8-1976

The effect of photoperiod on the regressive phase of the ovarian cycle of the lizard, Anolis carolinensis.

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THE EFFECT OF PHOTOPERIOD ON THE REGRESSIVE PHASE OF THE OVARIAN CYCLE OF THE LIZARD, *ANOLIS CAROLINENSIS*

BY

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A THESIS
SUBMITTED TO THE GRADUATE FACULTY
OF THE UNIVERSITY OF RICHMOND
IN CANDIDACY
FOR THE DEGREE OF
MASTER OF SCIENCE
IN BIOLOGY

AUGUST 1976

THE EFFECT OF PHOTOPERIOD ON THE REGRESSIVE PHASE OF THE OVARIAN CYCLE OF THE LIZARD, ANOLIS CAROLINENSIS

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ACKNOWLEDGEMENTS

I should like to express my deep appreciation to several people for their help in the completion of this thesis: Dr. Francis B. Leftwich, my committee chairman; Dr. Gerald C. Schaefer; Dr. David W. Towle and Dr. Willie M. Reams whose comments and suggestions have made this a better thesis. I should like to thank Dr. Kenneth A. Blick (Psychology Department, University of Richmond) and Mr. Eugene G. Maurakis (fellow graduate student) for their help in the statistical analysis of the data. Also I should like to thank Mr. Frank L. Holt for his help in the microscopic analysis of the tissues.

ABSTRACT

The effects of constant photoperiod (14 hours of light) and decreasing photoperiod (13-8 hours of light) on the regressive phase of the ovarian cycle of the lizard Anolis carolinensis were investigated. Changes in body, liver, ovary and oviduct weights were measured and microscopic examinations of several ovarian parameters were made.

In both light regimens body and liver weights decreased over the first four weeks of the experiment, but both increased at the sixth week. In addition, ovary weight was highly variable but exhibited a decreasing trend and oviduct weight decreased.

The percentage of anoles with yolked follicles decreased in both regimens. The number and diameter of yolked follicles decreased in both regimens while the numbers of atretic follicles and follicle scars increased in both regimens. The nutritional state of the anoles was believed to have played a role in producing these changes.

There were decreases in the number of previtellogenic follicles and in the diameter of the largest previtel-

logenic follicles in anoles subjected to a decreasing photoperiod. There were no changes in these parameters in anoles kept at a constant photoperiod. On the basis of these data, decreasing photoperiod is proposed to be the environmental cue for regression in Anolis carolinensis.

INTRODUCTION

The annual reproductive cycle of Anolis c. carolinensis (American green anole) consists of three distinct phases in both sexes (Schaefer, 1972): (1) pregametic (spermatogenesis in the male; Fox, 1958: previtellogenesis in the female; Schaefer, 1972; Crews and Licht, 1974; Crews, 1975; Holt, 1975); (2) gametic (spermiogenesis in the male; Fox, 1958; Licht, 1971: vitellogenesis in the female; Schaefer, 1972; Crews and Licht, 1974; Crews, 1975; Holt, 1975) and (3) regressive, during which the animals are photothermally refractory (Fox and Dessauer, 1958; Schaefer, 1972). In the female the pregametic phase begins in November and lasts through February when the ovaries contain small translucent previtellogenic follicles ranging from 1.2 - 2.0 mm in diameter and there are atrophic oviducts (Schaefer, 1972; Crews and Licht, 1974; Holt, 1975). The gametic phase lasts from March through August when a single follicle per ovary accumulates yolk until it reaches a diameter of about 8.0 mm (10 - 14 days) at which time it is ovulated (Schaefer, 1972; Jones, et al., 1973a; Licht, 1973;

Crews and Licht, 1974; Crews, 1975; Holt, 1975). This ovulatory pattern with only one follicle ovulated at a time, alternating between the left and right ovaries is known as monoallochronic ovulation (Hamlett, 1952; Jones, et al., 1973a). In late August, vitellogenesis ceases and the yolking follicles begin to degenerate rapidly, undergoing atresia, a process in which they become highly vascularized, discolored, flaccid and mottled in appearance (Schaefer, 1972; Crews and Licht, 1974; Crews, 1975). The atretic follicles or corpora atretica gradually degenerate into follicle scars or corpora albicantia (Telford, 1969; Schaefer, 1972). During September and October, Anolis is photothermally refractory (Schaefer, 1972; Licht, 1973).

The ovarian cycles of reptiles are controlled by both exogenous and endogenous mechanisms. Rainfall seems to be an important environmental cue for some reptiles because of the moisture it provides for egg incubation and for plant growth (Mayhew, 1966; Sexton, et al., 1971). Rainfall for plant growth is important for insectivorous lizards, because the plants support insect populations

in seasonally dry regions (Mayhew, 1966; Sexton, et al., 1971).

