molecules, according to which scientist is talking at the moment. Whatever they are, they cause influenza, the common cold, smallpox, infantile paralysis and, who knows, perhaps cancer. We are about to have our first look at them—new pictures to enlarge the rogue's gallery of medicine.

We also are about to photograph the vitamins and the enzymes, which like the viruses are too small in structure for any previous instrument to catch. There will be hundreds of surprises in the common substances around us and within us when there are a sufficient number of electron microscopes put to work.

### Even Molecules of Matter

But the possibility which gets the scientists most excited is that they may even see the molecules of matter. Though micrographs of the molecule are just now a little beyond the horizon of the instrument, there is no theoretical reason why they may not be achieved; the super-microscope will only have to reach particles one hundredth the size of those it now easily photographs. Lifetimes of labor and millions of dollars are being spent on chemical methods of getting circumstantial evidence of molecular design. Direct molecular micrography would be a great fundamental achievement. It might even surpass in its consequences the roles that electrons play in telephone and radio. Chemists have been like clever blind men, using their brains instead of eyes to puzzle out the structure of the molecule. If they could really see how molecules of various substances are put together, it might—almost certainly would—speed up enormously the advance of organic chemistry, the science which already has given us nylon, rayon, synthetic rubber, the plastics—whole new industries.

To understand how it may be possible to reach down into the infinitesimal and actually study the arrangement of the atoms in the molecule, we shall have to know the dimensions involved in the problem. The convenient scale is the Angstrom, used in measuring light waves. (The name honors a Swedish physicist.) An ordinary pencil lead is about a millimeter in diameter. A millimeter is 10,000,000 Angstroms. Like Alice in Wonderland, nibble your imaginative mushroom on the side labeled "Going Down" and note the various stops as we descend. Starting at a millimeter—10,000,000 Angstroms—we come to the reddest light we can distinguish with the eye, in other words, the longest wave-length of visible light, at 7600 Angstroms, and we pass the shortest visible light, deep violet, at 3900 Angstroms. How small a thing we can see depends upon the wave-length of the light we use to do the seeing, much as the size of human fingers sets a limit to how tiny an object we can pick up. With visible light, that is, in the ordinary microscope, we can pick up objects about 2000 Angstroms in diameter, about half the wave-length of the shortest visible light ray. The ultraviolet ray microscope, using wave-lengths about half as long as the shortest we can see, can pick up objects about 800 Angstroms in diameter.

The wave-length of electronic radiation varies according to how fast the electrons are traveling. An electron pushed along by a potential of only one volt travels nearly 370 miles per second, which is slow going in the electronic world, but gives a wave-length of 12 Angstroms. A million-volt potential pushes electrons whizzing at more than 175,000 miles per second, giving a wave-length of about one-hundredth of an Angstrom. Atoms are about 2 Angstroms apart in a molecule consisting of carbon and hydrogen atoms, to choose one example. That is why scientists believe it probable molecules may be photographed.

The electron microscopes in use up to now have a range of 10,000 to 90,000 volts. The smallest sizes of particles now being seen with the instrument are about 100 down to 50 Angstroms. The one thing in the universe the electron microscope never will be able to "see" is the electron itself, smallest particle or least gob of electricity, or most minute atomic fragment, whichever you may wish to call it.

This suggests the horizon toward which scientists in London, Berlin, Camden, Toronto and Pasadena are pushing. The hard exciting trail toward the infinitely small beckons. A new era of exploration has begun.

*Science News Letter, October 12, 1940*

PHYSICS

## "Whiskers" Made Visible On Micro-organisms

**See Front Cover**

THE micro-organism on the cover is 45,000 times life-size. It was photographed with the new electron microscope in the RCA laboratories at Camden. It is Aerobacter cloacae found in the intestines. Note that the electron microscope shows flagella extending from the organism. There is what appears to be a capsule about the organism. Preparation by Dr. K. Polevitsky of the University of Pennsylvania Dental School.

*Science News Letter, October 12, 1940*

PUBLIC HEALTH

# Warns U. S. Is in Danger Of Invasion by Epidemics

AMERICA is in greater immediate danger of an invasion of her shores by epidemics almost sure to sweep Europe this winter, than by any armed forces. This was the gist of a statement by the chairman of the Medical Preparedness Committee for the State of Michigan, Dr. Burton R. Corbus. He said that American medicine is rallying to meet this threat.

Dr. Corbus pointed out that typhus in the Balkans and France is very prevalent, and "it is expected that influenza will hit these regions and others this year. Almost surely the epidemics will leak to these shores."

He said that another problem to be met by American medicine, in the unfortunate eventuality of war, was the impossibility of avoiding dealing with tropical diseases unfamiliar to many doctors taken from civil practice. If our troops had to move southward, "some additional instruction in these subjects would have to be given physicians attached to troop units," he said.

"Remember what havoc yellow fever caused among the men working on the Panama Canal," Dr. Corbus emphasized, "and yellow fever, together with malaria, is one of the more familiar tropical diseases."

He stressed the well-known fact that this country's supply of quinine is not adequate to meet the demands which such conditions would place upon it, pointing out that the substitute for this drug has not been thoroughly proven.

Dr. Corbus served during the first world war as a major in the medical department, attached to an evacuation hospital.

*Science News Letter, October 12, 1940*