Technical Papers

Molting of Roaches without Prothoracic Glands

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The prothoracic glands (p.g.) of insects are commonly regarded as essential for the initiation of molting and metamorphosis. This view is well supported (*1*), but on analysis the evidence, although it is extensive, proves to have been derived mainly from one type of experiment in which glandular tissue is implanted into body parts that lack the p.g., and the molting of these parts is taken as proof of p.g. function. Technical difficulties have in the past prevented the alternative approach of extirpating the p.g. in immature individuals.

In roaches, the glands were first identified on histological grounds by Scharrer (*2*) as a flat layer of cells investing a pair of slender prothoracic muscles. That these structures could induce molting was demonstrated by Bodenstein (*3*), who implanted them into adults, which then molted, although ordinarily they never do so because their own p.g. have degenerated. The success of such experiments was the result of the discovery (*3*) that regression of the p.g. could be prevented by removing the corpora allata.

In contrast with many other insects, the location and structure of the p.g. in roaches encouraged the belief that these glands could be removed from immature specimens without killing them. This note reports the outcome of such operations.

The procedure is the relatively simple one of cutting three of the peripheral attachments and pulling the glands out by means of the fourth. The principal difficulties are that the glands are hard to see and that they are frequently attached by fine tracheae to other tissues, with the result that they are likely to break when removal is attempted. Nevertheless, they may be removed easily from a fair proportion of individuals.

From some 200 operations attempted on nymphs of *Periplaneta americana* L., 80 specimens survived with what were considered complete extirpations. These were held individually for observation; to my surprise, most of them presently proceeded to molt. In fact, no difference could be detected between their molting behavior and that of various types of controls, which included unoperated individuals, animals with sham operations, others with reimplanted glands, still others with partial extirpations or with added supernumerary glands, and so on (Table 1). Many of the p.g.-less specimens molted on a normal schedule through several instars and became normally reproductive adults.

Table 1. Removal of prothoracic glands: molting behavior in the first postoperative instar.

Diagnosis	Total	Died	Molted to adults	Molted to nymphs	Percentage molting
Extirpation complete	80	7	13	60	91
Extirpation probable	7	0	0	7	100
Extirpation partial	15	3	1	11	80
Sham operation	10	2	0	8	80
Reimplanted p.g.	19	2	0	17	89
Extra p.g. implanted	5	0	2	3	100
Unoperated controls	20	0	4	16	100

In view of these results, and assuming that molting in the nymphal roach follows the usual sequence in which the p.g. are stimulated by the periodically activated brain to release a substance that evokes the molting response, we are forced to conclude that Scharrer's organ cannot be the only source of p.g. hormone in immature *Periplaneta*. There is at present no evidence to indicate what the supplementary source may be, and it appears that considerable further experimentation will be required for its identification. Meanwhile, these observations serve to emphasize the fact that hormonal relationships in insects are actually more intricate than is sometimes assumed in schemes constructed on the basis of the limited types of data currently available.

References

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2. B. Scharrer, *Biol. Bull.* **95**, 186 (1948).
3. D. Bodenstein, *J. Exptl. Zool.* **123**, 413 (1953).

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X-ray Examination of Molecular Configuration of Asparagine in Crystalline L-Asparagine Monohydrate

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Although asparagine and glutamine are similar with regard to the presence and arrangement of the three functional groups —NH_2, —COOH, and —$CONH_2$ and differ only by the existence of one more methylene group in glutamine, differences exist in their properties and behavior that would not be expected of true homologs. These differences have been summarized by Steward and Thompson (*1*). Crystalline glutamine has a straight-chain form (*2*).