THE FILTERABLE VIRUSES

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There exists just at the range of vision of our most powerful microscopes, or beyond this range of vision, a large number of microorganisms, the identity of which is uncertain. They are called "filterable" viruses because they will pass through our best clay filters. In 1898 the first of these was discovered by Loeffler and Frosch, in studying the foot and mouth disease of cattle. The same year Beijerinck demonstrated as the cause of mosaic disease of tobacco, a filterable organism. In passing it is interesting to note that as in bacteriology, where the first diseases studied by Pasteur were in the industries, so in this new class of organisms, initial studies were made upon diseases of animals and plants. The application to human diseases came later.

During the next few years, a large number of diseases were investigated in various parts of the world, adding much to our knowledge concerning filterable viruses. By 1913, more than forty diseases were attributed to this cause. Among these were diseases of plants, as the mosaic disease of tobacco; disease of animals, including horses, sheep, cattle, swine, dogs, guinea pigs, rabbits and rats; diseases of birds, especially black birds, and chickens; and diseases of man. The latter list includes small pox, scarlet fever, measles, polyomyelitis, trachoma, rabies, Dengue fever, yellow fever and Rocky Mountain spotted fever.

Recent literature, especially since the war, has been full of work confirming the filterability of the organisms of these diseases and methods and means of their prophylaxis. Of more interest, however, are the new diseases of man which are included, namely, influenza, epidemic encephalitis, trench fever and the "common cold." There is no need to mention the ravages which influenza has wrought all over the world in the last three years. The discovery of the causative agent is a great step toward its final eradi-

cation. Epidemic encephalitis is a new disease little known till the last two years. Its long course however makes it a dreaded affliction and its eradication imperative. Trench fever is of little importance in this country in times of peace at least. The common cold is the most costly of all of our diseases. While various factors are concerned in the common cold, a filterable virus has recently been isolated as one excitant. It is gratifying to know that in all four of these diseases, priority of investigation as to the real cause belongs to American scientists. No longer are our laboratories dependent upon Europe for stimulation.

The nature of the filterable viruses as a group is uncertain. Park divides them into three classes; first, diseases produced by filterable agents of unknown morphology, an example of which is foot and mouth disease. These organisms are probably too small to be visible with our most powerful microscopes. Second, diseases produced by filterable agents shown to be visible. Polyomyelitis comes in this class, the virus of which can barely be seen with a microscope. Third, diseases produced by viruses of questionable filterability. In this class are several diseases, one of which is smallpox. Another classification which might be used is a division into plant and animal kingdoms. In the plant kingdom are those viruses closely related to the bacteria, as polyomyelitis and encephalitis. In the animal kingdom, one disease, the agent of which in certain stages is filterable, has lately been shown to be related to protozoa, namely yellow fever. Noguchi has very lately shown this to be Leptospira icteroides. Probably other diseases, especially those in which mosquitos are involved in transmission, belong in the same group. Both Williams and Hawkins have claimed that the virus of rabies belongs among the rhizopods.

Lately an Italian investigator has shown that any substance which will cause the clumping of the viruses makes these organisms easy to study with the microscope. Great possibilities lie in this field.

There are still many problems to be solved. One that is to be emphasized especially is that more attention be paid to this group of organisms. There should be devised more

accurate methods of study, including possibly zoology and botany. When one thinks of the immense amount of work done in attempting to isolate the cause of influenza, much of it of the crudest nature, it is no wonder that the results were negative. The ability to run around with a cotton swab in either hand is not sufficient training to cultivate such delicate organisms as the filterable viruses. Not till the causative agents of these diseases are demonstrated can we go very far in either prophylaxis or treatment. It is a satisfaction to know that already for several diseases, especially smallpox and rabies, we have an absolute preventative in vaccine; and in at least two diseases, polyomyelitis and hog cholera, a curative serum has been produced. The outlook for future work in this line is bright.

DISCUSSION OF DR. HULL'S PAPER

Is there any similarity of mosaic disease of cucumbers and tomatoes in these filterable virus forms? Better staining methods by use of mordants and testing out on the line of chemical agents and media were suggested. Mention was made of the work of Prof. Ernst Bessey of Michigan Agricultural College and his colleagues in mosaic disease.

Dr. Latham agreed with Dr. Hull in his plea for co-ordinating the several sciences relating to bacteriology in order to more readily enhance the correctness and extensiveness on the results along the lines that deal with virus. Dr. Pollock felt that such co-ordination and co-operation would result in great practical good so far as junior sanitary leagues etc. in connection with schools and school teaching is concerned.