, just as they fell
when they died. Do you think
there would be much room

for you and me? And if there was would it be possible for man to enjoy himself when on every hand his gaze would meet the ghastly stare of some of his ancestors? Or would it be pleasant to go climbing over miles and miles of rubbish and then still as far as your eye could reach, see nothing but rubbish and ruins? I am sure it would not. I think then that no one will deny the statement that micro-organisms are the greatest scavengers on earth.

This brings us up to the third and last Topic. Micro-organisms as disease producers and their effects on man. These organisms are generally bacteria of some form and nearly all belong to the beneficial type and are divided into three great classes *v. l. z.* Micrococci, Bacilli, Spirilla. The Micrococci is a globular or ellipsoid

shaped body and is the germ of some of our fatal diseases.

Bacilli is a rod shaped germ, and is the most common of all the disease producing germs. It is from this germ that the general term bacteria was derived. Spirilla is a spiral shaped rod and a few of our diseases are produced by this germ.

The theory of germs causing disease had gradually but surely been making progress for a hundred years past, when in the middle of the present century such men as Pasteur and Koch fixed it forever. Many are the diseases which have been proven to be the result of Micro-organisms. Of these some of the most common are measles, diphtheria, Tuberculosis, (or consumption), Actinomycosis, small pox, cholera, spleenic fever, typhoid fever, Glanders, and a great many others. But to prove that a disease is caused by a germ is no

easy matter. We may find a germ in connection with a disease but this proves nothing, it may be simply a coincidence. The germ must be isolated from all other germs, and this sometimes proves to be a very difficult task, and by inoculation in a healthy animal reproduces the disease. One is not enough for there may be a happen so in this case two or three times is sufficient; but after very many times we may feel reasonably sure that we have found the germ of that particular disease.

There is often a difficulty of finding the germ in the first place before we can isolate it. A great many germs are so transparent that they cannot be seen in the tissue. The use of stains has somewhat alleviated this difficulty but then it sometimes takes years of labor to find the particular stain

which will stain a certain germ. It was by these long and extremely slow methods that the germs of diseases were discovered. And until the germ of a disease is known little or nothing can be done with it. The physician does not know how to treat it or what measures to take to prevent its ravages.

For instance let us take as an illustration that dread disease which over ran Europe. The black death came among men well fitted for it to work its most direful results. The country was full of petty wars and striffs, or if there was no war the high ways were full of robbers so that people were compelled to live in crowded cities ~~surrounded~~ surrounded with high walls and little or no attention was paid to sanitary measures.

So when the disease made its invasion it had the best of soil to grow upon. Thousands of persons died in a single day. In Norwich fifty seven thousand died in a few days. In London thirteen acres of land was added to the burial grounds. Ten thousand died in one night - and over half of the population was destroyed. Nothing could be done to stay its ravages until it was discovered that it was caused by a germ. Then by cleaning up the streets and tearing down the vile and filthy places, and by introducing strict sanitary measures it was checked and now when it breaks out it is quickly brought under control. This one disease alone has done more for mankind than any other one thing. It has reduced the population by weeding out the weak and puny ones and left the strong and vigorous.

to repopulate the earth thus making a stronger and harder race. It also introduced cleanliness and now every one knows that those who leave their homes and bodies in a filthy condition must suffer the consequences.

A few years ago Dr. Koch announced to the world that he had found the germ of that dread disease which annually causes one seventh of our deaths. There is not a neighborhood but that has its victims of consumption. The patient has only a cold at first. Then gradually grows worse until finally he is laid away to rest and we return to our work and nothing remains to tell the story save the broken hearts and sad hours.

There are many other instances which I might enumerate but it is useless I have already given enough to show

that - micro-organisms are at one and the same time man's greatest - benefactor and his worst - enemy. Without - them he could not - live and with them he has one continual struggle for existence. They are a necessary evil and we should treat - them as such. Use them for the good they do and protect - ourselves against - their evil results. Just because they are small we should not ~~at~~ treat - them as of no practical use; for they have a significance in the economy of nature, a usefulness to man, and a value in the industrial arts.