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VIRUS LABORATORY
BERKELEY 4, CALIFORNIA

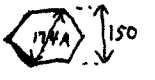
January 6, 1955

Dr. Rosalind Franklin
Birkbeck College Crystallography Laboratory
(University of London)
21 Torrington Square
London, W.C.1.
England

Dear Doctor Franklin:

Dr. Stanley has shown me the manuscript of the short paper you have written for Nature on your recent deductions about the structure of TMV. I found the paper most stimulating reading and was pleased with its lucidity.

I continue to be disturbed about the origin of the hexagonal-shaped platelets of fragmented TMV which I and others have observed. I conclude that you would say that the external shape of the rod is cylindrical, with possibly some grooving, and that the diameter of the cylinder is 150 A. A difficulty with this conclusion is that the density does not come out right. A cylinder of length 3000 A, diameter 150 A, and molecular weight 50 x 10^6, will yield a density of 1.52 gm/cc. I am under the impression that a value of 1.57 gm/cc is accepted as being essentially correct for the density of TMV. On the other hand, an hexagonal contour of 150 A miner diameter and 174 A diameter from corner-to-corner brings the calculated density to 1.36 gm/cc.



On the other hand a model in which thin platelets would be hexagonal is not good. If the pitch of the helix is (3n + 1) units in three turns, with n = 12, it might be possible to construct a slowly turning hexagonal prism for which, in any one thin section, there are 12 ▽-shaped units making up the hexagon. At the end of three turns (69 A) a phase shift of 30° would have accumulated, thus producing a slowly turning hexagonal prism which would make one complete turn in 36 turns of the helix. The trouble with this model is that the hexagonal rods could not come closer than a center-to-center distance of 174 A. As you have stated, the birefringence evidence from wet and dry crystals indicates that there is space between the packed rods, and so a straight, hexagonal prism for the whole rod is apparently impossible.

Interpenetrating ground cylinders?

There remains the possibility that the rods have a slowly-turning hexagonal contour, but that the corner-to-corner diameter of the hexagon is 150 A, and the minor diameter is 130 A. The observations of Bernal and Fankuchen yield only the center-to-center separation of the rods, and give no information about the actual diameter of the rods. This would be a fine model, allowing a hexagonal cross-section in any thin section, providing for space between the rods, and resulting in a minimal center-to-center separation of 150 A. The difficulty is that the calculated density would now be entirely out of accord with the observed value.

So I am afraid this letter is of no use, except that it points out the density difficulty in an assumed cylindrical model, and it reiterates the fact that numerous hexagonal platelets have been photographed here, at Wisconsin, and at M.I.T. I wish a consistent contour could be found which would fit together the evidence from X-ray analysis, birefringence, density determinations, and electron microscopy.

With best regards and wishes,

Sincerely,

Robley C. Williams

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RCW/mla