Electron-Microscopical Structure of Some Ophthalmic Fibrous Structures

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Electron-microscopic pictures were shown of a series of structures of the bovine eye, respectively the sclera, the cornea, the lens capsule, the connective tissue of the tapetum fibrosum, and Bruch's membrane.

The sclera shows a picture of densely intertwined collagen, distinguished by the characteristic transverse striation of 640 A.; the diameter of the fibres varies from approx. 400 to approx. 1500 A.; there is little ground substance. Preparations of corneal connective tissue made in the same way—so-called replicas—show that the cornea consists of parallel fibrils, all of the same diameter and arranged in layers one fibril thick; the subsequent layers run at varying angles.

The transverse striation is masked by the interfibrillar mu-coid. After removal of the mucoid, either by mechanical fragmentation or by preparing replicas of ferment-pretreated tissue, a type of transverse striation different from that of the cornea is revealed; periodicity is approx. 210 A. This is one-third of the normal periodicity of collagen. The diameter of the fibrils is approx. 350 A.

The lens capsule, though, properly speaking, too thick for electron-microscopical investigation, is stretched in places by drying and electronic bombardment, but in such a manner that conclusions can be drawn about its structure. Several layers of parallel fibres of unknown nature are seen, approx. 50 A. thick, sticking together by apparently highly viscous ground tissue.

Isolated fibres of the tapetum fibrosum were investigated. They show the picture of cross-striated fibrils usual in collagen. Characteristic is the frequent occurrence of terminations of collagen fibrils in the form of tapered fibres. This is noticeable because here terminations of natural collagen are shown for the first time. The average length of the collagen fibrils is apparently very small, in agreement with the pulp-like consistence of the tissue.

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The speaker had succeeded in finding fibres ending in a point on both ends; the shortest was about 50 microns long. The crystals described in the tapetum fibrosum are visualized with the electron-microscope as squamiform structures, some hundreds of A. thick.

Bruch's membrane was investigated by the so-called layer-stripping technique, which makes the preparation of replicas of various levels of stratified structures possible.

The homogeneous part facing the pigment epithelium is finely granulated, the diameter of the granules varying from 50–100 A. in this layer openings of varying width are also visible. Here also the crystals are found, though dispersed, as is the case in the entire choroid. The fibrous part, which should be regarded as a denser part of the choroid, has an entirely collagenous layer adjoining the homogeneous part, which consists exclusively of collagen; in the deeper layers another, less specific component is visible, in all probability to be determined as elastin.

The investigations were carried out in the Department of Bio-molecular Structure et the University of Leeds.

Discussion.

Van Walbeek: Recent investigations carried out by Neumann, Loeven and myself have made a complement fixation between collagen and inucoprotein very probable. On these grounds, it seems advisable to be very careful' in interpreting pictures obtained after any kind of pre-treatment of the cornea.

Van den Hooff replied:

The conclusion concerning the relationship between collagen and ground substance in the cornea—the sheath-like cover of the fibrils with mucoprotein— has been drawn after electron-microscopical investigation of untreated material. The spatial relationship found' is in agreement with the hypothesis proposed in Loeven's thesis.

The trypsin pre-treated preparations only served to investigate the coarser structure of the cornea! collagen in replicas.