

and height of acidity 5.0. The probabilities of the higher values of the means of the control group resulting from chance is, therefore, remote. Too few cases were available for valid comparison of the means for men and women separately but the individual values of means in the control group exceeded those in the alveolar resorption group by 83 to 134%.

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**Diurnal Rhythm of Melanophore Hormone Secretion in the
Anolis Pituitary.**

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The *Anolis* lizard exhibits a striking color change by assuming a bright green color at night and usually turning a dark brown under the influence of light. This spectacular metachrosis is brought about by the concentration or dispersion of pigment in the melanophores which exposes or obscures respectively a green reflecting chromatophore layer and thus produces either a bright green or a dark brown animal. These dermal melanophores are directly controlled by the secretions of the pars intermedia of the pituitary gland (Kleinholz¹). The removal of this region or of the whole pituitary induces a permanent pigment concentration and consequently a green animal, while injections of melanophore hormone produce pigment dispersion and a dark brown animal. Thus hormone release and inhibition are easily recognized in a normal animal by its striking effect upon the integument color.

In preliminary experiments these lizards exposed to continuous light on a white background at 22° and 40°C for as long as 4 days exhibited a tendency to turn green during the corresponding night period and dark brown during the day. (*Anolis* lizards were obtained from Ocala, Florida.) This suggested a diurnal rhythm which was further tested by placing one group of 13 and another of 11 lizards in constant darkness for 8 and 18 days respectively. Throughout this period the temperature remained within a 22-24°C range. Observations were made twice to 4 times within the 24-hour day and were spaced at least 4 hours apart.

¹ Kleinholz, L. H., *Biol. Bull.*, 1935, **69**, 379; *J. Exp. Biol.*, 1938, **15**, 474.

Within 2 days after confinement to constant darkness it became evident that the animals exhibited a diurnal rhythm in their color response. During the solar night all animals turned green, while during the solar day up to 90% of them changed to brown. These periods of metachrosis commenced rather precisely at 6 A.M. and 4 P.M. and were completed within 2 hours. Fig. 1 shows the results of 8 days of observations on 13 animals in which the percentage of dark animals is plotted against the time of day. The observations on the other series of animals confined for 18 days to total darkness yielded similar results. In these tabulations an animal was considered dark when no more green was visible or, more precisely, when they assumed stage 3 or 4 of the color scale proposed by Kleinholz and Rahn.²

It will be seen from Fig. 1 that 10-15% of the animals did not turn dark during the solar day. Upon exposure to the observation light these lizards required on the average 1.6 minutes to turn dark, while during the solar night the average reaction time was 3.9 minutes. This suggests that even in these animals there is a diurnal change in the melanophore hormone level which is, however, not

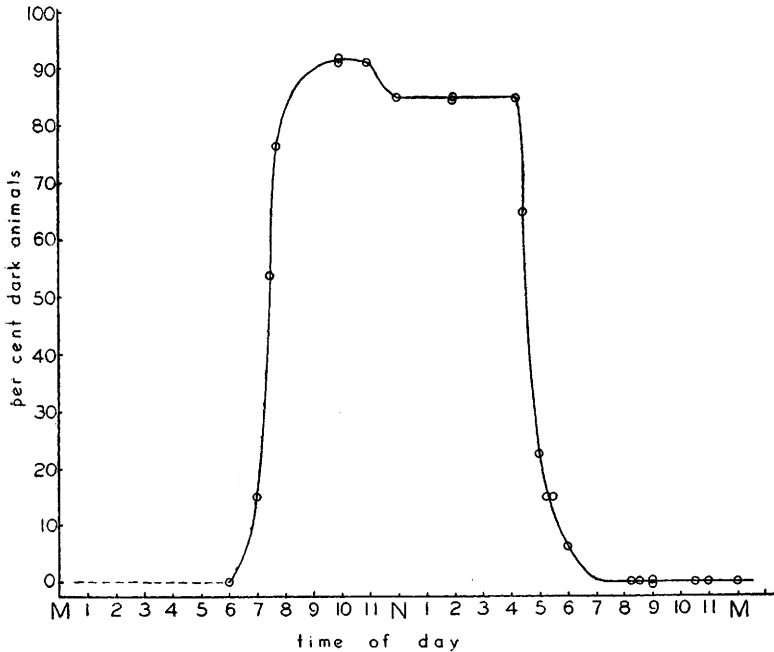


Fig. 1.
For explanation see text.

² Kleinholz, L. H., and Bahn, H., *Anat. Rec.*, 1940, **76**, 157.

large enough to attain the melanophore threshold during the solar day.

Lizards exposed continuously for 6 days on a black background to 3 foot-candles did not exhibit a very strong color rhythm. On an average 98% of them remained dark during the solar day, but only 40% turned green between 7 P.M. and 8 A.M. These observations were further complicated by a high mortality among the animals, yet they suggest that even continuous exposure to light was not able entirely to suppress the secretion rhythm.

In control experiments 30 lizards were completely or partially (*pars intermedia* only) hypophysectomized and exposed to normal changes of night and day for as long as 3 weeks. In no case was darkening observed, all animals remaining bright green.

These observations then lead to the conclusion that the *pars intermedia* of the *Anolis* lizard pituitary exhibits a diurnal secretory cycle which is independent of light receptors, but is normally reinforced by the alternating day and night period. In the lamprey,³ *Xenopus*,⁴ and *Salamandra maculosa*⁵ similar observations on a persistent melanophore rhythm in continuous darkness have been reported. In *Salamandra* a definite cycle exists for only a week, while in both this form and the lamprey continuous light disrupts the rhythm. In all these forms, especially *Xenopus*, the reported melanophore rhythm is very slight, never attaining the maximal states of concentration and dispersion as seen so strikingly in *Anolis*. It would be premature to speculate concerning the control mechanism of this cyclic secretion process were it not for the recent evidence of Etkin,⁶ who finds the functional activity in the *pars intermedia* of *Rana* normally restrained, probably through the mediation of the hypothalamic-hypophyseal tract. For *Anolis* this suggests possibly an activity rhythm in the hypothalamic nuclei which controls the diurnal release of the melanophore hormone from the *pars intermedia*.

Summary. *Anolis* lizards which normally exhibit a different color response to day (brown) and night (green) were subjected to continuous light or darkness over a period from 6 to 18 days. Under the former condition a weak, but under the latter a very marked and precise diurnal color rhythm was exhibited for as long as 18 days. Hypophysectomized animals remained permanently green.

³ Young, J. Z., *J. Exp. Biol.*, 1935, **12**, 254.

⁴ Hogben, L., and Slome, D., *Proc. Roy. Soc. B.*, 1931, **108**, 10.

⁵ Pauli, W., *Z. wiss. Zool.*, 1926, **128**, 421.

⁶ Etkin, W., *J. Exp. Zool.*, 1941, **86**, 113.