To test this hypothesis young *R. catesbeiana* tadpoles obtained during the winter, all initially between stages V and VIII, were divided into four groups and placed in distilled water containing 0, 1, 10, or 100 ng of thyroxine (T_4) per milliliter. Canned spinach was present in the aquariums approximately 8 hours each day. After the feeding period, the tanks were cleaned and refilled with fresh T_4 solutions. Beginning on day 4, tadpoles from each group were killed at intervals, and sheets of their ventral skin were tested for potential difference as described above.

Although impressive structural changes normally occurring very late in spontaneous metamorphosis were obvious by the 8th and 12th days of exposure to T_4 at concentrations of 100 and 10 ng/ml, respectively (Fig. 1), this treatment did not lead to development of measurable transepidermal potential differences until day 12 with 100 ng/ml and day 18 with 10 ng/ml (Fig. 2). Thereafter, skin potentials increased progressively toward the values measured in adult frog skin (30 to 50 mv). Skin from control tadpoles and those exposed to T_4 at a concentration of 1 ng/ml did not mature sufficiently to generate potential differences within the 38-day period of the experiment.

The results of these experiments leave little doubt that thyroid hormone is instrumental in either establishing or activating the biological machinery essential for active transport of sodium by frog skin. We consider less likely an alternate interpretation of these results, that the potential difference due to active sodium transport is canceled out by the shunting effects of free movement of chloride, or of other anions. This possibility would lead to the conclusion that a relative impermeability to chloride develops late in metamorphosis, thus making manifest the electrical effects of the epidermal sodium pump. In addition, preliminary experiments in which skin from young tadpoles was bathed with chloride-free Ringer solution revealed no potential differences and therefore lend no support to the concept of a simultaneous and equal movement of sodium and chloride.

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Lizard Reproduction: Refractory Period and Response to Warmth in Uta stansburiana Females

Abstract. *Photoperiod does not affect timing of the female reproductive cycle in* Uta stansburiana. *This lizard is refractory to reproduction until early December. Later, prolonged warmth under laboratory conditions initiates the reproductive cycle in some lizards regardless of photoperiod.*

The influence of photoperiodism on the reproductive cycle of reptiles is complicated by temperature fluctuations which regulate daily activity of ectotherms. Thus, photoperiod experiments on reptiles are difficult to evaluate without knowing the behavior of the animal in nature (*1*).

Research on reptile reproduction has resulted in three general conclusions: (i) photoperiod provides the primary stimulus for the reproductive cycle in some species (*1–3*); (ii) temperature usually modifies but seldom, if ever, initiates reproductive response (*1, 2, 4, 5*); and (iii) a refractory period (as in birds) during which the reproductive cycle cannot be initiated experimentally has not been demonstrated.

The iguanid lizard *Uta stansburiana* in western Texas lays three clutches between March and August; follicles begin to enlarge and undergo vitellogenesis in February or March (*6*). The population endures cold winters −30°C mean daily minimum for January 1959–62) by burrowing underground, but the lizards do not hibernate, and they are active on sunny days in winter. We have observed their activity for several winters and can predict photoperiod (duration of daily exposure to sunlight) from hourly climatological data (*7*). Photoperiods estimated in this way are nearly always shorter than observed photoperiods, thus giving a conservative, or minimum, estimate of the actual daily exposure time of lizards to sunlight in nature.

Adult females were kept in terraria (3 m in diameter) in dark rooms for 6 to 9 weeks. Isolated groups of 10 to 20 lizards were exposed to varying photoperiods from fluorescent and heat lamps during the time of day at which the lizards are usually active. To simulate summer conditions, temperature was maintained above 27°C but not kept constant. Food (*Tenebrio* larvae) and water were available at all times. Sand on the floor was not deep enough to permit burrowing. Animals collected from the natural population at the beginning and end of each experiment served as controls.

Observations made under these conditions indicate that the female reproductive cycle of *U. stansburiana* is not timed by photoperiod. Reproductive response as measured by the presence of large yolked follicles was not significant-

Table 1. Reproductive response of female *Uta stansburiana* at 27°C and above. Reproductive females are distinguished by enlarged (>2 mm diameter) yolked follicles. Controls (c) are adult lizards collected from the field at the beginning and end of each experiment. Experimental lizards which lost 0.5 g during the experiment are excluded, because all controls were healthy.

Photoperiod (hr/day)	Dates	Lizards	
		No.	No. reproductive
	Experiment A		
6(c)*	13 Oct. 1963	10	0
3	13 Oct.–8 Dec.	18	0
6	13 Oct.–8 Dec.	19	0
12	13 Oct.–8 Dec.	20	0
6(c)*	8 Dec. 1963	7	0
	Experiment B		
3(c)*	8 & 16 Dec. 1963	10	0
3	16 Dec.–2 Feb.	9	5
3–12†	16 Dec.–2 Feb.	7	4
12	16 Dec.–2 Feb.	6	3
3(c)*	1 Feb. 1964	8	0
	Experiment C		
4(c)*	14 Dec. 1964	10	0
<½	14 Dec.–1 Feb.	9	6
4(c)*	1 Feb. 1965	10	1
	Experiment D		
6(c)*	13 Sept. 1964	12	0
6	22 Sept.–25 Nov.	13	1
6(c)*	29 Nov.	6	0
6	20 Oct.–22 Dec.	16	4
6(c)*	14 Dec. 1964	10	0

