Effects of Parietalectomy and Sustained Temperature on Thyroid of Lizard, *Sceloporus occidentalis.** (24867)

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Stebbins and Eakin(1) observed that lizards (*S. occidentalis* and *Uma inornata*) maintained in laboratory runways exhibited heightened thyroid epithelium and reduction of colloid several months after removal of the parietal eye (parietalectomy). A lesser but similar effect has been found in a sample of their field specimens of *S. occidentalis* and is here reported.

Methods. A total of 377 animals was treated surgically, half parietalectomized, half sham-operated, and returned to study area in Berkeley hills(1). Because the principal objective of the investigation was an analysis of effects of parietalectomy on behavior, recaptured animals were released immediately after inspection and recording of certain data; only toward the close of the study were specimens taken for microscopical examination. Accordingly, the sample of 22 parietalectomized and 12 sham-operated lizards was small. Fig. 1 shows relative heights of thyroid epithelium in summer (June-July), spring (March), and winter (November) animals, parietalectomized (*P*) and sham-operated (*Sp*), expressed as percentage of follicular diameter. The mean value for each group (indicated by cross lines in the Dice-Leraas graphs) was based upon measurements with ocular micrometer of average epithelial height and follicular diameter of 20 randomly selected follicles in each specimen. The mean heights in μ of the follicular epithelium of the classes are: summer—*P* 10.6, *Sp* 10.4; spring *P* 9.4, *Sp* 6.3; winter—*P* 4.8, *Sp* 4.5.

Results. Fig. 1 shows no difference between parietalectomized and sham-operated animals taken in the summer. Although differences between experimental and control animals collected in spring and winter were not found by a t-test to be statistically significant at the 5% level, they are in the same direction as that observed in our laboratory experiments(1), namely, toward a higher follicular epithelium in the parietalectomized lizards.

Considering the annual picture of both parietalectomized and sham-operated animals, it is clear that there is a significant seasonal variation in microanatomy of the thyroid gland. Lizards taken in November possessed numerous large follicles filled with dense colloid. The epithelium was commonly no higher than the diameter of its flattened nuclei. The thyroid gland of specimens collected in March exhibited a large number of small or medium-sized follicles, the epithelium of which was low columnar. The follicular epithelium in summer specimens was high, sometimes 3 times the diameter of its nuclei, and the colloid was reduced and thin. This seasonal variation in thyroid gland of *S. occidentalis*, recently shown also by Wilhoft(2), is basically similar to that described by Miller (3) in *Xantusia vigilis*.

Could above changes be caused by annual cycle in solar heat? Eggert(4) found that hypertrophy of the thyroid occurred in *Lacerta agilis* kept at temperature of 24-29°C. Wilhoft(2) has shown similarly that maintaining *S. occidentalis* at 35°C (mean of normal activity range(5) for a few weeks leads to hypertrophy of the thyroid. The following experiment was performed to determine if this effect is mediated by the pituitary. Adult *S. occidentalis* freshly collected from Berkeley hills in summer were hypophysectomized under cold anesthesia (animal placed in cracked ice). By means of dental drill a small hole was made in the floor of the cranium immediately ventral to the hypophysis. The anterior lobe was removed by aspiration; in some instances posterior lobe also was extirpated. A sham-operation in controls consisted of drilling through the cranium and

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exposing the hypophysis. Animals were operated in sets of 2 or 3, matched so far as possible as to size and sex. In sets of 2, a hypophysectomized (*H*) and a sham-operated (*Sh-H*) animal were placed in separate containers in the 35°C chamber for 3 weeks. In sets of 3, in addition to *H* and *Sh-H* lizards, a second sham-operated animal (*Sh-R*) was maintained for 3 weeks in a room with variable temperature, never below 14° at night and above 35°C in the day (see Wilhoft(2) for details of method). The numbers of specimens were: 20 *H*, 20 *Sh-H*, and 10 *Sh-R*.

The mean percents (epithelial height/follicular diameter) are shown in the 3 Dice-Leraas graphs on the right of Fig. 1. The group of sham-operated animals kept at room temperature (*Sh-R*) was unfortunately reduced in number by death of 4 animals, the result of over-heating when thermal control failed. It will be observed, however, that there is good agreement between thyroids of these controls and those of summer specimens in the field study (Fig. 1). Mean epithelial heights in μ of the classes are: *Sh-R* 12.7; *Sh-H* 20; *H* 3.8. Histological differences between the 3 groups were strikingly significant. Without first checking the identity of a specimen, one could almost invariably assign it to the proper class by inspecting a few representative thyroid follicles. The hypophysectomized lizards usually ceased eating (mealworms) after a week or 2 and became inactive. Five died before the end of 3 weeks. Sham-operated animals at 35° (*Sh-H*), on the other hand, fed well and were very active.

