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毒 VIRUS 病

SO FAR, VIRUSES ARE FOUND TO BE CAUSES OF MANY DISEASES, THEY INVADE ANIMALS, PLANTS & EVEN BACTERIA. SYSTEMIC & PLANNED RESEARCHES ARE BEING CARRIED OUT. IN THE NEAR FUTURE, EVERYONE HOPES, THE PUZZLE OF VIRUS WILL BE FOUND OUT.

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Virus has been a puzzle to the biologists since its discovery. As they are the cau of many diseases(I), of both plants & animals and even bacteria, much concern is g ven to it and large scale research is in progress now. This passage gives a genera idea about virus.

Viruses are very tiny particles varing in size from IOOÅ- 3,000Å. If you know that Imm I,OOOmicron and Imicron= IO,OOOÅ, you should catch the idea of how microscopic are they. It is so beyond the resolving power of the light microscope & is only visibl under the electron microscope.

*** To be continued on Pg I5 6

First Discovery :--

It was in the end of I9th century that a Russian botanist, Iwanowski, first disco a virus, the tobacco mosaic virus(TMV) and studied it in experiments. He presses sap from a mosaic-diseased tobacco plant and inoculated it into another healthy t

(continued)

bacco plant. The latter soon became diseased and symptoms shown were exactly the same of the former ill plant. The 2 plants now had the same disease
Iwanowski then prepared another sample of the sap and had it filtered. He inoculated another healthy tobacco plant with the filtrate (treated sap) and found that, the healthy one again caught the same disease. He concluded that the latter 2 healthy plant were infected with the same agent. Iwanowski was in great curiosity as it was known that, at that ime, no pathogen(2),e.g. a disease-causing bacterium, can pass through a filter. He repeated his experiments and found out that it was not a mis-. Lastly he gave his conclusion :"a disease could be transmitted from one plant to another by a filtered sap that was free of visible living bodies even when viewed the most powerful light microscope. And the sap contained something that caused infectious disease(傳染病)." From Botany, 4th Ed. T.Elliot Weier.

Nature & Characteristics of Viruses :---
Its difference between other microscopic parasitic bacteria :---

Size --

So far, many viruses are studied. Not all of them are beyond the resolving power of light microscope. For instance, the smallpox virus can be seen under a high power light microscope.

Activity --

A virus cannot grow outside its host , a living tissue. It must get a host first and then lives in it. For example, influenza virus, outside the host body, is only a group of non-living particles. When it invades into the host cells, it grow and multiplies giving rise to the next generation.

Structure --

A virus particle is not a cell which is the smallest unit of life. It is only a group of complex molecules arranged in higly specialised manner.

There are rod & oval shaped viruses. Generally the virus particle has its DNA or RNA (3) molecules in its central core. These genetic materials are surrounded by a shealth composed of protein molecules. Sometimes the shealth contains lipids (4) as well. The central core is responsible for multiplification of the virus and the shealth for penetration into the host cells.

Fig. I shows the external features of some viruses.

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Relations with the host --

When the virus invades a living body, the latter is said to be the host of it. In parasitic bacteria, the host's nutrients are extracted by the parasitic bacteria to synthesize all necessary bacterial constituents(DNA or RNA molecules, nucleic proteins etc...) and to yield energy by oxidation. The bacteria possess their own synthetic and energy-yielding systems and all the necessary tasks the bacteria have to do are to extract nutrients from the host. The bacteria may in return give out metabolic wastes which may or may not be harmful to the host. Pathogenic bacteria are those bacteria that give out very harmful wastes that comfuse the metabolism of the host to a great extent that the host is diseased.

In case of viruses, the relations with their hosts completely different. The active virusin the host cell lacks an energy-yielding and synthetic systems. It seems to become a part of the host cell constituents. It uses the energy yielded by the host and makes the host synthesize its own viral constituents. In this way, by comfusing the host metabolic systems, the host is damaged to a great extent.

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Virus outside the host --

We have said that a virus is only active when it gets into the body of a suitable host. Outside the host, it may be considered, and in fact, non-living. It shows the characteristics of non-living things. For example, , the tobacco mosiac virus (TMV) was crystallized firstly by Wendell Stanley in 1935. The pure crystal gives no sign of life. It is only a group of complex molecules and it is the reason why it is referred to a particle only.

I8 A

Classification :---

Viruses, so far, are not classified according to their morphology (5) as we do oth
living things. They fall into 3 groups, divided according to what type of hosts th
choose, which are
I.) the animal viruses - the viruses live in animal bodies,e.g. Varicla virus (6)
2.) plant viruses, viruses live in plant bodies, e.g. TMV,
3.) the bacterial viruses, viruses must live in the cell bodies of unicellular bac
teria, e.g. e.g. T_2 & other similar viruses,
Bacterial viruses are also called bacteriophages, or simply phages.

To have an understanding on the way of the viruses live, I choose the phage partic
as an example.

