Factors in the Yellowing Process of the Human Eye Lens

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Particularly little systematic research has been carried out on the yellowing process of the eye lens during aging, known to every ophthalmologist. As a matter of fact, all that is known is limited to the investigations of Schanz [1913], Said and Weale [1959] and Boettner and Wolter [1962].

There are still important biochemical controversies as regards the chemical nature of the yellowing. Broadly outlined, two chemical mechanisms are indicated in the literature: (1) In the lens an accumulation develops of a water-soluble, strongly fluorescing pigment, markedly absorbing in the blue and the long-wave ultraviolet regions. Such pigments were isolated by Francois et al. [1961], Cremer-Bartels [1962] and Cooper and Robson [1969]. (The latter pigment was identified by Van Heyningen as a glucoside.) (2) The yellowing would be based on the photo-oxidation of the aromatic amino acids present in the lens (a theory adhered to by Grover and Zigman), and which would give rise to the formation of melanine-like products. This had already been postulated earlier [Fischer, 1940].

As regards the role of the yellow pigment, thoughts go into the direction of a 'cutting off' of the blue light rays, due to which less trouble is experienced of the chromatic aberration of the human eye, and of a protecting function against the possible harmful effect of ultraviolet rays on the retina. However, the yellow pigment proves by no means static – it changes with increasing age, with the seasons [Klang, 1948], in diabetes [Klang, 1948], in alloxan diabetes [Brolin, 1954] as well as in naphthalene intoxication in rats [Brolin, 1950] – which appears from in vivo determinations of the lens fluorescence. The author's personal investiga-

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tion is based on a determination of the scotopic sensitivity in 16 normal test persons, varying in age between 8 and 68 years.

The difference between this sensitivity and the scotopic sensitivity curve of aphakic test persons yields the lens absorption of the test subject concerned. It appears that the lens absorption thus determined in vivo agrees well with the absorption of the pigment isolated by Cooper and Robson. However, especially in elderly persons, abnormalities occur in the blue region that cannot be explained on the basis of this pigment. It seems possible that this pigmentation is based on the formation of melanine-like products.