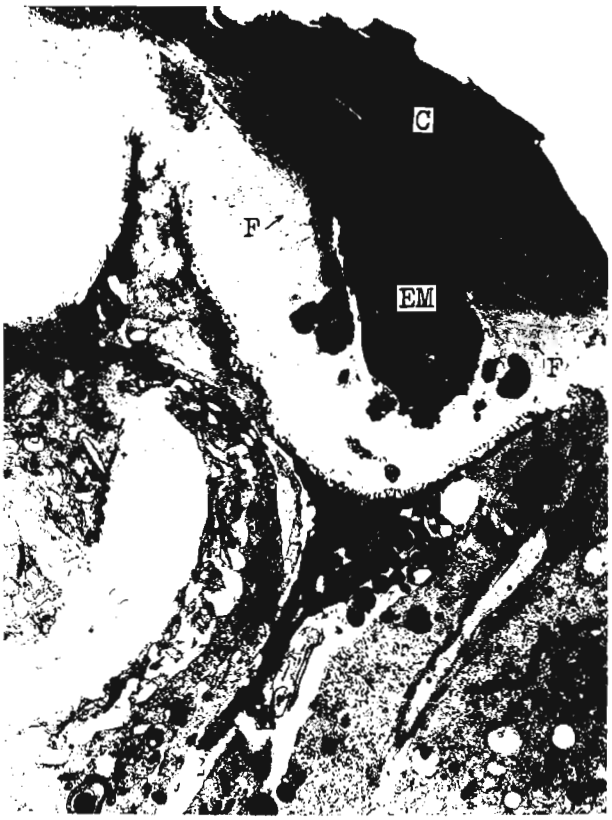


Fig. 2. Electron micrograph of ommatidium with malformations: electron-dense masses (EM) closely connect with cornea (C) and are surrounded by fibrils (F). [X 5,000]

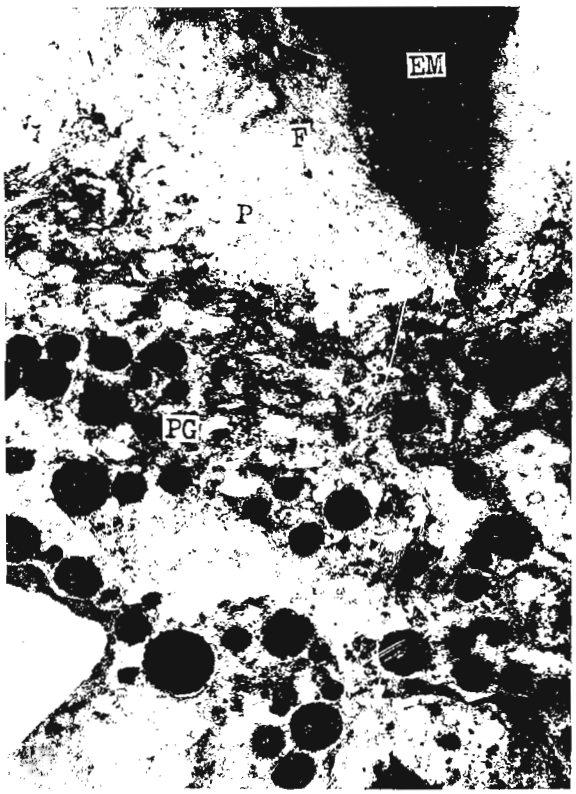


Fig. 3. Electron micrograph of ommatidium fragment with malformations. Space of pseudoconus (P) around electron-dense mass (EM) filled up by fibrils (F). Pigment cells contain protein granules (PG) only. [X 22,000]

References: Alexandrov, I.D. 1982, DIS 58:10-12; Becker, H.J. 1966, Current Topics Developm. Biol. Vol. 1, NY-London, Acad. Press, 155-171; Fuge, H. 1967, Zeitsch. Zell. 83: 468-507; Rapoport, I.A. 1948, Trans. Inst. Cytol., Histol., and Embryol. Vol. 2, Publ. 1: 3-135.