Bacteriophages --

Discovery :
Phages were discovered firstly in I9I5 by Twort and in I9I7 by Herelle. They studi
the viruses(phages) in independent experiments.
They were puzzled by the sudden dissolution or lysis of part of the bacterial col
onies which they were studing. It was sure that the lysis of the bacterial colonie
was due to an infectious agent

" I) too small to be seen with the light microscope,
2) capable of passing through a fine filter,
3) capable of being transmitted in bacterial cells "
(From Botany 4th Ed.)

Infection, the life cycle : 感染
(e.g. T_2 phage)
When some T_2 virus particles are added to the surface of a bacterial colony, cul-
tured in agar solution, the former(phage) selvingly prepare invasion.

The tail of the T_2 virus(see the figures) becomes attached on the cell wall of the bacterium. It is suggested that the tail of a T_2 virus is a hollow structure composed of protein molecules. The bottom end of this rod-like structure is a pin and the top portion of it is a protein shealth continued with the tail shealth. Surrounding by the protein shealth is a central core composed of DNA molecules, which are considered the main living units of the virus.

When a virus finishes its attachment to the cell wall of the bacterium, the DNA molecules in the central core move down through the tail passage and migrate into the bacterial cell body. Up to this portion, invasion is completed. Once its entrance this deadly particle's DNA molecules become very active. They seem to be the constitutents of the bacteria. The repulication of the bacterial DNA immediately stops & the enzyme-systems (6) cease function soon.The viral DNA, having some unknown ability , change th bacterial synthetic systems. The bacterial systems now produce, not bacterial but viral, DNA molecules and all the substances required by the virus for its multiplification. Under favorable conditions, there are about 100 complete T_2 viruses in the bacterial cell in one hour's time. They derive from one virus. They are named'completebecause they possess tail, shealth & all other viral components. It is noted that whenever a bacterium is infected one by phage, the latter will prevent it from the infection of other similar type of virus.

Up to this stage, the bacterium undergoes disintegration or lysis and all the phage particles are released, they come to infect other bacterial cells.

T_2 phage is called a virulent phage as it causes the rapid lysis of the host.

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Up to this date, our knowledge of viruses is very limited. It is a type of thing which stands between non-living & living things. Its ability of destroying certain pathogenic bacteria rapidly has prevented the spreading of diseases, but on the other hand, it causes many fatal diseases. Some types of cancer are found to be caused by some viruses. Though large-scale researches are being carried out in many laboratories, whether the puzzle of viruses can be found out soon is beyond one's prediction.

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(I) Common diseases caused by viruses are :
influenza, smallpox, poliomyelitis (man)
dog distemper for animals
mosaic diseases (plants)

(2) DNA = deoxyribonucleic acid
RNA = ribonucleic acid,
They are genetic materials composing the genetic genes.(基因) in the chromosomes (染色體) of the nucleus. They carry the genetic message & are important in giving the organsim's characteristics. When cell division takes place, the DNA replicates giving rise to exactly same sets of DNA molecules. The 2 daughter cells each of the receives one set of DNA molecules so that the 2 offsprings have the same characteristics with their mother.

(3) Pathogens : disease-causing microscopic living things.

(4) Lipids : Lipids is a group of organic cpds, having the elements C,H,O, in the molecules. Its members include the common fats & oils(simple lipids) and other complex lipids(wax).

(5) A branch of biology studies dealing with the forms & structures of living things.

(6) All body functions are controlled by enzymes , especially the biochemical reactions,. Enzyme systems are those systems dealing the enzyme functions.

