

**Ovarian response of pinealectomized and intact white-footed mice kept under naturally short photoperiods<sup>1</sup>**

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**Summary.** Pinealectomized and intact adult female white-footed mice were maintained outdoors from 28 November to 2 January. At the termination of the experiment, ovarian weight was significantly greater ( $p < 0.02$ ) in the pinealectomized group compared with that of the intact animals. Microscopic examination of the ovaries revealed that those of the intact animals had fewer and smaller follicles than those from animals which had had their pineal glands removed.

The reproductive system of the white-footed mouse is known to be highly sensitive to photoperiodic manipulation<sup>2,3</sup>. In at least some species photoperiod acts on the pineal gland to synchronize annual reproductive events<sup>4</sup>. The pineal gland is generally considered to exert an inhibitory influence over the reproductive system. In the hamster, removal of the pineal gland blocks the antigonadal action of short daylengths. The effect of natural photoperiods on male hamsters maintained outdoors under controlled conditions has been investigated<sup>5</sup>. In that experiment reproductive collapse in the hamster due to short photoperiods during the winter months was prevented by pinealectomy. In the present study we tested the effect of pineal removal on the ovarian response to naturally short photoperiods in the adult female white-footed mouse, *Peromyscus leucopus*.

**Materials and methods.** Laboratory reared adult female *P. leucopus* were pinealectomized (PX) and allowed to

recover for 2 weeks. PX ( $n = 13$ ) and intact ( $n = 12$ ) animals were housed 2 or 3 per clear plastic cage. Woodshavings and cotton were provided as nesting material. Food (Wayne lab-blox) and water were available ad libitum. The animals were placed outdoors in a 3-sided enclosure with the open side sheltered by an overhanging roof. Mice were subject to naturally occurring changes in lighting and temperature. After 5 weeks exposure to ambient conditions (from 28 November to 2 January), the animals were killed. Body weight and total length measurements were made. The reproductive tracts were removed and the ovaries were cleaned and weighed on a Cahn Electrobalance. The data thus collected were analyzed by Student's *t*-test. Ovaries were fixed in Bouin's fluid and later prepared microscopic examination. Embedded material was sectioned at 5  $\mu\text{m}$ , fixed to slides and stained with H & E.

**Results and discussion.** Mean ovarian weight was significantly greater ( $p < 0.02$ ) in the PX group than in the intact animals; the respective weights were  $15.7 \pm 2.0$  (SEM) mg for the PX group compared with  $9.9 \pm 1.1$  mg for the intact group. Microscopic examination revealed that the ovaries of the intact group (figure 1) had fewer and smaller follicles than did those in mice which lacked an intact pineal gland (figure 2). Gross body measurements did not differ between the 2 groups. Clearly, pineal removal prevented the repressive effects of naturally short daylengths on the reproductive systems of female *P. leucopus*. Under laboratory conditions the mean ovarian weight of adult mice kept under long photoperiods (LD 16:8) was found to be  $14.1 \pm 0.9$  mg while under short photoperiods (LD 8:16) mean ovarian weight was found to be  $9.9 \pm 2.1$  mg (unpublished observations). Therefore, the intact group in the present experiment was being subjected to a lighting regime which was repressing ovarian function, whereas the PX group, being unable to respond to the inhibitory effect of short photoperiodic conditions, maintained large and presumably functional ovaries.

This experiment produced 2 important observations: 1st, removal of the pineal gland prevents the inhibitory effect of naturally short photoperiods on the reproductive system of *P. leucopus*, and 2nd, pinealectomized white footed mice can be successfully utilized under natural conditions to assess pineal mediated phenomena. It thus appears that, under field conditions, the photoperiod acting by way of the pineal gland may be important in synchronizing the annual reproductive cycle in *P. leucopus*.

Since there was no difference in gross body measurements, it may be added that, pinealectomy itself apparently did not have an adverse effect on the animals subjected to natural conditions of light and temperature.

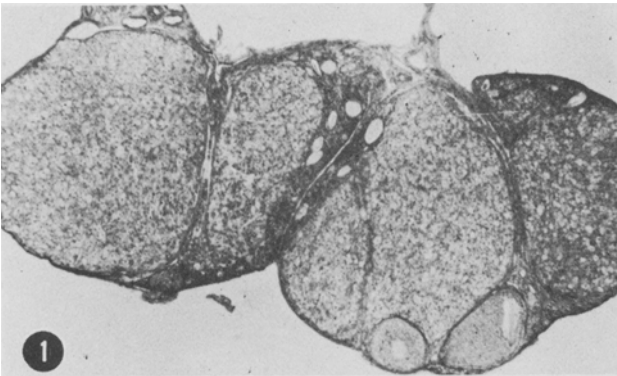


Fig. 1. A section through a typical ovary from an intact adult white-footed mouse which had been exposed to 5 weeks of naturally short photoperiods.  $\times 40$ .

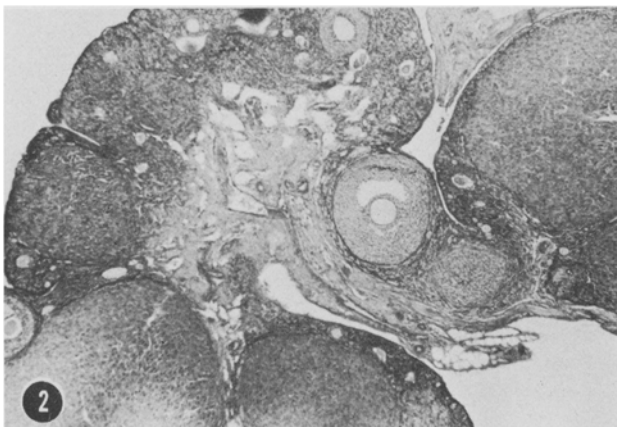


Fig. 2. A section through a typical ovary from a pinealectomized adult white-footed mouse which had been exposed to 5 weeks of naturally short photoperiods.  $\times 40$ .

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