in wild type, a situation which is also the case for non-rdgB ora flies. Thus the R1-6 terminals, which are an especially sensitive indicator of degeneration in rdgB flies, survive well in rdgB; ora flies. We observed no differences in this regard with aging under the cyclic illumination, i.e., among flies fixed when newly emerged or after being aged 1, 2 or 3 weeks. To ascertain whether the stock we studied retained rdgB in combination with ora, we did a genetic cross to separate rdgB from ora. Optical examinations of the progeny verified that degeneration still occurred meaning rdgB, still present, had been uncovered from ora's protection. In summary, we conclude that ora affords fairly complete protection against degeneration in rdgB flies, even more protection than suggested by Harris & Stark (1977). In functional terms, genetic elimination of the photopigment and its organelle prevents light-induced degeneration by depriving rdgB flies of photic stimulation.

References: Carlson, S.D. & W.S. Stark 1985, Invest. Ophth. Vis. Sci. Suppl. 26; Carlson, S.D., W.S. Stark & C. Chi 1984, Invest. Ophth. Vis. Sci. Suppl. 25:18; Chen, D.-M. & W.S. Stark 1983, J. Insect. Physiol. 29:133-140; Harris, W.A. & W.S. Stark 1977, J. Gen. Physiol. 69:261-291; Harris, W.A., W.S. Stark & J.A. Walker 1976, J. Physiol. 256:415-439; Hotta, Y. & S. Benzer 1970, Proc. Natl. Acad. Sci. USA 67:1156-1163; Koenig, J.H. & J.R. Merriam 1977, DIS 52:50-51; Stark, W.S. & S.D. Carlson 1982, Cell Tiss. Res. 225:11-22; Stark, W.S. & S.D. Carlson 1983, Cell Tiss. Res. 233:305-317; Stark, W.S., D.-M. Chen, M.A. Johnson & K.L. Frayer 1983, J. Insect Physiol. 29:123-131.

Stark, W.S. and S.D. Carlson.* University of Missouri, Columbia, USNA. *University of Wisconsin, Madison, USNA. Ultrastructure of the compound eye and first order neuropile in the sevenless (sev) mutant of **D.melanogaster.**

The sevenless (sev) mutant has been extremely useful in the analysis of function and development of photoreceptors in the Drosophila visual system (Harris et al. 1976; Stark et al. 1976, 1979; Heisenberg & Buchner 1977; Hu & Stark 1977, 1980; Jacob et al. 1977; Stark 1977; Labhart 1977; Fischbach & Reichart 1978; Hu et al. 1978; Campos-Ortega et al. 1979; Fischbach 1979; Willmund 1979; Stark & Johnson 1980; Miller et al. 1981; Broda & Willmund 1981; Coombe 1984). In the compound eye of a nonmutant fly, each ommatidium contains 8 receptor cells of 3 types: R1-6 has photoreceptive rhabdomeres peripherally oriented around the central axis of the ommatidium while R7 and R8 have distal and proximal central rhabdomeres, respectively. The rhabdomere of each photoreceptor cell is normally never fused to that of its neighboring cell in the open rhabdomere configuration of the fly retina. In the sev mutant the R7 cell does not form (Campos-Ortega et al. 1979) and thus it lacks R7 function (e.g., Harris et al. 1976). Recently, we initiated a program of ultrastructural research on Drosophila visual mutants, sponsored in part by the High Voltage Electron Microscope (HVEM) Laboratory, an NIH Biotechnology Resource, at The University of Wisconsin, Madison. We reexamined sev and a white-eyed strain (w sev) because there was so little ultrastructural data extant on that mutant. Our preliminary observations are now presented which include the premier micrographs from its lamina ganglionaris (first optic neuropile and thus the first synaptic relay station of the retinal projection).