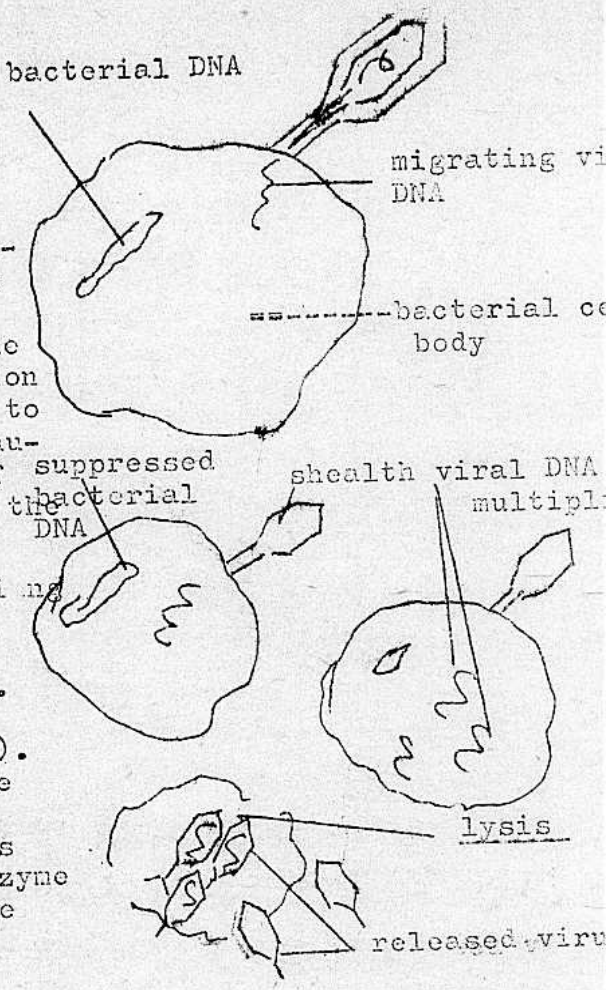

Fig. I a

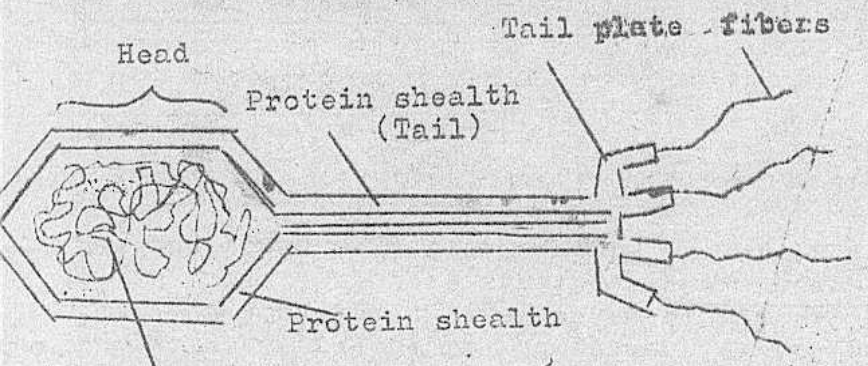

Fig. I b

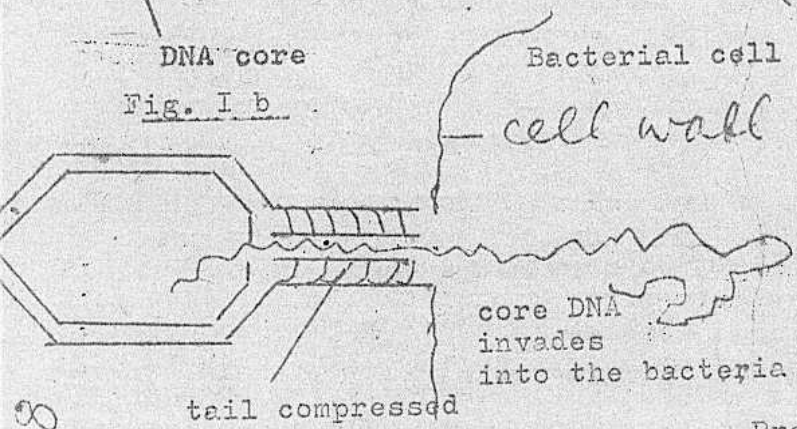

Fig. I a&b
From Biology, A. Villee

Showing the structure of a T_2 phage and its invasion into a bacterial cell

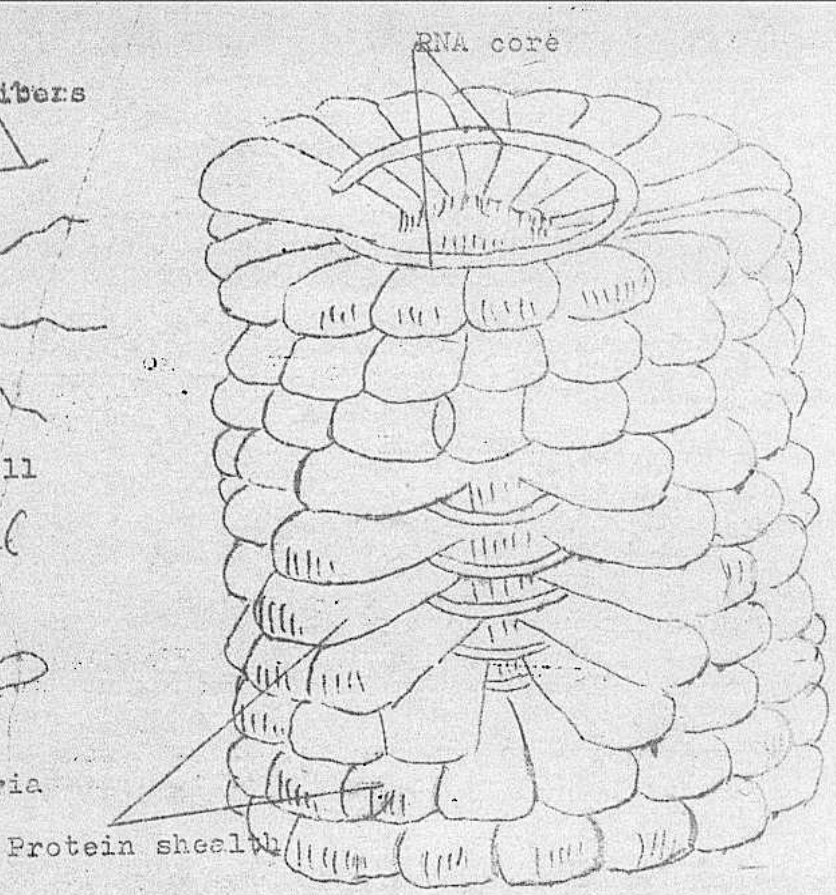

Fig. 2 Showing a TMV virus. The RNA core is spirally arranged.
From Botany T.Elliot Weier