Temperature and photoperiod are apparently the most important environmental cues for reptiles in areas where food and water are not limiting (Schaefer, 1972). Several investigators have expressed the opinion that photoperiod is the predominant cue for gonadal recrudescence in lizards such as Anolis carolinensis (Clausen and Poris, 1937; Fox and Dessauer, 1958), Phrynosoma cornutum (Mellish, 1936), Xantusia vigilis (Bartholomew, 1950) and Uma notata (Mayhew, 1961; 1964) and the turtle Pseudemys elegans (Burger, 1937). Other researchers believe that temperature is the primary environmental cue for the lizards Uta stansburiana (Tinkle and Irwin, 1965) and Sceloporus undulatus (Marion, 1970) and for garter snakes of the genus Thamnophis (Fox, 1954; Hawley and Aleksiuk, 1976). Finally some researchers believe that there is an interaction of photoperiod and temperature in controlling the reproductive cycle of the lizard Anolis carolinensis (Licht, 1966; 1967a; 1967b; 1969; 1971; 1972; 1973; Schaefer, 1972).

The exogenous environmental cues trigger endogenous mechanisms. Research on the endogenous mechanisms has established that gonadal function is controlled by gonadotropins released by the anterior pituitary of Anolis carolinensis (Licht and Pearson, 1969; Licht, 1970; 1974; Licht and Papkoff, 1971; Jones, et al., 1973a; Jones, et al., 1974; Holt, 1975) as well as Phrynosoma cornutum (Mellish, 1936; Mellish and Meyer, 1937) and Lygosoma laterale (Jones, 1969). The gonadotropins stimulate the granulosa cells surrounding the ovarian follicles to produce and secrete estrogen (Jones, 1969; Licht, 1970; Eyeson, 1971; Callard, et al., 1972a; Jones, et al., 1973a; 1973b; 1974; Holt, 1975) which stimulates the liver to synthesize and release vitellin (Hahn, 1967; Eyeson, 1971; Callard, et al., 1972a; Gerstle and Callard, 1972; Holt, 1975). Vitellin is taken up by the ovarian follicles accounting for the increase in follicle size (Eyeson, 1971; Neaves, 1972; Jones, et al., 1973b; Marschall and Gist, 1973; Holt, 1975).

In late August the ovarian follicles cease to accumulate yolk and the ovary regresses. This process has

been reported to be independent of external environmental cues (Licht, 1973; Crews and Licht, 1974; Crews, 1975). Licht (1972b; 1973) refers to the regressive phase as being "spontaneous" or controlled by an "endogenous" mechanism. The present research endeavors to examine the regressive phase of the ovarian cycle by studying the effects of a constant "stimulatory" photoperiod and a decreasing photoperiod on the reproductive system and the process of vitellogenesis in female Anolis carolinensis.

MATERIALS AND METHODS

One hundred adult Anolis carolinensis females, collected in southern Louisiana, were shipped by air and arrived in Richmond, Virginia on August 5, 1975. Immediately upon arrival, the lizards were placed in 13 cm X 18 cm X 29 cm plastic cages with five animals per cage. Each cage was covered with screen wire secured by a rubber band. In each cage, water was supplied ad libitum in petri dishes and by squirting water along the sides of the cages. The lizards were also provided mealworms ad libitum for the duration of the experiment.

In order to determine the reproductive condition of the lizards, ten animals were randomly designated as initial controls. These animals were killed with ether and weighed 24 hours after arrival in Richmond. Immediately after weighing, a mid-ventral incision was made from the cloaca to the pectoral girdle. The pleuroperitoneal viscera were retracted and then the animals were tagged and stored in 10% formalin for later examination.

Throughout this report, photoperiodic regimens will

be designated by the number of hours of light (L) per 24 hours, e.g. 13L means 13 hours of light followed by 11 hours of darkness. The daily photoperiod as well as temperature were controlled by placing the cages in Lab-line Biotronette Mark III environmental chambers. In the chambers, the lizards were exposed to cool-white light from four Life Line fluorescent 40 watt bulbs and two Sylvania 40 watt incandescent bulbs. Temperatures within the chambers for the six weeks of the experiment ranged from daily high temperatures of 31C to 33.5C and nightly low temperatures of 21C to 24C as determined by a maximum-minimum thermometer. Humidity was maintained between 40-50% throughout the experiment by flooding the bottoms of the environmental chambers with water.