In general, distal sections through the peripheral retina showed 6 rhabdomeres (R1-6) while proximal sections showed 7 (R1-6 and R8) as expected. A rare exception to this generalization is shown in Fig. 1 (bar = 1 μm). Here a distal ommatidium is cross sectioned to reveal the trapezoidal arrangement of photoreception cells, and we suggest that the central cell is R7 as labeled. The neighboring ommatidium is at a more proximal level, and from its shape and orientation it is proposed that the central cell is R8. It is possible that the designated R7 cell is really an R8 cell in the R7 position (see Campos-Ortega et al. 1979) but our observations suggest that a few isolated ommatidia near the equator may actually have R7. The electron dense small spheres in close apposition to the rhabdomeric microvilli are the ommochrome pigments of the retinula cells which migrate during light and dark adaptation in the red eyed fly. Very deep in the retina, there are quite few ommatidia which apparently lack some of the 7 expected rhabdomeres. On closer examination (Fig. 2, sev, bar = 1 μm), it is shown that rhabdomeres of adjacent R1-6 cells occasionally fuse (arrow). It should also be noted that rhabdomeric fusions are found in which the two sets of conjoined microvilli are at very different angles. At this proximal level, intraretinular pigment granules, which are typically concentrated distally, are not seen, as expected, even though this section (Fig. 2) is from a red eyed fly.

Beneath the basement membrane, the axons of each ommatidium are bundled into pseudocartridges (Fig. 3, w sev, bar = 1 μm). As expected, most of these fascicles have 7 axons. Fig. 4 (w sev, bar = 1 μm) shows a longitudinal section through the distal level of the first optic neuropile. A type 1 monopolar interneuron (L1 or L2) is revealed for a considerable length: through the perikaryon (MP), nucleus (Nu), neck (N) and up to a point where dendrites (D) project laterally to retinular cell terminals (R). The L cell soma shows numerous mitochondria as well as a Golgi body (G). The R cell terminal is identified by capitate projections. Another pseudocartridge, obliquely sectioned, lies just outside the L cell's perikaryon
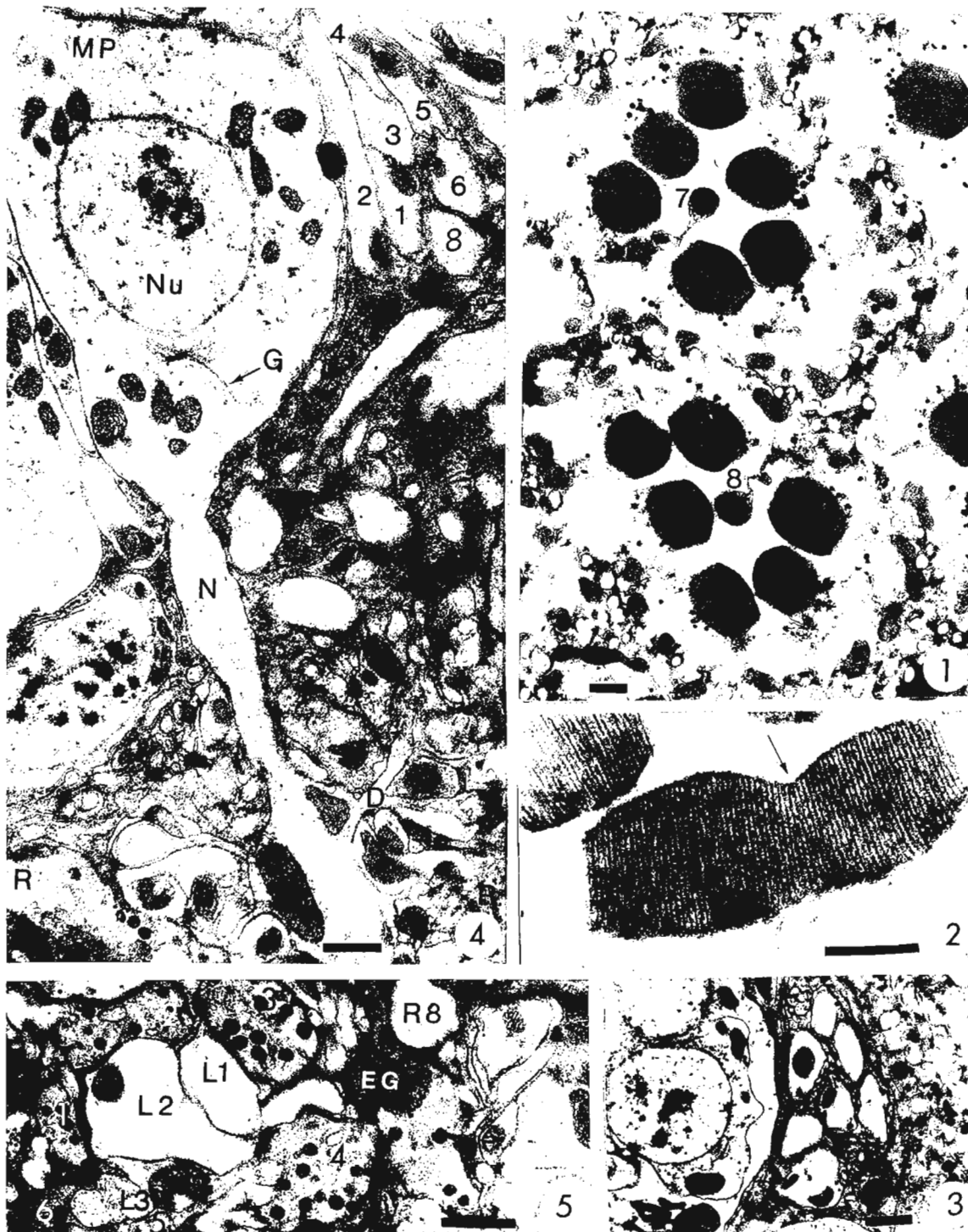
Stark & Carlson, "Ultrastructure of the compound eye ....": **Figures 1 through 5.**

