Chen, P.S. and C. Brugger. Zoologisches Institut der Universität, Zürich, Switzerland. The ultrastructure of the anal organs of Drosophila larvae.

We reported previously the presence of a pair of anal organs at the posterior end of Drosophila larvae (Gloor and Chen 1950). These can easily be demonstrated by immersing the larvae briefly in a 0.5% $AgNO_3$ solution. Subsequent to a short exposure to light, two symmetrical dark-brown plates located on each side of the anus are visible. From their analysis of the ionic concentration of larval hemolymph in solutions of different salinities it was concluded that these organs absorb chloride and sodium ions from the environmental medium. In connection with our studies on the lethal mutant 1(3)tr, which accumulates an enormous amount of hemolymph of very low osmotic concentration (Hadorn 1949 and unpublished data), we undertook an electron microscope analysis of the anal organs of both the wild type and the ltr-homozygous larvae of D. melanogaster.

By using a scanning electron microscope (Cambridge Stereoscan S4) it was observed that the cuticular surface in the anal organ region has a porous structure, due to infoldings of the epicuticle. Studies of thin sections with a Hitachi transmission electron microscope revealed that underneath the cuticle the plasma membrane of the giant hypodermal cells show numerous folds which are oriented perpendicular to the cuticular surface. On the other hand, the plasma membrane on the basal surface appears quite smooth. The hypodermal cells are rich in mitochondria and other organelles such as free ribosomes, endoplasmic reticulum, microtubules, lysosomes, vacuoles of heterogeneous sizes and electron dense bodies have also been noticed.

Of particular interest are the profound changes of the fine structure of the hypodermal cells in larvae treated with solutions of different salt concentrations. When the larvae were immersed for one hour in a hypotonic medium (distilled water), the folds of the plasma membrane become greatly increased and penetrate more deeply into the cell. Mitochondria are also increased in number and many of them move into the interspace between the folds. Conversely, in a hypertonic medium (1.5-5.85% NaCl) there is a distinct reduction of both the folds and mitochondria. At still higher salinity (10% NaCl) the folds of the plasma membrane nearly disappear. Similar to that already reported for the anal papillae of the mosquito larvae (Copeland 1964, Sohal and Copeland 1966) the present results indicate that in Drosophila larvae the uptake of inorganic ions through the anal organs can be regulated by variations of the surface area of the plasma membrane of the hypodermal cells on the cuticular surface. Furthermore, alterations in the number and distribution of mitochondria at different salinities suggest that the ionic absorption must be an energy-consuming process.

We have so far detected no morphological difference in the ultrastructure of the anal organs between the wild type and mutant larvae. If osmoregulation is involved in the ltr lethal mutation, the effect must occur at some other level.

Literature cited: Copeland, E. 1964, J. Cell Biol. 23:253-264; Gloor, H. and P.S. Chen 1950, Rev. suisse Zool. 57:570-576; Hadorn, E. 1949, Rev. suisse Zool. 56:271-280; Sohal, R.S. and E. Copeland 1966, J. Insect Physiol. 12:429-439.

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of the female was dissected out and the spermatozoa in the tract did not appear as active as wild-type. Most spermatozoa were confined to the region just distal to the vaginal plug and none were observed in the spermathecae. Electron microcroscopy of the testis showed a large percentage of degenerating sperm bundles. In many individualized spermatids the axial filament was attached to the major mitochondrial derivative lateral to the normal position. This abnormality may be a symptom of the underlying cause of sterility.

With regard to $sc^{260\text{-}15}$ the cause of sterility must be associated with the spermatozoa or the seminal fluid. With regard to ta and sv^{de} the interesting problem lies in the causal relationship of the two reproductive phenomena studied: courtship behavior and reproductive tract morphology. Are the two abnormalities related or do they occur independently? Does one give rise to the other or are they both induced by a third cause? (Supported by N.S.F. Research grant GB12969 and N.I.H. Biomedical Institutional Research Funds).

References: Kiefer, B.I. 1969, Genetics 61:157-166; Lindsley, D.L. and E.H. Grell 1968, Genetic Variations in Drosophila melanogaster. Carnegie Inst., Washington, D.C.; Merle, J. 1968, Insect Physiol. 14:1159-1168; Romrell, L.J. et al. 1972, J. Ultrastr. Res. 38:563-577; Spieth, H.T. 1952, Bul. Am. Museum Nat. His. 99:7-473; Tokuyasu, K.T. et al. 1972, Z.F. Zellforsch. 124:479-506.