* Average minimum, estimated from daily weather records, for the time covered by the experiment. † Photoperiod gradually lengthened from 3 to 12 hours per day.

ly different at experimental photoperiods less than, equal to, or greater than the minimum field photoperiod (experiments A and B, Table 1). In experiment C, lizards received illumination for ¾ to 1 hour on Mondays, Wednesdays, and Fridays, or an average experimental photoperiod of less than ½ hour per day, considerably less than the average minimum field photoperiod (4 hours per day). At autopsy, 67 percent of the experimental lizards had enlarged yolked follicles, whereas gonadal development had begun in only one of ten controls.

The reproductive cycle of most female *U. stansburiana* is refractory to environmental stimulation until early December. Although none of 57 females was reproductive at the end of experiment A, 12 of 22 females were reproductive at the end of experiment B two months later. Photoperiods were the same in both experiments, indicating a temporal difference in reproductive capability. In experiment D, one year later, 1 of 13 females became reproductive between September and November while between October and December, 4 of 16 became reproductive with the same photoperiod.

That temperature has greater influence than photoperiod in initiating the reproductive cycle has been suggested for at least one other temperate-zone reptile (*4*); however, photoperiod is generally considered more important. While careful studies (*2, 3*) have established the predominant influence of photoperiod in some species, other studies (*8, 9*) had inadequate controls.

The refractory period in birds is probably controlled by the neurosecretory system (5), and apparently provides time for resynthesis of neurohormonal substances depleted by reproductive activity of the previous season (*10*). We do not know the physiological basis or adaptive significance of the refractory period of *U. stansburiana*. However, because fat-body cycling parallels the reproductive cycle and is directly related to reproductive potential (*12*), the refractory period may provide time for enlargement of the corpora adiposa and may be controlled by factors other than those which affect refractoriness in birds.

Environmental factors affecting reproductive cycles are of obvious evolutionary interest. Varying responses among different species of the same genus (*9*) may indicate that the relative importance of environmental stimuli is evolutionarily labile. Asplund and Lowe (*12*) have reported sympatric populations of *Urosaurus ornatus* and *Uta stansburiana* with contrasting reproductive cycles and suggest that the species have had different macroclimatic evolutionary histories.

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Chilocorus similis Rossi: Disinterment and Case History

Abstract. *Cytological proof is presented that the Asiatic predator* Chilocorus similis (*Coleoptera, Coccinellidae*), *liberated in California sometime between the years 1923 and 1947, has since been masquerading there under the name* C. orbus.

On page two of his "Biological Control of Insect Pests in the Continental United States," Clausen (*1*) states: "*Chilocorus similis* Rossi, the predator of the white peach scale [*Pseudaulacaspis pentagona* (Targ.)] and of the San Jose scale (*Aspidiotus perniciosus* Comst.), imported from Japan in 1901 and 1902 and extensively colonized in Georgia, showed a marked increase the following year and was still common in 1905, but eventually died out." On page 31 he continues: "The San Jose scale, which originated in Asia and was first observed in the United States about 1870, quickly spread over the entire country. . . ." "A coccinellid beetle, *Chilocorus similis*, is an abundant enemy of the scale in Japan, and efforts were made to import and establish it from 1895 to 1923, but without success." Further, on page 32, he concludes as follows: "Several shipments were made to the United States, but only two individuals survived. However, they proved sufficient for rearing purposes, and large numbers were produced in the insectary at Washington, D.C., for release in several States. The field colonies appeared to thrive, especially those in Georgia, where recoveries were made for several years, but the species did not persist beyond 1905."

According to Marlatt (*2*), the predator species introduced from China and Japan between 1895 and 1902 was *C. similis* Rossi. In 1923, material under this name was released in Santa Barbara County, California, but Clausen is of the opinion (*3*) that the species involved in these various importations was *Chilocorus kuwanae* Silvestri and that *C. similis* has, in fact, never been introduced into North America.

In 1948, I understand, specimens received from China labeled *Chilocorus renipustulatus* Scriba were cultured in large numbers at the Citrus Experiment Station, Riverside, California, and liberated in that State. In connection with these later releases Clausen (*2*) comments on page 32: "Several attempts have been made to establish this predator on various other scale insects in California, but they likewise were not successful." It is my purpose herein to present evidence for at least one exception to this generalization.

Three species in the genus *Chilocorus* Leach are native to California: *Chilocorus cacti* (Linnaeus), *Chilocorus orbus* Casey, and *Chilocorus fraternus* Leconte. The first is easily recognized, but the last two can be distinguished from each other only with much difficulty (*4*), although their taxonomic separation is greatly facilitated over most of their range by their almost complete geographic isolation. On the other hand, *C. orbus* and *C. fraternus* are well characterized cytologically, not by chromosome number, for both have 22 chromosomes, but in the morphology of the autosomes; those of *C. orbus* are reasonably uniform in size and shape, whereas those of *C. fraternus*