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The Isolation and Properties of Crystalline Tobacco Mosaic Virus

After Bacteria were proved to be the source of many, or all, as was widely believed, infectious diseases, Iwanowski and later Beijerinck showed that the existence of another organism capable of causing infectious diseases. These organisms, not known then to be living or non-living, were called viruses.

Science has long regarded processes like reproduction, mutation, and metabolic activities as identifiers of living organisms. Viruses bring together two of the three properties mentioned above, for they do not have their own metabolic activity outside their host cell. Chemists could not but wonder at the size of viruses, as little as 10 micrometres, which is smaller than some proteins, and Biologists wondered how the virus could perform basic metabolic functions as it could not store such essential "large" proteins.

The nature of viruses was being studied via experiments with proteins and enzymes. Here, breakthroughs were made by Vinson and Petre when they studied the effects of chemical manipulations on the Tobacco Mosaic Virus, chosen due to its chemical stability and ready availability. Reactions of enzymes with this virus in different pH media, failing to create an unredeemable loss of infectivity, proved that the Tobacco Mosaic Virus is a protein.

With the help of isoelectric precipitation, the virus could be concentrated and purified, yielding a crystalline material as the end product. After several laboratories worldwide verified this isolation procedure, the new task at hand was to prove whether the virus activity was a property of the crystalline material. Even though the crystalline material was found to retain almost all the virulent activity of the starting material, it was debated whether the crystalline material represented the Tobacco Mosaic Virus because the old belief that viruses are living organisms was prevalent.

Experiments conducted on different diseased plants and even different types of plants altogether resulted in the separation of the same crystalline material. Fractional introspections never found any presence of a third substance. When the crystalline material was treated with pH and temperature that causes the virus to become less effective, the protein's denaturation rate was in tandem with how the virus loses its activity. By investigating many such 'coincidences', it was proved that the crystalline material was the Tobacco virus.

The focus was now shifted to characterization. Pirie's work claimed that the crystalline virus was actually a nucleoprotein, later confirmed by Loring's observation. The virus was shown to have a considerable molecular weight, a rod-like structure and the important property of being able to aggregate end-to-end. Many more properties of the virus were discovered, like the presence of 8 particular nucleic acid particles in a virus rod or what happens to these nucleic acids due to different mutations.

We are asked to keep in mind that this plethora of information about the Tobacco Mosaic Virus could be obtained due to its stability. Many viruses elude such investigations due to extreme instability; hence, the field of virus research has a lot of scope and much thirst for scientists willing to do good.