

Photograph referenced as "TMV model"

Contributors

Wilkins, Maurice Hugh Frederick, 1916-2004

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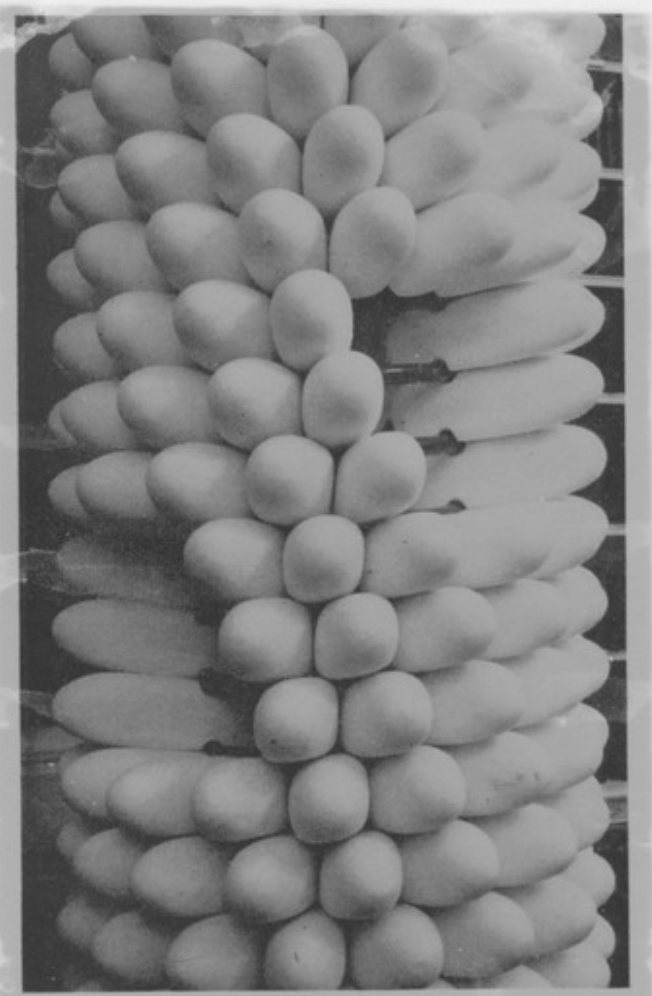
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Hemoglobin is certainly not unique in being constructed from sub-units. The classical example is the respiratory pigment hemocyanin, whose molecular weight runs into millions, and which was long ago shown by Svedberg and his collaborators using the ultracentrifuge to dissociate under conditions of changed pH into a large number of sub-units. Green and Aschaffenburg (12)



Photograph of a model of tobacco mosaic virus, showing the helical arrangement of sub-units and of the single strand of ribonucleic acid (indicated by a black wire).

The structure of viruses as determined by x-ray diffraction" in *Plant Pathology - Problems and Progress, 1968-1968*, New York: Acad. Press, in press.)

hollow spherical shell, in the same manner as the vertebrate solid known as the snail shell, closed containing micelles. Although the three-dimensional structure has not been investigated in detail, chemical studies of very large proteins which do not dissociate into single protein units never

The viruses are not proteins since they contain nucleic acids. However, their protein coats are constructed from sub-units, and the structure has been investigated in many cases. The tobacco mosaic virus even the pre-war x-ray studies of Fankuchen indicated a helical structure with a rod-shaped particle. More recent studies by Rosalind Franklin and by Caspar, have shown that the structure actually is a helix with an arrangement of 2,100 sub-units, each sub-unit has a pitch of 23Å., and 16 $\frac{1}{3}$ sub-units (see fig. 5). The evidence is consistent that all the sub-units are identical and that the RNA in the virus is arranged in a helix which is parallel to the protein helix.

The more common so-called icosahedral viruses are built on a similar principle of symmetrical arrangement of sub-units is applied in a different manner. They are closed and highly symmetrical in shape. This first x-ray study of virus crystals was found to possess the