All anoles were exposed to 14L for 24 hours. They were then divided into two groups. Regimen I was kept at 14L for the duration of the experiment. Regimen II was subjected to a decreasing photoperiod. The photo-period was reduced one hour per week. Designations for Regimen I are: 14L2 which means the lizards were kept at 14 hours of light and killed at the end of two weeks;

14L4 and 14L6 for lizards killed at four and six weeks. Designations for Regimen II are: 13L-12L which means the lizards were kept at 13 hours of light for one week followed by 12 hours of light for one week and they were killed while at 12 hours of light; 13L-10L and 13L-8L for photoperiods down to 10 hours by four weeks and 8 hours by six weeks. At each two week sampling period the lizards were killed and prepared for examination as described previously for the initial controls.

At the time of examination each animal was soaked in distilled water for approximately ten minutes. The distilled water was changed after each group. After soaking, the animals were placed on a paraffin filled petri dish and examined with a Wild stereoscope. The liver was removed and weighed. The oviducts (from the infundibulum to the vaginal pouch) were removed and weighed. If a shelled egg was present in the ovisac, it was removed and weighed and its weight was subtracted from the animal's body weight in order to equalize results with anoles that did not have shelled eggs. The oviduct with the shelled egg removed was weighed. The

ovaries were removed, freed of connective tissue and weighed. All weighings were made to the nearest 0.1 mg. Preservation in 10% formalin has been found to decrease tissue weight by about 10 - 15% (Schaefer, 1972); however, the consistency of the weight decrease allowed for the use of preserved tissue weights instead of fresh tissue weights.

The ovaries were placed on a moist Kimwipe and examined with a Wild stereoscope to determine the reproductive condition. The Wild stereoscope had an ocular micrometer that was standardized for all measurements made. The parameters for each ovary examined were: the number of previtellogenic follicles (0.2 - 2.0 mm); the diameter (mm) of the largest previtellogenic follicle; the number of yolked follicles (2.0 - 8.0 mm); the diameter (mm) of the largest yolked follicle; the number of atretic follicles and the number of follicle scars.

A one-way analysis of variance test (ANOVA) was used to detect differences between or within the photoperiodic regimens. ANOVA tests with three or more groups with a significant F ratio at the 0.05 level of confidence

were then subjected to a Duncan's new multiple range test (Steel and Torrie, 1960) to determine which groups differed significantly from each other. ANOVA tests were also done on the groups that were killed at the same two week intervals to determine if there were significant differences (0.05 level of confidence) between the regimens.

RESULTS

The effect of photoperiod on the body weights of the anoles is presented in Table 1 and Figure 1. The body weights for the initial controls were higher than for any of the experimental groups. The weight loss was significantly lower by the fourth week for Regimen I and by the second week continuing to the fourth week for Regimen II (Tables 3 and 4). For both regimens body weights increased at the sixth week with the increase being significant for Regimen I (Table 4). There were no significant differences in the body weights for groups of anoles killed at the same sampling period (Table 3), indicating that the body weight fluctuations were following a similar pattern for both regimens.

The liver weights followed a pattern similar to that of the body weights (Table 1; Figure 2). Final liver weights were higher than those of the initial controls. Liver weight decreased for both regimens through the fourth week; however, the loss was not significant (Tables 5 and 6). In both regimens there was a sharp statistically significant increase in liver weights by

the sixth week (Tables 5 and 6). No significant differences were found between groups killed at the same sampling period (Table 5).

Ovary weights were quite variable (Table 1; Figure 3). Only a comparison of the initial controls with Regimen I showed statistically significant differences (Table 7). In that comparison, the ovary weight at six weeks was significantly lower than the ovary weight of the initial controls (Table 8). There were no significant differences between the groups killed at the same sampling period (Table 7). Even though the weights fluctuated, no values exceeded those of the initial controls.

The oviduct weights decreased during the experimental period (Table 1; Figure 3). Final oviduct weights for both regimens were significantly lower than those of the initial controls (Table 10). Oviduct weight was significantly different between regimens only at the two week sampling period, where it was higher in Regimen I (Table 9). As the body weights for the anoles at this time period of the experiment were not significantly different, sampling error can probably be ruled out.

There were no significant differences in the number of previtellogenic follicles when the two regimens were compared to the initial controls for the first four weeks of the experiment (Table 2; Figure 4). At the sixth week, the number of previtellogenic follicles in Regimen II was significantly lower than for the initial controls (Table 12). The number of previtellogenic follicles in Regimen I dropped at the end of four weeks but then returned to the level of the initial controls (Figure 4). Regimen II had a significant decrease at each two week sampling interval and by the sixth week was significantly lower than Regimen I (Table 11).

The effect of photoperiod on the diameter of the largest previtellogenic follicle is shown in Table 2 and Figure 4. There were no significant differences during the entire experimental period for Regimen I (Table 13). Regimen II had a significant decrease in diameter by the fourth week with a slight increase at week six (Table 14). Regimen II had significantly smaller previtellogenic follicles at weeks four and six than did Regimen I (Table 13).