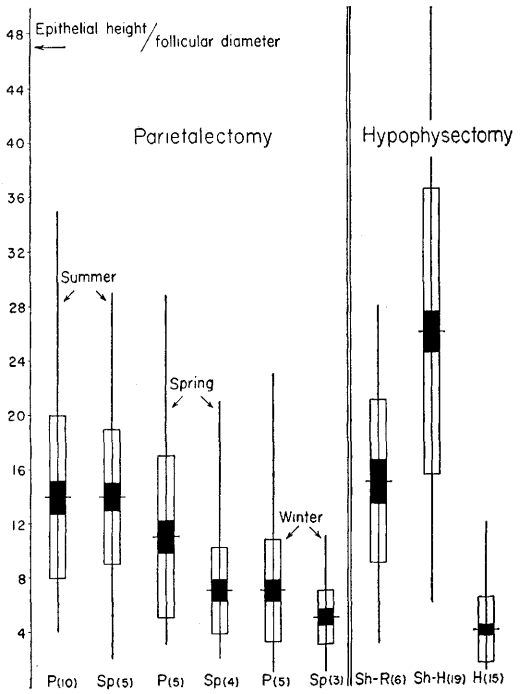

FIG. 1. Height of thyroid epithelium in *Sceloporus occidentalis*, expressed as percentage of follicular diameter, in field study on parietalectomy (left) and laboratory study on hypophysectomy (right). In each Dice-Leraas graph cross line indicates mean percent and vertical line the range of percent in each sample (P = parietalectomized, Sp = sham parietalectomized, H = hypophysectomized, Sh-R = sham hypophysectomized at room temperature, Sh-H = sham hypophysectomized at higher temperature (35°C). Solid rectangles show 2 stand. errors of mean and open rectangles stand. dev.

Discussion. The studies on parietalectomy of *S. occidentalis* reported by Stebbins and Eakin(1) and in this paper suggest that removal of the third eye leads to varying degrees of thyroid stimulation depending upon environment of animal. The effect is more apparent in animals maintained in laboratory runways, with lower thermal limit in the day-time often at 25°C, than in field specimens which had considerably lower temperatures available to them even on the warmest summer day. Wilhoft(2) has shown that keeping this lizard at mean temperature of its normal activity range for a few weeks induces hypertrophy of the thyroid, and in this paper we have presented evidence that this response is mediated by the anterior lobe of the pituitary body, presumably by its thyrotropic hormone. Recently, Fortune(6) found that high temperature (25°C) increased secretion of thyrotropin in the teleost, *Phoxinus laevis*. Taking these several findings together it seems probable that the parietal eye, hypophysis, and thyroid are somehow linked together in the physiology and behavior of this lizard in relation to solar radiation. The difference in degree of effect of parietalectomy upon the thyroid of field and laboratory animals is probably owing to the fact that in laboratory runways thermal conditions—especially a lower day-time thermal limit as high as 25°C—to which the animals were subjected over several months, intensified the differential (yet to be specifically identified) between experimental

and control animals. In the field, on the other hand, because climatic factors are more complex and variable and thermal range available is so much greater, the differential is not sufficiently magnified to bring about a clear dissimilarity in histology of the thyroid of parietalectomized and sham-operated lizards. A possible explanation for the similarity in thyroids of experimental and control lizards collected in summer might be a masking of the differential by the endocrine interplay incident to reproduction.

Summary. 1. Parietalectomized lizards (*Sceloporus occidentalis*), free living in the field, presented evidence of above-normal thyroid activity in animals collected in winter and spring, but not in summer. 2. An annual cycle of thyroid activity is exhibited by both parietalectomized and sham-operated lizards. 3. Thyroid hypertrophy induced by 3 weeks of constant temperature (35°C) is mediated by the hypophysis.

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Cytomegalic Inclusion Disease of Lacrimal Glands in Male Laboratory Rats.* (24868)

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This paper reports the presence of cytomegalic inclusion disease in intraorbital and exorbital lacrimal glands of laboratory rats. This condition was observed in adult males of 8 laboratory colonies but was not seen in any females nor in wild urban or rural Norway rats.

Methods. For recent toxicological study (unpublished) several hundred adult male Sprague-Dawley rats were purchased from a Midwestern firm. Routine histological survey of tissues from head and neck showed invasion by cytomegalic inclusion disease. Certain distinctive features described by Wyatt (1) as essential to complete a morphological diagnosis were satisfied, namely, eosinophilic intranuclear inclusion bodies, margination of nuclear chromatin, and specific cellular gigantism. Basophilic cytoplasmic inclusions were not observed. To procure normal lacrimal tissue, 6 adult male rats from each strain of Naval Medical Research Inst. stock, *i.e.*, Long-Evans, Sprague-Dawley, and NMRI-Dental caries-susceptible, were selected at random and lacrimal glands prepared for histological examination. All strains showed extensive lacrimal involvement by inclusion disease. All other organ systems were free of any cytomegalic inclusion disease. Sample male rats, 4 to each group, were procured from 4 other laboratory colonies in various geographic locations in U.S. Inclusion disease was present in all lacrimal glands, although variations in inclusion morphology and severity of the lesion were observed. These findings will be reported later. A group of wild urban male and 6 rural Norway rats, trapped in the Baltimore area, were free of lacrimal involvement. However, urban rats possessed intranuclear inclusions within kidney tubular cells, similar to the condition previously reported by Hindle(2). Salivary gland virus disease as described by Kuttner (3) and Smith(4) was present in acinar epithelium of submandibular glands and in ductular cells of sublingual glands of farm rats.

Results. Sample male and female rats of

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