at the upper right of this figure. Axon numbering in this pseudocartridge is arbitrary. The perikaryon of a satellite glial cell is positioned to the left of the monopolar's neck. We have on rare occasions observed a pseudocartridge with 8 axons, confirming our contention that a few ommatidium may have 8 photoreceptor cells, including R7. Fig. 5 (sev, bar = 1 μm) shows a cross sectioned optic cartridge with its centrally localized L1, L2 and L3 interneurons surrounded by R1-6 axon terminals. To the right, and surrounded by an electron dense epithelial glial cell (EG) is the R8 axon without its R7 counterpart which is normally contiguous to R8. The closely paired R7 and R8 axons normally pass through the lamina without synapse on their way to terminations in the second neuropile, the medulla.

In summary, our micrographs show that, for the most part, the compound eye lacks the R7 cell. In addition, we have depicted the occasional fused condition of rhabdomeres in the peripheral retina of the compound eye. The structure of the lamina ganglionaris is unaffected by the loss of R7 except that R7's axon, which normally traverses the lamina, is lacking.

References: Broda, H. & R. Willmund 1981, J. Insect Physiol. 27:789-792; Campos-Ortega, J.A., G. Jurgens & A. Hofbauer 1979, Wm. Roux Arch. 186:27-50; Coombe, P.E. 1984, J. Comp. Physiol. 155:661-672; Fischbach,K.F. 1979, J. Comp. Physiol. 130:161-171; Fischbach, K.F. & H. Reichert 1978, Biol. Behav. 3:305-317; Harris, W.A., W.S. Stark & J.A. Walker 1976, J. Physiol. (Lond.) 256:415-439; Heisenberg, M. & E. Buchner 1977, J. Comp. Physiol. 177:127-162; Hu, K.G., H. Reichert & W.S. Stark 1978, J. Comp. Physiol. 1978, 126:15-24; Hu, K.G. & W.S. Stark 1977, J. Comp. Physiol. 121:289-305; Hu, K.G. & W.S. Stark 1980, J. Comp. Physiol. 135:85-95; Jacob, K.G., R. Willmund, E. Folkers, F.F. Fischbach & H.Ch. Spatz 1977, J. Comp. Physiol. 116:209-225; Labhart, T. 1977, Naturwissen. 64:S.99; Miller, G.V., K.N. Hansen & W.S. Stark 1981, J. Insect Physiol. 27:813-819; Stark, W.S. 1977, J. Comp. Physiol. 115:47-59; Stark, W.S., K.L. Frayer & M.A. Johnson 1979, Biophy. Struct. Mech. 5:197-209; Stark, W.S., A.M. Ivanyshyn & K.G. Hu 1976, Naturwissen. 63:513-518; Stark, W.S. & M.A. Johnson 1980, J. Comp. Physiol. 140:275-286; Willmund, R.J. Comp. Physiol. 129:35-41.