The percentage of animals within the regimens that had yolked follicles at each sampling period is shown in Figure 5. Ideally the percentages should go down to zero if yolked follicle production had stopped. There is a distinct decrease in the percentages over the six weeks of the experiment. Regimen I had a lower percentage at the end of the experiment than did Regimen II.

The number of yolked follicles per animal decreased over the six weeks of the experiment for both regimens (Table 2; Figure 6). The number of yolked follicles in Regimen I were significantly lower than those of the initial controls at the two and six week sampling periods (Table 16). There were no significant differences between the two regimens (Table 15).

As with ovary weights, there were wide fluctuations in the diameters of the largest yolked follicle (Table 2; Figure 6). Since ovary weight is largely a reflection of the size of the yolked follicles during the gametic phase, the similarity seen here is not surprising. Even though there was a wide variation in the diameters, they never exceeded those of the initial controls (Fig-

ure 6). The decrease in diameter at the sixth week was significantly lower than all previous measurements for Regimen I (Table 18). There were no significant changes within Regimen II (Table 17). Even though there were no significant decreases in the number and diameter of yolked follicles within Regimen II, there was a definite decreasing trend for both parameters (Figure 6). It is possible that some of the follicles considered as yolked may have been atretic. The only way to definitely determine if the follicles were atretic would have been to examine them histologically. Since that was not done, the numbers and diameters of yolked follicles may actually be much lower than estimated.

Numbers of clearly atretic follicles increased during the experiment (Table 2; Figure 7). The increase was significant when both regimens were compared to the initial controls (Tables 19 and 20). There were no significant differences between regimens at each two week sampling period (Table 19). Numbers of follicle scars also increased over the experimental period (Table 2; Figure 7). The number of follicle scars in both regimens

were significantly greater than those of the initial controls (Tables 21 and 22). The only difference between regimens was at the fourth week when the number of follicle scars were higher in Regimen I than in Regimen II (Table 21). These data on follicle scars are presented to demonstrate that the animals were reproductively mature (Telford, 1969).

DISCUSSION

The ovarian cycle of Anolis carolinensis appears to be controlled by a complex interaction between the animal and its environment. Both male and female anoles have the potential to be continuous breeders (Licht, 1971; 1973); however, both sexes become reproductively inactive near the end of August. Environmental temperatures in the New Orleans area, where the anoles used in this study were collected, during August and September are decreasing but still around 30C during the day and 20C at night (Licht, 1969; Schaefer, 1972). During the same period, the photoperiod decreases about one hour (Schaefer, 1972) or about one-fourth of the yearly change.

The cessation of reproductive activity in Anolis has survival importance. Should egg laying continue into the cold winter months, survival chances of the hatchlings would be greatly reduced (Schaefer, 1972; Licht, 1973). The regressive phase is also a mechanism for energy conservation. The anoles stop yolking eggs and store lipid reserves for winter survival and for use in the spring for yolking when food supply is low

(Schaefer, 1972; Licht, 1973).

Licht (1967a; 1967b; 1969; 1971) has thoroughly studied the effects of temperature and photoperiod on the annual testicular cycle of Anolis carolinensis. Testicular recrudescence begins during October when low body temperatures seem to favor testicular enlargement (Licht, 1967a; 1967b). From November through February the lizards are in hibernation; however, testis weight and spermatogenesis increase over seasonal lows found in September (Licht, 1971). During the hibernation period the anoles are in the hibernaculum (except for slight activity on warm days) and temperature controls testicular recrudescence (Licht, 1967a). Photoperiod has been found to influence recrudescence only when body temperatures are high (32C), but at low temperatures (20C) recrudescence was independent of photoperiod (Licht, 1966; 1967a; 1969). Once recrudescence has begun, testicular growth seems to be independent of photoperiod and its completion depends on higher temperatures in the spring (Licht, 1967b; 1969). The elevated temperatures in the spring increase the release of gonado-

tropins from the pituitary which act on the testes to increase androgen secretion (Licht, 1971; 1972a; 1972b). There is also an increase in spermiogenesis in response to the elevated temperatures (Licht, 1971) with the peak for these processes occurring in April (Fox, 1958; Fox and Dessauer, 1958). Testis weight begins to decrease near the end of April, but spermatogenesis does not begin to decrease until July (Licht, 1971). Decreasing photoperiod is believed to bring about the regressive phase of the testis (Fox and Dessauer, 1958; Licht, 1967a; 1967b) by cessation of gonadotropin release from the pituitary (Licht and Pearson, 1969; Licht, 1971; 1972a).

