THE PIGMENT OF THE VERTEBRATE LENS

A FEW years ago the late H. D. Judd and the writer described the yellow lenses of squirrels, snakes and lampreys.[1] The yellow coloration constitutes one of several types of intra-ocular filters which are widespread among diurnal vertebrates and have a quadruple effect in promoting visual acuity.

At that time it was suggested that yellow lenses might be found in certain other animals, among them the tree-shrews (*Tupaia*), the strongly diurnal geckoes, *Phelsuma* and *Lygodactylus,* and the hyrax, *Procavia.* Some of these predictions have since been fulfilled by investigators whose cooperation is deeply appreciated:

Dr. Hugh M. Smith, of Bangkok, Thai, compared the lens of an adult *Tupaia belangeri* with the "Noviol O" glass which matches the lens of the average sciurid species, and judged it to be "about halfway between Noviol O and colorless."

Mr. Arthur Loveridge, of the Harvard Museum of Comparative Zoology, examined the lens of an adult *Lygodactylus picturatus* on Manda Island, Uganda, and reported to the writer that it was pale yellow.

Procavia seems to be nocturnal rather than diurnal as we had been led to believe; but, on the other hand, the American beaver appears to be fundamentally diurnal or indifferent to night and day, not strictly nocturnal as usually described, and might be expected to have a yellow lens. Accounts of old travelers and recent statements by those familiar with the animal in wild regions indicate that the beaver has readily become nocturnal wherever it is in even light contact with civilization, but is diurnal when quite undisturbed. Protected beavers in such sanctuaries as the national parks have slowly reverted to diurnality in recent years.

A large (50 lb.) *Castor canadensis* obtained by courtesy of the Michigan Department of Conservation proved, however, to have colorless lenses. The beaver retina has not yet been studied histologically, but the small amount of rhodopsin present after thorough dark-adaptation indicates that it contains rods, though these are probably small or small in numbers. The species thus has a twenty-four-hour eye and, having avoided such restrictive specializations as a yellow lens, is able to become nocturnal when it must.

The vertebrate lens pigment—possibly a closely knit group of compounds rather than a single one—has been named "lentiflavin"[1] and was found to be readily extractible only with alkali. Since most melanins (though apparently not ocular melanins) are alkali-insoluble this ambiguous behavior stalemated our attempts at chemical identification and led us to hope for a further clue from the study of albinos.

Some time ago Dr. S. A. Houchen, of Olney, Illinois, kindly examined for us the lenses of a two-year-old member of the famous Olney population of albino gray squirrels (*Sciurus carolinensis leucotis*). He pronounced them "a trifle lighter" than Noviol O. This describes the normal gray squirrel lens; but since the writer could not supply Dr. Houchen with a glass sample exactly matching the latter, it was not certain whether the albino might not show some reduction in pigmentation.

This uncertainty was recently removed when the writer obtained an albino woodchuck, *Marmota monax.* The specimen had one patch of light color on the head and some in the tail, but otherwise (and as regards the eyes) was a perfect albino. The lens proved to be exactly matched by Noviol O, as is that of the normal woodchuck.

The yellow coloration of vertebrate lenses is thus certainly not due to sparse melanin, as in normal human adult and early cataractous lenses. It does not seem to be known whether "melanoid" pigments (which are alkali-soluble) can be formed by albinos. Lentiflavin does not appear to be a carotenoid, an anthocyanin or a flavone, and perhaps represents a hitherto unknown group of animal pigments. Further attack upon the problem of its chemical nature can best be made by investigators living where ground-squirrels (*Citellus* spp.) abound, since in their lenses the pigmentation is rich enough to yield an adequate KOH extract with a minimum of collecting effort.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN APPARATUS FOR THE STUDY OF EXPERIMENTAL AIR-BORNE DISEASE[1]

AN apparatus for the study of experimental air-borne disease, developed in the Laboratories for the Study of Air-borne Infection, consists essentially of three parts: (1) a tight chamber in which to subject animals to a controlled infected atmosphere, (2) a special atomizer which delivers a fine stream of droplet

[1] G. L. Walls and H. D. Judd, *Brit. Jour. Ophthalmol.,* 17: 641–75 and 705–25, 1933.

[1] This study is supported by a grant from the Commonwealth Fund to the University of Pennsylvania for investigations on air-borne infection, with laboratories in the Department of Bacteriology, the Children's Hospital of Philadelphia and the Henry Phipps Institute for the Study, Treatment and Prevention of Tuberculosis.