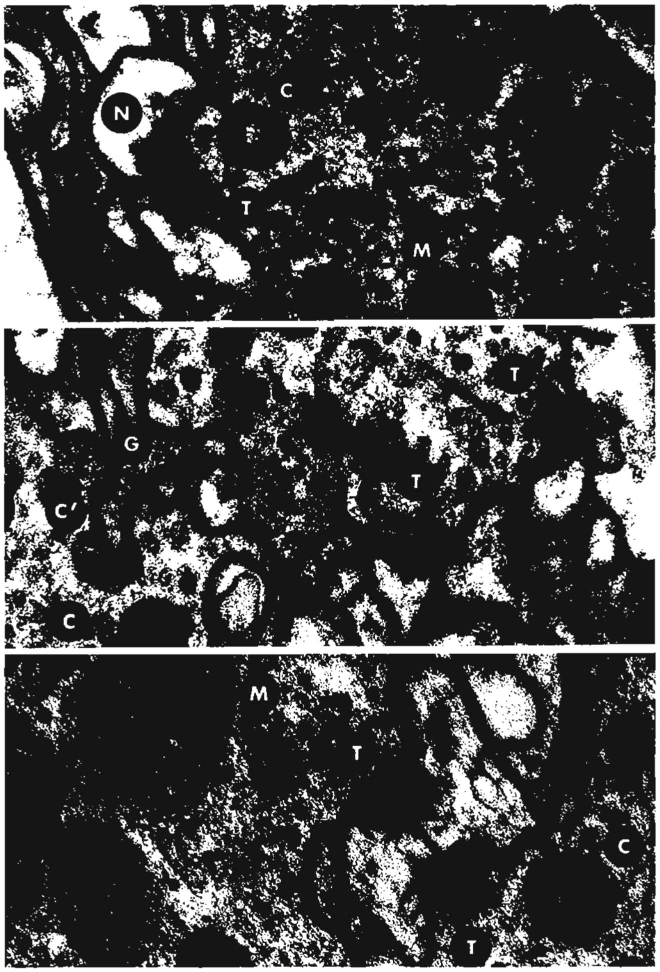
Stark, W.S.* and A.W. Clark. University of Wisconsin, Madison. Visual synaptic structure in normal and blind Drosophila.

The discovery that the nonphototactic Drosophila mutants tan and ebony had ERG defects interpreted as impairment of first order synaptic transmission (Hotta and Benzer, 1969) has led to a search for the physical basis of the functional lesion. While there has been some recent progress in pinpointing the biochemical lesions in tan (Konopka, 1972) and ebony (Hodgetts and Konopka, 1973), Pak, Grossfield, and White (1969) reported a lack of clear structural differences between mutant and wild type.

The accompanying electron micrographs (magnified x 61,500) demonstrate some similarities of membrane -associated synaptic structures in white-eyed wildtype (w), tan (w t), and ebony (w;e). Dissected heads, prefixed in 1% each gluteraldehyde, formaldehyde, and acrolein in 2% sucrose phosphate buffered to pH 7.4 and postfixed in 1% OsO4, were embedded in Spur, sectioned, stained with uranyl acetate and lead citrate, and photographed in a Phillips electron microscope. The top micrograph shows a typical synapse in w with a membrane-bound T-shaped synaptic ribbon (T) in the photoreceptor axon. The synaptic morphology is similar to that discovered in the lamina ganglionaris of Sarcophaga by Trujillo-Cenóz (1965). The round bodies found in the photoreceptor axon (C) are double membrane surrounded projections from glia called capitate projections by Trujillo-Cenóz. Part of a mitochondrion (M) in the presynaptic cytoplasm is also shown. It is noteworthy that there does not appear to be a dense clustering of synaptic vescicles near the ribbon as in typical synapses. Numerous small membrane enclosed bodies present in the presynaptic cytoplasm may be flat viscicles but they appear more like smooth endoplasmic reticulum. There are two collaterals of monopolar neurons (N) on the postsynaptic side with a subsynaptic cisterne of smooth endoplasmic reticulum shown in one where the plane of section was favorable. This one-presynaptic to two-postsynaptic arrangement is typical in Diptera. The middle micrograph shows a photoreceptor axon synapsing onto two separate pairs of collaterals in w;e (but also commonly observed in w and w t). This is commonly found in Dipteran optic cartridge, a unit in the lamina ganglionaris in which six photoreceptor axons synapse onto a meshwork of collaterals from two second order cells (Trujillo-Cenóz, 1965; Boschek, 1971). The pre- and post-synaptic morphology appears similar for w and w;e. Note the capitate projection (C') (in an adjacent photoreceptor axon) which is continuous with a glial cell (G). The bottom micrograph shows T-synapses from two separate photoreceptor axons onto a pair of postsynaptic fibers in a w t preparation (but also seen in w and w;e preparations with a good plane of section). All aspects of the synaptic morphology are the same as in w and w;e with the possible exception that the presynaptic endoplasmic reticulum (or flat vescicles) may show less definition.