Stocker, R.F. and M. Schorderet. University of Fribourg, Switzerland. Sensory projections of homoeotically transformed eyes in **D.melanogaster.**

Homoeotic mutants transform particular body parts into others and thereby create displaced sensory neurons, whose axons reach the central nervous system (CNS) at abnormal sites. This allows one to study how the position of sensory neurons affects the specificity of their central connections (Palka & Ghysen 1982; Stocker 1982). The pattern of sensory projections from all types of homoeotic structures tested so far are remarkably constant, i.e., terminals occupy their normal projection area or centers of serially homologous structures. Similar observations have been made in the pattern of afferents from surgically generated ectopic appendages (Stocker & Schmid, in prep.). These data suggest that sensory axons are able to recognize specific structures in the CNS, even if they arrive through an ectopic nerve.
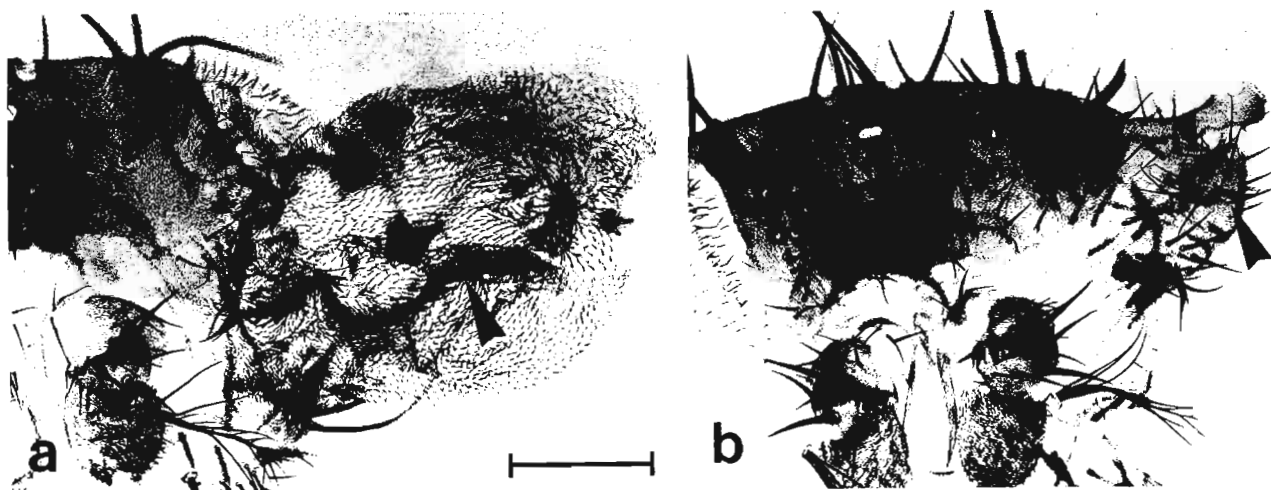

Figure 1. Homoeotically transformed eyes in ey^{opt} (a) and tuh (b). The wing tissue present in ey^{opt} is characterized by sensilla of the triple row (arrowhead). In tuh transformation leads to sensory bristles typical of abdominal tergites (arrowhead). Bar 200 μm.