# LETTERS TO THE EDITORS

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## The Endocrine Chain in an Insect

IT is now well recognized that growth and moulting in the insect are initiated by a hormone produced in the neurosecretory cells of the brain. This brain factor activates the thoracic gland, which is then believed to secrete the definitive growth and moulting hormone[1]. But the possibility remains that there may be yet further links in the chain of endocrine organs, located in the abdomen.

The œnocytes and the dermal glands have already been excluded[2]; but the pericardial cells and the various types of hæmocytes are obvious possibilities. Blockage of the hæmocytes by the injection of Indian ink into the 4th-stage larva of *Rhodnius* at one day after feeding causes a delay in moulting which may range from one to three or four weeks beyond the normal fourteen days. Blockage of the pericardial cells with trypan blue has no effect—unless sufficient is injected to fill the hæmocytes also. Similar results are obtained with iron saccharate.

These injections no longer cause any great delay if made later than the third day after feeding (Fig. 1): clearly they interfere with the initiation of mitosis in the epidermis (which begins at the fourth or fifth day), not with the ordinary processes of intermediary metabolism. The detailed study of the hæmocytes in *Rhodnius* is not yet complete; but there is already histological evidence of secretory activity becoming evident on the fourth day after feeding.

Butenandt and Karlson[3] have recently succeeded in isolating in crystalline form from the pupæ of the silkworm an active principle which will induce puparium formation in *Calliphora* and which, as proved by Williams[3], will cause renewed development in the diapausing pupa of *Platysamia*. Through the kindness of the German authors I have been able to test the activity of their hormone on *Rhodnius* and have found that 0·5–0·75 μgm. injected into the decapitated 4th-stage larva at twenty-four hours after feeding (weight about 80 mgm.) will induce moulting. In *Rhodnius*, as in *Platysamia*, the hormone is equally effective when injected into the isolated abdomen. This suggests, as Butenandt and Karlson point out, that it is the active principle of the thoracic gland. But in view of the observations reported in this communication, the possibility remains that it may be a product of the hæmocytes. That possibility is favoured by the observation that moulting induced by injection of the hormone is not delayed by blockage of the hæmocytes with Indian ink or iron saccharate.

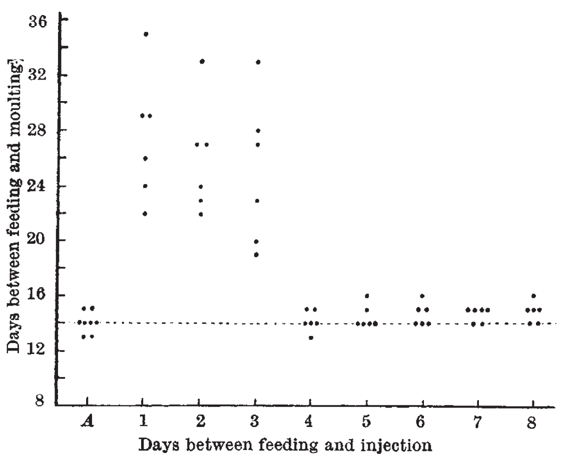


Fig. 1. Effect of blockage of the hæmocytes on the time between feeding and moulting in the 4th-stage larva of *Rhodnius*. 5 mm.³ of 2 per cent iron saccharate was injected into batches of six larvæ on the first to the eighth day after feeding. *A*, control batch of eight which received no injection

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Cambridge. Jan. 10.

[1] Wigglesworth, V. B., "The Physiology of Insect Metamorphosis" Mon. of Exp. Biol., No. 1 (Cambridge, 1954).

[2] Wigglesworth, V. B., *Quart. J. Micro. Sci.*, 77, 191 (1934).

[3] Butenandt, A., and Karlson, P., *Z. Naturforsch.*, 9b, 389 (1954).

## A Critical Response to Changing Length of Day in an Insect

IN British populations of the emperor dragonfly, *Anax imperator* Leach, the final larval instar is usually entered in August. A diapause follows, and metamorphosis is postponed until the following spring. In this way, emergence of the adult is closely synchronized[1].

Close inspection of the time-frequency distribution of emergence has shown it to be bi-modal, and it has been established that the larvæ emerging in any one year are of two distinct types.

The first, major emergence group (Fig. 1, *A*) is composed of larvæ which have entered the final instar the previous year and have since completed diapause. The second emergence group (Fig. 1, *B*), which is developed to a variable extent from year to year, and which seldom comprises more than 10 per cent of the annual population, is made up of larvæ which have over-wintered in the penultimate larval instar, entered the final instar in spring, and emerged shortly afterwards.

That larvæ of the second group metamorphose without delay demonstrates that the diapause in the final instar must be facultative, being induced in summer and autumn, yet being averted in spring. In Nature, it was found that the latest date upon which the final instar was entered by a larva destined to forgo diapause was May 28. Since the duration of metamorphosis is known, a further check is provided by the latest dates of emergence, which are closely similar from year to year. From three years of observations there is strong evidence for concluding that diapause is averted in larvæ entering the final instar before June 1, but is induced after that date.

The seasonal incidence of diapause suggests that the environmental factor responsible for its determination is likely to be the sign of change in successive lengths of day. Preliminary experiments conducted in 1952 have lent support to this thesis. In these experiments, larvæ experiencing unchanging photoperiods of a length corresponding to July 31 responded in a fashion similar to those subjected to a regime of decreasing lengths of day, both groups entering diapause.

This observation suggests that, when daily increments fall below a certain threshold value, they are no longer appreciated as such, but are recorded by larvæ as being of constant length, until such time after the summer solstice as decrements begin to