Thus the evidence indicates that the testicular cycle in Anolis carolinensis is begun by temperature and ended by photoperiod. Anolis males appear to be photosensitive only about four months during the year, from July through October (Licht, 1971; 1972b). Licht (1971; 1972b) postulates that once the photoperiod falls below a certain "critical day length" of 13.5 hours, the testes begin the regressive phase. The end of the photosensitive phase occurs when the day length falls

below 12 hours (Licht, 1971).

The annual ovarian cycle of female Anolis has many similarities to the annual testicular cycle. Emergence of the anoles from the dark hibernaculum in late winter seems to be regulated by temperature or an endogenous mechanism (Licht, 1972b). Schaefer (1972) found that a 14 hour photoperiod stimulated the production of ovarian follicles (pregametic phase) in the laboratory. He found a similar response in field collected animals in late January and February which were experiencing an increasing photoperiod and low, unpredictable temperatures. The process of vitellogenesis was found to begin in response to temperature and was independent of photoperiod (Schaefer, 1972). Temperature seems to be the only environmental cue needed for testicular recrudescence, but photoperiod and temperature seem necessary for completion of ovarian recrudescence. Photoperiod is the environmental cue that triggers testicular regression, but according to Licht (1972b; 1973) ovarian regression is "spontaneous", "endogenous" and "relatively independent of photothermal conditions".

The present study measured several anatomical parameters to determine the effects of photoperiod on the regressive phase of the ovarian cycle. The body weight was found to decrease for four weeks followed by an increase in the sixth week for both regimens. The weight increase was expected for Regimen II as the study of field collected anoles found that maximum weight was achieved in late summer and early fall (Dessauer, 1955; Fox and Dessauer, 1957). The increase was not expected for Regimen I and the reason for it may have been increased food consumption which was observed for both regimens. Food consumption by anoles has been found to be seasonal and photoperiod may have an effect. Fox and Dessauer (1957) found that maximum food consumption occurred during July when photoperiod is maximal. The anoles used in the present study arrived in August, thus they had experienced their natural period of maximal feeding and their appetites would be in a natural decline.

Liver weights of Anolis are greatest in the fall when the glycogen and lipid content is the greatest (Dessauer, 1953; 1955). Dessauer (1955) found that the

lipid content in the livers of anoles in the spring rarely exceeded 5% of the dry liver weight while in the fall it was rarely less than 20% of the dry liver weight. Anoles in the present study had a dramatic increase in liver weight from week four to week six in both regimens. The increase was expected for Regimen II as the liver shifted from vitellogenesis to lipogenesis. The increase for Regimen I was not expected and the reason for it is unknown. It is possible that increased food consumption, as mentioned previously, was responsible for the increases in liver weight in both regimens.

Ovaries and oviducts of anoles are minimal in size throughout autumn and winter (Dessauer,1955). As described previously, during the gametic phase of the cycle the ovaries and oviducts increase in size and remain hypertrophied until cessation of reproductive activity in late summer. The ovaries and oviducts are minimal in size by mid-September (Dessauer, 1955). During the six weeks of the present study there was a decrease in ovary and oviduct weights for both regimens. In summary, the decreases in ovary and oviduct weights coupled with

increases in body weight and liver weight could indicate that regression was occurring in both regimens.

Licht (1973) made similar observations when he exposed a group of A. carolinensis to constant 14L and another group to constant 10L. He concluded from his data that both groups went into "spontaneous regression". To determine the reproductive condition of the ovaries he used abdominal palpation for follicles over 3.0mm or oviducal eggs. Evidence from the present study on body, liver, ovary and oviduct weight changes coupled with abdominal palpation would surely lead one to conclude that both regimens were in the regressive phase of the cycle. Microscopic examination of the ovaries; however, leads to the conclusion that anoles exposed to constant 14L were not undergoing ovarian regression.

Anoles kept at a constant 14L maintained their production of previtellogenic follicles during the experiment. Anoles subjected to a decreasing photoperiod showed a significant decrease in previtellogenic follicle production. By the sixth week the anoles in Regimen II were producing significantly fewer previtellogenic follicles

than were anoles in Regimen I. Also anoles in Regimen I maintained the diameter of the largest previtellogenic follicle while there was a significant decrease for Regimen II. At the fourth and sixth weeks of the experiment the diameters were significantly lower in Regimen II than in Regimen I. Thus, anoles at a constant 14L maintained previtellogenic follicle production and size while anoles in a decreasing photoperiod had a decrease in production and size of the previtellogenic follicles. Schaefer (1972) found that increasing photoperiod in the late winter and early spring caused an increase in previtellogenic follicle production. Therefore it seems reasonable to conclude that decreasing photoperiod would inhibit previtellogenic follicle production as was seen in the present study.

