the steric ones, are similar the inhibitory power depends essentially on the affinity of the P atom for an electron-rich center of the enzyme.

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Interaction between perfluoro-octanoic acid and the fibrous proteins keratin and collagen

KLEVENS and others[1–3] have examined the interaction of perfluoro-octanoic acid ($C_7F_{15}COOH$) with bovine serum albumin. They claim that the F–C–F groups in the PFO replace some water at hydration sites in the protein structure and enter the hydrogen-bond network. Further it is claimed that these F–C–F groups can act as bridges between protein chains. The interaction of PFO with keratin and collagen fibres has now been examined by the authors.

Wool fibres (Corriedale) were placed in a saturated aqueous solution (about 0.023 *M*) of PFO at room temperature (20°). These fibres were examined at regular intervals of time for length and birefringence. After 30 days the fibres appeared to reach a stable contraction of about 4 %. At this stage load-extension curves of the fibres showed a complete disappearance of the initial high-modulus Hookean region of the normal load-extension curve of an undamaged wool fibre in water. The fibres acted mechanically in a very similar manner to a supercontracted fibre in conc. LiBr. The X-ray diffraction pattern of the wool fibres at this stage showed a disappearance of the 5.1 Å meridional arc and a weakening of the 9.8 Å equatorial reflection with an increase in the amount of "arcing" compared with the X-ray diffraction picture of an undamaged fibre. Continuous washing in distilled water over periods up to 7 days gave no noticeable reversal of either the mechanical properties or the X-ray diffraction pattern. It appears that the PFO has penetrated both the matrix and microfibrillar structure of the wool fibre. Extensive washing in water is not able to remove it from the portion of the wool structure responsible for the X-ray diffraction pattern and the mechanical properties when wet, namely the microfibrils[4]. The PFO has disorganized the α-helices probably by taking part in the inter- and intra-chain hydrogen bonding. The inter-helical distance appears to be preserved although there is some disorganization indicated by the change in the 9.8 Å equatorial reflection.

Wool fibres placed in a PFO solution in D_2O at room temperature for 30 days and subsequently washed in D_2O showed a complete hydrogen to deuterium exchange of the hydrogen in the amide –NH (detection technique described by FRASER AND

Abbreviation: PFO, perfluoro-octanoic acid.

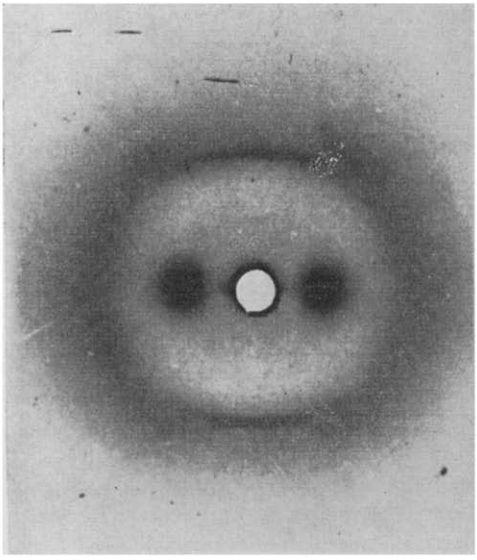

Fig. 1. X-ray diffraction pattern of normal wool keratin fibres.

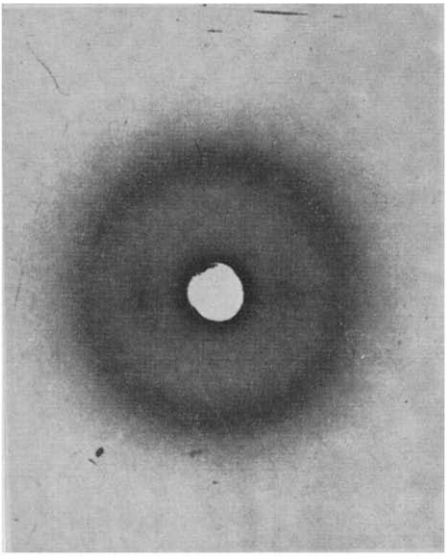

Fig. 2. X-ray diffraction pattern of wool keratin fibres immersed in PFO for 10 weeks, washed in water for two days and then dried. Similar conditions of exposure were used for both patterns of Figs. 1 and 2.

MACRAE[5]). This again indicates the complete penetration of the keratin structure by the PFO since, with normal wool fibres in D_2O at room temperature, the hydrogen to deuterium exchange proceeds only to about 70 % completion.

Collagen fibres from rat tail when placed in a satd. aq. PFO at room temperature contract rapidly lengthwise and swell diametrally. After about 10 min the rate of change of diameter and length has decreased considerably. X-ray diffraction photographs of collagen fibres that have been treated with PFO for 20 min show a major weakening in the high-angle X-ray diffraction pattern when compared with the pattern obtained from the same fibre untreated. When the fibre was allowed to remain in the PFO for an extended period (more than two days) it contracted into a rubber-like material, which was found difficult to handle.

The PFO apparently is capable of rapidly entering into the crystalline structure of the collagen fibre, as it does in keratin, by its ability to enter the hydrogen-bonded network which stabilises the crystalline phase.

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