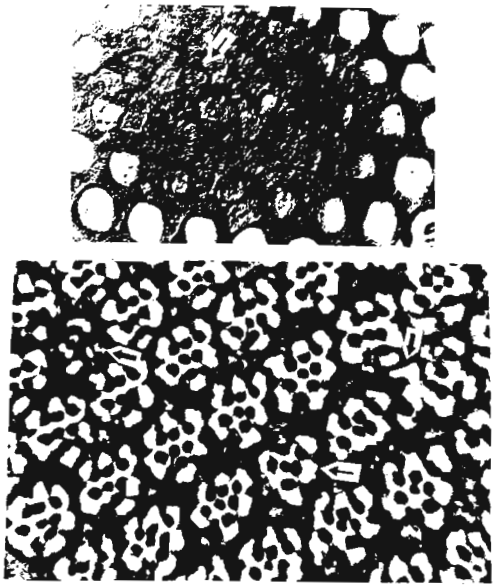
Antoine, M. L., K. A. Itoku and W. S. Stark. University of Missouri, Columbia, Missouri. How developmentally related are photoreceptors and pigment cells in the Drosophila compound eye?

Quite a few studies have addressed the developmental issue of whether all receptors of an ommatidium are descended from one cell (Ready, Hanson and Benzer 1976; Hofbauer and Campos-Ortega 1976; Campos-Ortega and Gateff 1976; Campos-Ortega and Hofbauer 1977; Campos-Ortega, Jürgens and Hofbauer 1978, 1979; Lawrence and Green 1979). The concensus of this literature is that receptors of a facet need not be clonally related, though their probability of relatedness is based on their proximity through development which obviously tends to be higher for mitotically related cells.

Despite this intense interest there are surprisingly few studies discussing relatedness of receptors and other cells in the compound eye. In this study, we made mosaics from heterozygotes of our compound mutant stock bw; ora cd and bw (Stark, Srygley and Greenberg 1981) to analyze relations among the two primary pigment cells and the six R1-6 receptors. Such analyses involve reconstructions from distal and proximal sections and have been undertaken only a few times (Benzer 1973; Ready, Hanson and Benzer 1976; Harris and Stark 1977; Lawrence

and Green 1979; Stark, Srygley and Greenberg 1981).

The ora and cd mutant characteristics were used to mark the R1-6 rhabdomeres and primary pigment cells, respectively. The cd mutant marks primary pigment cells intensely: even though cd decreases ommochromes, the pigment granules remaining in primary pigment cells are large and conspicuous. The ora mutant is well known for its elimination of R1-6 rhabdomeres. In the work presented here, we studied mosaics using the techniques of Stark, Srygley and Greenberg (1981) except that we generated many small mosaic patches with gamma rays delivered to late third instar larvae. The plates show mosaic patches which result. The Nomarski micrograph (top plate) shows about 7 distal ommatidia (one at arrowhead) with mixed primary pigment cell types due to somatic (mitotic) crossovers induced in late third instar larvae. Where the plane of section is favorable, one of the two primary pigment cells shows the dark mutant (cd) phenotype resulting from mitoses after crossing-over. The bottom plate (phase contrast micrograph) shows ommatidia in which ora eliminates most R1-6 rhabdomeres (large-stemmed arrows); sometimes only one rhabdomere is missing (small-stemmed arrow).



Even from the micrographs, it is apparent that there are more marked primary pigment cells than marked receptor cells. We analyzed 262 ommatidia from four eyes. Each primary pigment cell was scored for presence or absence of the dark mutant (cd) phenotype. R1-6 were scored for presence or absence of rhabdomeres due to the ora mutant gene. Of the 262 ommatidia scored, 206 were completely normal. Of the other 56, 37 had marked primary pigment cells only, 15 had marked R1-6 cells only, and only 4 had both. Curiously, none of the 41 ommatidia with marked primary pigment cells had both cells marked. This indicates that receptors are more clonally related to each other than to primary pigment cells. If developing ommatidial cells (at the time of irradiation) are as likely to give rise to primary pigment cells as they are to give rise to R1-6 cells, then the expectation would be that primary pigment cells are mutant as frequently as R1-6 cells, but this is not the case. We suggest that there would be more mitoses of primary pigment cell precursors than receptor precursors after the gamma rays which induced somatic crossing-over in late larval life.

Some work has emphasized rigid cell lineages (Campos-Ortega and co-workers) while other work emphasizes the lack of clonal restrictions among cells of an ommatidium (Ready, Hanson and Benzer 1976; Lawrence and Green 1979). Our study points to the possibility of a partial restriction between primary pigment cells and receptors late in development.

We thank Robert Greenberg for constructing the bw; cd ora stock, Bob Srygley for inducing somatic crossing-over, Wanda Koch for histology, Allen Shearn for use of his ^{137}Cs Gammator source, David Marcey for suggestions about this study, and Allyson Joggerst and Kiran Srivastava for technical assistance. The major support was the provision of an Olympus microscope by the Division of Biological Sciences, University of Missouri-Columbia.

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