The percentage of anoles with yolked follicles decreased in both regimens. The number of yolked follicles as well as the diameter of the largest yolked follicle decreased for both regimens with the decreases being significant for Regimen I. Though the decreases were significant for Regimen I, there were no significant differences between regimens. As anoles in both regi-

mens were experiencing a weight loss for four of the six weeks of the experiment, these decreases in yolked follicle parameters may be a reflection of the nutritional state of the lizards. Since there were no significant differences between regimens, the effect was essentially the same for both regimens. Schaefer (1972) found that vitellogenesis is a temperature dependent process and he found that vitellogenesis would continue even during the regressive period at high temperatures (32C). Since the temperature changes were constant during the present experiment with daily high temperatures high enough to stimulate yolking, the nutritional condition of the anoles could have caused the decreases.

Examination of the data shows that the number and diameter of yolked follicles was lower in Regimen I than in Regimen II. If the nutritional state of the anoles was not sufficient to maintain yolking, then potentially yolked follicles would become atretic. The diameter would be smaller because the production of previtellogenic follicles was maintained so there would be more follicles competing for a lower amount of vitellin.

The production of atretic follicles for both regimens was almost identical. For Regimen I the lower vitellin production due to nutrition would cause an increase in atretic follicles because previtellogenic follicles that do not accumulate yolk would become atretic. Also yolking follicles that could not accumulate more yolk would become atretic. For Regimen II the decrease in gonadotropins would cause an increase in atretic follicles from non-yolking previtellogenic follicles.

Anolis carolinensis can detect light through the parietal eye (pineal eye) (Clausen and Poris, 1937; Miller and Wolbarsht, 1962; Eakin, 1970; Callard, et al., 1972a; Stebbins and Cohen, 1973) as well as the lateral eyes. The parietal eye has been demonstrated as a functional organ in regulating circadian locomotor rhythms in Sceloporus occidentalis (Stebbins, 1960; Eakin, 1970), Sceloporus olivaceus and Sceloporus magister (Underwood, 1973). Regardless of the method of light detection, the stimulus is passed to the hypothalamus and possibly to the pineal. The secretions of these organs affect the gonads. The parietal eye and the pineal gland are sep-

arate organs but have common embryonic origins, arising from closely related evaginations of the roof of the diencephalon (Eakin, 1970; Callard, et al., 1972a). It is believed that detection of light by the parietal eye directly affects the activity of the pineal gland. This contention is supported by the fact that parietalectomy and pinealectomy have similar effects in promoting ovarian recrudescence in Sceloporus occidentalis (Stebbins, 1970; Stebbins and Cohen, 1973).

Melatonin has not been demonstrated in Anolis; however, enzymes responsible for the synthesis of pineal indoles have been detected in several other reptiles (Callard, et al., 1972a). Pineal impairment of Anolis carolinensis females resulted in significant ovarian development (Levey, 1973). Levey (1973) also demonstrated that melatonin treatment (10ug) brought about a significant reduction in ovarian activity. Thus, melatonin exhibits an antigonadal effect in Anolis females. Melatonin release is increased as photoperiod decreases in many vertebrates (Fraschini and Martini, 1970; Turner and Bagnara, 1971), but has not been demonstrated in Anolis.

In contrast to Licht (1972a) who states that the regressive phase of the ovarian cycle is independent of photothermal conditions, the present research indicates that decreasing photoperiod had an inhibitory effect on the ovaries. Thus the following sequence of events may occur. The decreasing photoperiod may be detected by the parietal eye or the pineal itself and results in increasing levels of pineal secretions. The pineal secretions may act on the hypothalamus to reduce the release of pituitary gonadotropins or light detection by the parietal and/or the lateral eyes may directly affect the hypothalamus to reduce gonadotropin release, which would bring about regression. Pineal secretions may also act directly on the ovaries to inhibit ovarian activity. The decreasing levels of gonadotropins would decrease previtellogenic follicle development and thereby decrease estrogen production. The decrease in estrogen levels would reduce vitellogenesis by the liver. The decreasing levels of gonadotropins would also lead to the observed increase in atresia in Regimen II. It is believed that the corpora atretica play a role in re-

gression by secreting a substance(s) which would inhibit steroidogenesis and vitellogenesis or prevent the uptake of vitellin by the follicles or even prevent the uptake of gonadotropins by the follicles (Licht and Crews, 1974).

