Prevention of Pineal-Mediated Reproductive Responses in Light-Deprived Hamsters by Partial or Total Isolation of the Medial Basal Hypothalamus*

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Summary

The influence of total or partial isolations of the medial basal hypothalamus (MBH) on pineal-mediated gonadal responses was studied in adult male hamsters. Light deprivation, due to exposure of hamsters to light: dark cycles of 1:23 (in hours) or blinding, led to involution of the testes, seminal vesicles and coagulating glands and to a statistically insignificant depression in bioassayable pituitary follicle stimulating hormone. The effects of darkness and the pineal on the pituitary-gonadal axis were completely prevented by total or anterior hypothalamic disconnections; posterior disconnections negated the responses in less than one-half the animals. The following tentative explanations for the results were discussed: 1. the hypothalamic cuts interrupted pathways which pass through the hypothalamus and transmit photic information between the eyes and the pineal gland, thus rendering the pineal unresponsive to photoperiodic stimuli; 2. the surgical manipulations within the hypothalamus caused a "central sympathectomy" which interfered with sympathetic control of pineal biosynthetic activity; 3. the hypothalamic cuts interrupted axons of extra-MBH pineal responsive neurons that are inhibitory to gonadotropin-regulating cells.

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within the MBH; 4. the hypothalamic cuts severed axons of extra-MBH neurons which determine the sensitivity of gonadotropin-regulating cells within the MBH, thus rendering the latter neurons unresponsive to the pineal influence.

**Introduction**

The pineal gland exerts a marked influence on the neuroendocrine-gonadal axis of rodents (Reiter and Fraschini, 1969; Reiter, 1971). However, the mechanisms by which pineal substances regulate reproductive phenomena have not yet been clarified.

Usually it is considered that pineal secretory products act on some neural structure which, via its axonal projections to the medial basal hypothalamus (MBH), determines the activity of the hypophyseotrophic area. Anton-Tay et al. (1968) speculated that a primary site of action of melatonin, a pineal antigonadotrophic material, is the serotonergic neurons of the midbrain. Fraschini (1970) proposed that pineal substances may intervene both within the median eminence and within the midbrain reticular formation to influence gonadotropin secretion from the anterior pituitary gland. Quay (1969, 1970) has maintained the idea that a primary site of action of the pineal is on the homeostasis of cerebral metabolism, changes of which affect the hypothalamic gonadotropin regulating mechanisms.

We observed, recently, that complete surgical isolation of the MBH prevented pineal-induced gonadal atrophy in adult male hamsters (Sorrentino and Reiter, 1971). These findings suggest that the pineal influence on gonadotropins secretion may be mediated by a neural center outside of the MBH. The work reported here was done to further clarify the influence of hypothalamic isolation on gonadal responses to the activated pineal gland in the golden hamster and to present several working hypotheses to explain the findings.

**Materials and Methods**

Adult male golden hamsters, weighing 90—112 grams at the beginning of the experiments, were used throughout the studies. During the course of the investigations animals were maintained 5 per clear plastic cage in light and temperature (73 ± 2°C) controlled rooms. Lighting was provided by 40-watt cool white fluorescent bulbs. The intensity of light within the cages varied from 40 to 85 ft. c. All animals had free access to food and water.

Seventy-eight hamsters were used in the first study. They were divided into the 8 groups shown in Table 1 and were maintained either in long (light : dark [LD] cycles of 16:8, in hours) or short (LD 1:23) daily periods of light. All operations were performed on animals anesthetized