tation. The principal diffraction ring has a diameter of 4.05 cm. There is no evidence whatsoever of true fibering. The twenty-one-day sample pattern also shows continuous diffraction rings but these are sharper, indicating larger micellar size, that is, longer chains, and the diameter of the principal diffraction ring is 4.25 cm. The thirty-five-day sample pattern shows for the first time definite evidences of preferred orientation as indicated by greater intensity of the diffraction rings on the equator as compared with the poles of the pattern. The fibering, however, is still imperfect. The diameter of the principal diffraction ring is 4.50 cm. Finally, in the mature fifty-day fiber the pattern indicates the maximum degree of preferred orientation, the sharpest and narrowest diffraction maxima, indicating the final size of the micelles and a diameter of the principal diffraction ring of 4.60 cm. There has been thus a progression in these samples in fibering, in micellar size indicated by diffraction breadth and in the actual crystal unit cell dimensions as indicated by the interference ring diameters. The dimensions are largest for the youngest sample. This seems to indicate, therefore, a condition of intra-micellar swelling or of the fact that the primary valence chains are not oriented within the colloidal particle in a perfectly parallel fashion. It may also mean that the crystalline substance is not yet true cellulose. As the sample ages the diffraction ring increases in diameter, which means that the unit cell dimensions decrease until in the mature fiber the dimensions for ordinary cellulose are reached. It is evident that preferred orientation occurs some time between the twenty-first and thirty-fifth day, probably quite sharply. Further tests are now being made with samples showing finer gradation in growth.

Another series of samples of mature cotton fibers showing markedly different physical properties has been subjected to X-ray analysis and here again the diffraction patterns are equally striking in their differences. The samples consisted of a cotton of high quality, one whose fiber quality had apparently been lowered by adverse developmental conditions and a third which represented an inferior variety. In all three cases the diffraction rings have exactly the same measurements corresponding to true cellulose. The differences lie, first, in the degree of preferred orientation, and secondly, in the sharpness of the interference maxima. There is a marked difference in the degree of fibering which is maximum in the case of the first sample and minimum in the third. For example, the cords of the arcs on the diffraction rings produced by fibering have the following lengths: first, 2.8 cm; second, 3.25 cm; third, 3.8 cm. This gradation is exactly the same as that displayed by the qualitative differentiation. Furthermore, an examination of the sharpness of interferences indicates that the chain lengths in the colloidal micelles are greatest in the first sample and least in the third. Therefore, satisfactory physical properties are unquestionably connected with colloidal size greater than a critical value and in the best possible arrangement of these micelles with respect to the fiber axis itself. While these samples represent perhaps extreme conditions it seems very probable that it will be possible to classify cotton within much narrower limits and that the X-ray method will, therefore, prove an indispensable new tool both for specification and research in the cotton industry. A continuation of these studies in a quantitative manner is in progress.

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