Studies on Sceloporus cyanogenys have demonstrated that progesterone exhibits an antigonadal effect (Callard, et al., 1972a; 1972b; 1972c). The evidence suggests that progesterone inhibits vitellogenesis by decreasing the availability of yolk protein by either acting on the hypothalamus to inhibit gonadotropin release or it may in some way prevent ovarian uptake of yolk proteins (Callard, et al., 1972c) It has been demonstrated in Dipsosaurus dorsalis (Callard and Ziegler, 1970) and Sceloporus cyanogenys (Callard, et al., 1972b) that prolactin is antigonadal. Prolactin was found to have no effect on the testicular cycle in male Anolis carolinensis (Licht and Jones, 1967). Prolactin has been found to increase lipid stores in birds which may be the reason for its antigonadal action (Callard, et al., 1972a). Growth hormone acts synergistically with other pituitary

hormones to increase estrogen synthesis and vitellogenesis (Callard, et al., 1972a). The levels and effects of these three hormones on the ovarian cycle needs to be studied in Anolis.

In conclusion, the evidence presented in the present study does not support the hypothesis that the regressive phase of the ovarian cycle of Anolis is "spontaneous", "endogenous" or "independent of photothermal effects". Decreasing photoperiod decreases previtellogenic follicle production which would lead to regression. As previtellogenic follicle production is lower, vitellogenesis is decreased and the energy is shifted to fat production. Constant photoperiod maintained previtellogenic follicle production. Therefore decreasing photoperiod in the laboratory caused ovarian regression in Anolis carolinensis.

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TABLE 1.

Mean weights of the body, liver, combined ovaries and combined oviducts for Anolis carolinensis.

Group*	Date Killed	Body wt. (gm)	Liver wt. (mg)	Liver wt. (%BW)	Ovary wt. (mg)	Ovary wt. (%BW)	Oviduct wt. (mg)	Oviduct wt. (%BW)
IC+	8/6	2.56	116.5	4.01	134.8	5.22	67.0	2.61
14L2+	8/20	1.94	67.2	3.33	49.2	2.50	37.2	1.94
13L-12L	8/20	2.06	81.7	3.93	95.3	4.69	55.5	2.83
14L4+	9/2	1.73	58.7	3.28	85.0	4.92	29.5	1.72
13L-10L+	9/2	1.82	68.8	3.64	51.8	2.78	31.3	1.76
14L6+	9/16	2.29	139.4	5.93	48.3	1.92	39.2	1.83
13L-8L	9/16	2.06	121.2	5.44	72.6	3.71	33.5	1.61

+ Weights of intraoviducal eggs were subtracted from body weights to equalize data with anoles that had no eggs.

*LEGEND. The following designations are used in all tables and figures.

IC- Initial Controls- 14 hours of light for 24 hours

Regimen I

14L2- 14 hours of light for two weeks
14L4- 14 hours of light for four weeks
14L6- 14 hours of light for six weeks

Regimen II

13L-12L- 13 hours followed by 12 hours of light at one week for each photoperiod.
13L-10L- 13, 12, 11 and 10 hours of light at one week for each photoperiod.
13L-8L- 13, 12, 11, 10, 9 and 8 hours of light at one week for each photoperiod.

TABLE 2.

Means of the number of previtellogenic follicles, diameter of the largest previtellogenic follicle, number of yolked follicles, diameter of the largest yolked follicle, the number of atretic follicles and the number of follicle scars for Anolis carolinensis.

Group*	PV	LPF (mm)	YF	LYF (mm)	AF	FS
IC	12.78	1.54	1.44	6.28	0.56	11.56
14L2	13.56	1.43	0.89	4.42	1.33	14.67
13L-12L	14.00	1.42	1.22	5.48	1.22	15.44
14L4	11.00	1.29	1.20	5.73	1.50	17.70
13L-10L	11.30	0.86	0.80	3.54	1.30	13.70
14L6	12.38	1.42	0.38	1.96	2.13	17.75
13L-8L	9.17	0.96	0.83	5.09	2.17	17.83

*See Legend, Table 1.

LEGEND

PV- Previtellogenic Follicles

LPV- Largest Previtellogenic Follicle

YF- Yolked Follicles

LYF- Largest Yolked Follicle

AF- Atretic Follicles

FS- Follicle Scars

TABLE 3.

Analyses of variance for the mean body weights for Anolis carolinensis.

A. Initial Controls and Regimen I

Source	df	ss	ms	F
Between Groups	3	3.75	1.25	10.32*
Within Groups	32	3.88	0.12	
Total	35	7.63		

B. Initial Controls and Regimen II

Source	df	ss	ms	F
Between Groups	3	2.66	0.89	6.22*
Within Groups	30	4.28	0.14	
Total	33	6.94		

C. Regimen I

Source	df	ss	ms	F
Between Groups	2	1.40	0.70	5.83*
Within Groups	24	2.91	0.12	
Total	26	4.31		

D. Regimen II

Source	df	ss	ms	F
Between Groups	2	0.34	0.17	1.13
Within Groups	22	3.35	0.15	
Total	24	3.69		

TABLE 3, cont.

