Since leads of different metals may be used with our technique, it is now possible to locate a thermocouple in the sample under pressure. The results of thermal analysis performed on KCN are shown in Fig. 2. The bars indicate the pressure range over which an alumel-chromel thermocouple at the center of the sample showed an evolution or absorption of heat. Bridgman's results are shown by the solid lines (*6*). The heats of transition were observed at constant temperature and with decreasing pressure. The sensitivity of the system, when an L and N No. 2284 galvanometer is used, is such that the quasi-adiabatic heating or cooling which occurs with sudden pressure changes of 300 bars is easily detectable.

By incorporating two thermocouples and producing a temperature gradient along the sample, the Seebeck coefficient may be obtained. In Fig. 3 the thermoelectric voltages of Cu phthalocyanine as a function of the temperature gradient at 20 kb are shown. The Seeback coefficient is 0.6 mv per degree Centigrade. The thermoelectric electromotive force was determined by the same thermocouples used to measure the temperature gradient, thus eliminating errors due to uncertainties in ΔT. No correction was made for the effect of pressure on the thermocouples since this is probably small (*7*).

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Giant Polytene Chromosomes in Hypodermal Cells of Developing Footpads of Dipteran Pupae

Abstract. *Large hypodermal cells with giant polytene chromosomes are present within the developing feet of* Sarcophaga *and other fly pupae. The cells secrete a large volume of cuticle; at this time there is extensive "puffing" of the chromosomes. Being hypodermal and superficially situated with permanent secretory products, the cells could be ideal experimental and genetical tools.*

The giant polytene chromosomes of flies have been one of the major sources of information on chromosome structure. These giant chromosomes have been obtained almost exclusively from various internal tissues of fly larvae; polytene chromosomes have also been found in the nurse cells of adult ovaries (*1*). Giant chromosomes have not previously been recorded in fly pupae, nor in external cuticle-secreting hypodermal cells of any developmental stage. It has now been observed that in the pupae of cyclorrhaphan Diptera, the developing footpads contain large hypodermal cells in which polytene chromosomes appear shortly before the cells become active and secrete adult cuticle. The diameter of the chromosomes exceeds that of the salivary gland chromosomes of *Drosophila*, and they are comparable in clarity of detail with any giant chromosomes so far recorded.

The cells were first noted in the fly *Sarcophaga bullata*, but have since been observed in all Cyclorrhapha in which well-developed footpads are present. Footpads are also present in many of the Nematocera and Brachycera, but the presence of giant chromosomes in these suborders has not yet been investigated. Giant chromosome preparations have not previously been obtainable for most cyclorrhaphan studies which have relied on metaphase preparations (*2*).

In the fly *Sarcophaga bullata*, the foot of the adult is covered with cuticle and is composed of a pair of claws, a median bristle, the empodium, and a pair of flattened, disk-like footpads or pulvilli (Fig. 1). On the ventral surface and lateral borders of each footpad are thousands of minute cuticular "tenent" hairs whose special properties allow the fly to adhere to smooth surfaces. Over the dorsal surface of the pad there are no hairs and the otherwise smooth cuticle is ridged in a proximo-distal direction. This dorsal cuticle appears as a slightly darker area in Fig. 1. The appearance is characteristic and similar in all the flies so far examined, except in *Drosophila* where the footpads are not flattened structures. Even here homologous cuticular areas may be present. Whereas each of the thousands of tenent hairs is secreted by a single hypodermal cell, the whole dorsal cuticle is the secretory product of but two flattened giant cells whose cytoplasm extends over the entire dorsal surface of the pad. The two giant cells are adjacent along the proximo-distal mid-dorsal line, and laterally and distally their cytoplasm borders on the small hypodermal cells (Fig. 2) of the pupal foot.

Early in the pupal stage the pretarsus is a simple bilobed structure, and it is during the process of transformation into the claws and footpads that rapid growth of the giant cells occurs, resulting, toward the end of the growth phase, in the development of giant polytene chromosomes within their nuclei. These chromosomes reach their maximum size shortly before the start of cuticle secretion. The nucleolus, which is granular and irregular in shape during growth, becomes more rounded and compact. The beginning of cuticle secretion coincides with distinct "puffing" of the chromosomes (Fig. 3), a phenomenon considered to be a visible expression of gene activity (*3*). Significantly, each of the many phases to the secretion of cuticle appears to be characterized by a different pattern of puffing. Granules, apparently of chromosomal origin, are

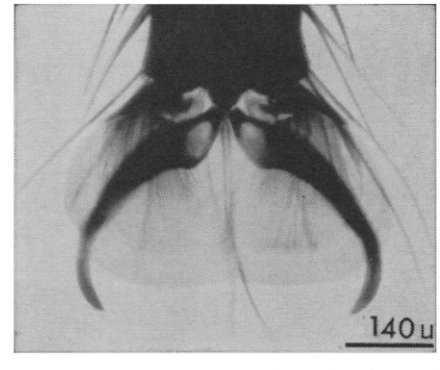

Fig. 1. Dorsal view of the fully formed foot (pretarsus) from a late pupa of *Sarcophaga bullata*, showing the paired claws, median bristle (empodium), and two flattened footpads (pulvilli). The distal and lateral edges of the footpads are lighter in color than the remainder and are composed of thousands of tenent hairs. The oval-shaped darker area is the dorsal cuticle secreted by the two giant cells.