Given that the first order synaptic structure is qualitatively the same for normal and blind Drosophila, what differences might exist? It is possible that the numbers of synapses

(Continued at bottom of next page)

Ranganath, H.A. and N.B. Krishnamurthy. University of Mysore, Manasagangothri, India.

## Chromosomal morphism in D. nasuta Lamb. I. Altitudinal variability.

Cryptomorphism is one of the genetic mechanisms evolved by many species of Drosophila to meet the adaptive needs in a dynamic environment. The high order of structural variability in the natural populations of D. nasuta has been recorded by Nirmala and Krishnamurthy (1972). The present report deals with the adaptive polymorphism of D. nasuta at different altitudes of Biligirirangana Hills and Sampaje Ghats (Mysore, India). Table 1 illustrates the trends in the response of chromosomal variability to different elevations.

The observations point to certain conclusions. The data evinces the genetic plasticity of the genotype of D. nasuta to the variation in the altitudes. The incidence of heterokaryotypes ascends with the increasing altitude; the mean number of heterozygous inversions per third chromosome and also per larva is more at higher elevations; particularly the frequency of the overlapping inversions H+K increases at higher altitudes; irrespective of the altitude the fact that the heterokaryotypes are always more than 50% demonstrates the prevalence of heteroselection at all altitudes.

Table 1. Trends in the altitudinal variability of the chromosomal structure of D. nasuta in Biligirirangana Hills and Sampaje Ghats.

| | | | | | Mean values of inversions | | |
|---|---|---|---|---|---|---|---|
| | Altitude of Mts. | Total larvae scored | Hetero-karyotypes (%) | Heterozygous H+K inversion (%) | Chromosome II | Chromosome III | Larva |
| Biligirirangana Hills | 820 | 106 | 64.2 | 16.0 | 0.25 | 1.16 | 1.41 |
| | 1040 | 138 | 81.9 | 24.6 | 0.29 | 1.68 | 1.97 |
| | 1300 | 95 | 94.8 | 42.1 | 0.28 | 2.07 | 2.35 |
| Sampaje Ghats | 500 | 68 | 67.6 | 8.8 | 0.24 | 1.36 | 1.50 |
| | 800 | 65 | 81.5 | 21.5 | 0.24 | 2.12 | 2.36 |
| | 1100 | 89 | 87.3 | 32.5 | 0.42 | 2.12 | 2.54 |

Thus, the existence of these altitudinal variabilities in the chromosomal morphism represents an expression of the flexible nature of the polymorphism present in D. nasuta.

Acknowledgments: The authors are deeply indebted to Dr. M.R. Rajasekarasetty, Professor and Head of the Department of Zoology, for many constructive criticisms and suggestions. This work is financially supported by Mysore University research grants.

Reference: Nirmala, S.S. and N.B. Krishnamurthy 1972, DIS 49:72.

---

(Continued from preceding page)

are different for blind mutant and wild-type. Or perhaps there are differences in synaptic transmission resulting from transmitter differences rather than structural differences. It is also possible that synapses other than receptor to monopolar neuron synapses, some of which may involve the centrifugal fibers described by Trujillo-Cenóz (1965) and Boschek (1971) may be altered in blind mutants. Further work may establish morphological differences between the synapses of wild-type and the nonphototactic mutants.

References: Boschek, C.B. 1971, Z. Zellforsch. 111:369-409; Hodgets, R.B. and R.J. Konopka 1973, J. Insect Physiol. 19:1211-1220; Hotta, Y. and S. Benzer 1969, Nature 222: 354-356; Konopka, R.J. 1972, Nature 239:281-282; Pak, W.L., J. Grossfield and N.V. White 1969, Nature 222:351-354; Trujillo-Cenóz, O. 1965, J. Ultrastructure Res. 13:1-33.

We thank Dr. W.H. Fahrenbach for advice on the preparation. Supported in part by NIH grant 144-B256 (to A.W.C.) and an NSF predoctoral fellowship (to W.S.S.).

*Present address: Department of Psychology, The Johns Hopkins University, Baltimore, Maryland 21218.