the loosening of many bonds through water movement and to the elastic stresses in the bent beam.

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ENTOMOLOGY

Hormone determining the Black Pupal Colour in the Silkworm, *Bombyx mori* L.

In general the pupal colour of normal strains of the silkworm, though slightly varying in shade, is amber; it can be easily distinguished from that of black pupa strains. The exocuticle of the black pupa contains much more black pigment than that of the normal pupa. From the fact that the pigment dissolves in alkaline solution, but not in acid, it is supposed to be melanin. In the silkworm, two kinds of black pupae are known. One is controlled by the *bp* gene, which is located on the XI chromosome, and the other is controlled by the *so* gene, which has no linkage with the *bp* gene[1–3].

If prepupae of the black pupa strain are kept at a low temperature during the temperature-sensitive period from the end of spinning until pupation, they become black pupae. On the other hand, prepupae of this strain which are kept at high temperature during this period do not manifest the black colour, but become normal-coloured pupae[3–5]. Such temperature sensitivity differs considerably among strains. In the *BT* strain, black pupae are manifested by the *bp* gene. All the individuals of this strain become black pupae when they are kept at 20° C during this critical period, but if kept at 30° C they become normal-coloured pupae. The manifestation of the black pupa is controlled by the hormonal mechanism in the *BT* strain. The complex of brain-thoracic ganglia secrete the black-pupa-determining hormone. If the temperature is kept at 20° C during the critical period, the brain is activated and gives a stimulus to thoracic ganglia, so that the black-pupa-determining hormone is secreted and the black pupal colour is manifested. On the other hand, if the temperature is kept at 30° C, the brain does not stimulate the thoracic ganglia and the normal pupal colour is manifested[4,5].

Table 1. The Actions of the Extracts in Isolated Abdomens

Series	No. of abdomens tested	No. of isolated abdomens showing: Normal pupal colour	Black pupal colour
Methanol extracts, water fraction	10	3	7
Methanol extracts, ether fraction	10	10	0
Control, distilled water	10	10	0
Control, olive oil	10	10	0

In order to clarify the mechanism of the manifestation of black pupae we first attempted to extract and purify the thoracic ganglionic hormone as described here. As the starting material, we used 6,000 thoracic ganglia, which were, within 24 h after spinning, stored in 50 ml. methanol. These ganglia were homogenized in methanol and centrifuged. The same extraction was repeated three times with the residue. The extract was concentrated and dried *in vacuo*. The final residue was a yellow substance that dissolved in 5 ml. of distilled water plus 5 ml. of ethyl ether. After shaking, the ether layer was removed and the water layer was washed three times with ether and concentrated to 2 ml. *in vacuo*. Throughout the whole treatment the temperature was never allowed to rise above 30° C; 0·005 ml. of this water fraction (equivalent to 15 ganglia) was injected into each of 10 isolated abdomens of the *BT* strain. The ether layer, which was also dried *in vacuo*, yielded a very small amount of yellow substance. This substance was dissolved in 1 ml. of olive oil, and 0·01 ml. of this solution (equivalent to 60 ganglia) was injected into isolated abdomens of the same strain.

As shown in Table 1, an active substance affecting the pigmentation of pupal colour exists in the water fraction of the methanol extracts but not in the ether fraction, suggesting that the hormone controlling the manifestation of the black pupa is of protein or peptide composition.

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Flower Basking by Arctic Insects

During observations on insect–flower relationships at Lake Hazen, Ellesmere Island (81° 49′ N, 71° 20′ W) we were struck by the fact that both males and females of the mosquitoes *Aëdes nigripes* Zett. and *Aëdes impiger* (Walker) spent up to 13 min at a time in the flowers of several plants, but especially *Dryas integrifolia* M. Vahl, although we know from other work that they could feed to repletion on nectar in 2–3 min. Noting, too, the almost paraboloid shape of these and some other flowers that face the Sun throughout the 24 h, we postulated that this habit had a thermal significance[1].

A thermocouple-potentiometer circuit was set up to measure temperature differences between points approximating the principal foci of the parabolic corollas of *D. integrifolia* and of the arctic poppy, *Papaver radicatum* Rottb., and similar points immediately outside the corollas. Although the poppy secretes no nectar, mosquitoes have been seen sitting in the corollas. The thermocouple junctions were painted dull black, flowers were shielded from wind, and their sexual organs were removed. In sunlight, temperature differences up to 6·5° F were recorded for *Dryas* flowers and up to 10·5° F for *Papaver*, a larger flower. These differences decreased markedly when the thermocouple was moved laterally away from the principal focus and when the Sun was obscured; they decreased somewhat when sunlight was diffused by light cloud. A smaller effect was measured in *Cerastium alpinum* L.

It is suggested that the turning habit and parabolic corolla form were selected for in these flowers by virtue of the contribution made by this thermal effect to the ripening of the germ cells. The basking habit of mosquitoes and other insects is presumably derived from nectar or pollen feeding. In an environment where the season is short and every calorie counts, it must have survival value in accelerating the ripening of the insect germ cells.

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