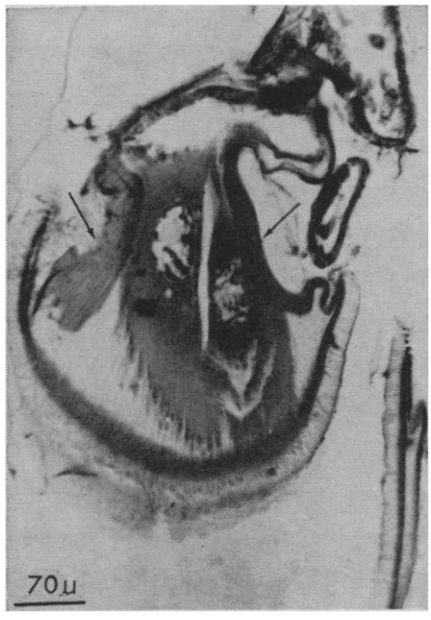

Fig. 2. Section through a footpad parallel with the dorsal cuticle. The previous section has removed the cuticle over the center of the pad exposing the giant nuclei and their cytoplasm; some of the dorsal cuticle remains at either side (arrows). On the distal and lateral margins, there are thousands of tenent hairs, each secreted by a single hypodermal cell. At the lower right, the edge of the second footpad is cut in vertical section and shows the ventral tenent hairs (left), dorsal cuticle (right), and narrow central lumen filled with haemolymph. Stained with methyl-blue-eosin; late pupal stage.

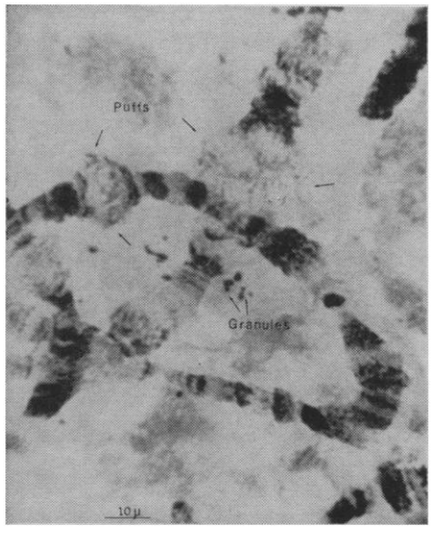

Fig. 3. Chromosomes from a giant hypodermal cell of the footpad at the time of cuticle secretion. Note the banding of the chromosomes, several large "puffs" representing areas of activity, and granules apparently of chromosomal origin. Lacto-acetic-orcein squash preparation.

also evident within the nucleus at the various developmental stages; some are shown in Fig. 3.

The changes occurring in the giant cells are closely paralleled by events taking place in the trichogen and tormogen cells which secrete hairs and sockets on the leg segments. These cells also possess banded chromosomes, but they are much smaller in diameter than the giant cell chromosomes, resembling those of the even smaller hair secreting cells of *Drosophila* (*4*). The very large size of the giant cells of the footpads in the Cyclorrhapha would seem to be correlated with the enormous volume of cuticle which they secrete. In the female *Sarcophaga bullata,* the footpads are not quite as large as in the male, and both the giant cells and their chromosomes are of correspondingly smaller dimensions.

The potentialities of these cells are considerable. They are superficially situated and easily accessible for experimental procedures. Being hypodermal cells they are almost certainly under the control of the molting hormone, and their secretory product remains as a permanent structure. The cells would be ideal material on which to observe possible changes in puffing pattern following the introduction of hormones (*5*). The cells and their nuclei are easily separable from the foot and it may be possible to transplant them, as has been done recently for salivary gland nuclei of *Drosophila* (*6*). *Sarcophaga bullata* is by no means the largest member of the Cyclorrhapha nor does it have the largest footpads; since there appears to be a direct correlation, for this particular cell type, between chromosome size and the volume of cuticle secreted, one may anticipate the discovery of flies having footpad cells and chromosomes with dimensions far exceeding those shown here.

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6-Aminopenicillanic Acid: Inhibition of Destruction of Cephalosporin C by Bacteria

Abstract. *6-Aminopenicillanic acid, from which all the true penicillins are derived, inhibits the destruction of cephalosporin C by certain microorganisms. This inhibition is probably specific for "cephalosporinase." The enzymatic deacetylation of cephalosporin C is not affected by the acid.*

Cephalosporin C (*1*) differs from the true penicillins in being derived from 7-aminocephalosporanic acid nucleus. It is not inactivated by penicillinase, although its biological activity is destroyed by another enzyme, "cephalosporinase" (*2*). It has been shown that a large number of microorganisms are capable of inactivating cephalosporin C by means of cephalosporinase or by deacetylation (*3*). Cephalosporin might also be inactivated by the action of cephalosporin-C amidase, if such an enzyme could be demonstrated.

All the true penicillins are derived from 6-aminopenicillanic acid (6-APA), which induces penicillinase formation (*4*). I have investigated the effect of this acid on the inactivation of cephalosporin C. Two bacterial cultures were selected, *Alcaligenes faecalis* ATCC 212 and *Alcaligenes viscosus* ATCC 337, because they both contain a very active intracellular penicillin amidase (*5*) and also completely destroy cephalosporin C in a very short time.

The cultures were grown submerged in Difco nutrient broth containing 0.2 percent yeast extract, at 28°C for 16 hours. The cultures were then centrifuged in duplicate and washed with 0.1*M* (*p*H 7.5) phosphate buffer. The cells were suspended in the phosphate buffer (1/10 the original volume) containing 4 mg of cephalosporin C per milliliter. To one of each pair of tubes 6-APA was also added, 4 mg/ml. The tubes were incubated for 4 hours in a water bath maintained at 37°C and were then centrifuged. Bioassays of the supernatants were performed by the usual penicillin assay-disk method (*6*). The zones of inhibition were recorded in millimeters of diameter (Table 1). The supernatants were also examined in duplicate by descending chromatography on Whatman No. 1 paper in isopropanol : pyridine : water (65 : 5 : 30), suitable antibiotics being used on control strips. The chromatograms