E. 14L2 and 13L-12L

Source	df	ss	ms	F
Between Groups	1	0.06	0.06	0.40
Within Groups	16	2.39	0.15	
Total	17	2.45		

F. 14L4 and 13L-10L

Source	df	ss	ms	F
Between Groups	1	0.04	0.04	0.57
Within Groups	18	1.23	0.07	
Total	19	1.27		

G. 14L6 and 13L-8L

Source	df	ss	ms	F
Between Groups	1	0.18	0.18	0.82
Within Groups	12	2.64	0.22	
Total	13	2.82		

* Significant at 0.05 level of confidence

TABLE 4.

Results of Duncan's new multiple range test of the mean body weights for *Anolis carolinensis*. Means underscored by the same line do not differ significantly at the 0.05 level of confidence.

A. Initial Controls and Regimen I

Group*	14L4	14L2	14L6	IC
Mean	1.73	1.94	2.29	2.56

B. Initial Controls and Regimen II

Group*	13L-10L	13L-12L	13L-8L	IC
Mean	1.82	2.06	2.06	2.56

C. Regimen I

Group*	14L4	14L2	14L6
Mean	1.73	1.94	2.29

*See Legend, Table 1

TABLE 5.

Analyses of variance of the mean liver weights as a percentage of body weights for Anolis carolinensis.

A. Initial Controls and Regimen I

Source	df	ss	ms	F
Between Groups	3	40.39	13.46	10.16*
Within Groups	32	42.42	1.33	
Total	35	82.81		

B. Initial Controls and Regimen II

Source	df	ss	ms	F
Between Groups	3	13.89	4.63	2.58
Within Groups	30	53.92	1.80	
Total	33	67.81		

C. Regimen I

Source	df	ss	ms	F
Between Groups	2	39.00	19.50	12.04*
Within Groups	24	38.98	1.62	
Total	26	77.98		

D. Regimen II

Source	df	ss	ms	F
Between Groups	2	37.74	18.87	8.20*
Within Groups	22	50.50	2.30	
Total	24	88.24		

TABLE 5, cont.

E. 14L2 and 13L-12L

Source	df	ss	ms	F
Between Groups	1	1.60	1.60	1.76
Within Groups	16	14.56	0.91	
Total	17	16.16		

F. 14L4 and 13L-10L

Source	df	ss	ms	F
Between Groups	1	0.91	0.91	2.46
Within Groups	18	6.68	0.37	
Total	19	7.59		

G. 14L6 and 13L-8L

Source	df	ss	ms	F
Between Groups	1	0.83	0.83	0.24
Within Groups	12	41.41	3.45	
Total	13	42.24		

*Significant at 0.05 level of confidence

TABLE 6.

Results of Duncan's new multiple range test for the mean liver weights as a percentage of body weight for Anolis carolinensis. Means underscored by the same line do not differ significantly at the 0.05 level of confidence.

A. Initial Controls and Regimen I

Group*	14L4	14L2	IC	14L6
Mean	3.28	3.33	4.01	5.93

B. Initial Controls and Regimen II

Group*	13L-10L	13L-12L	IC	13L-8L
Mean	3.64	3.93	4.01	5.44

C. Regimen I

Group*	13L-10L	13L-12L	13L-8L
Mean	3.64	3.93	5.44

*See Legend, Table 1.

TABLE 7.

Analyses of variance of the mean combined ovary weights as a percentage of body weight for Anolis carolinensis.

A. Initial Controls and Regimen I

Source	df	ss	ms	F
Between Groups	3	73.86	24.62	3.21*
Within Groups	32	245.05	7.66	
Total	35	318.91		

B. Initial Controls and Regimen II

Source	df	ss	ms	F
Between Groups	3	39.49	13.16	1.24
Within Groups	30	318.14	10.60	
Total	33	357.63		

C. Regimen I

Source	df	ss	ms	F
Between Groups	2	46.94	23.47	2.80
Within Groups	24	201.42	8.39	
Total	26	248.36		

D. Regimen II

Source	df	ss	ms	F
Between Groups	2	17.28	8.64	0.64
Within Groups	22	296.55	13.48	
Total	24	313.83		

TABLE 7, cont.

E. 14L2 and 13L-12L

Source	df	ss	ms	F
Between Groups	1	21.56	21.56	3.11
Within Groups	16	110.85	6.93	
Total	17	132.41		

F. 14L4 and 13L-10L

Source	df	ss	ms	F
Between Groups	1	22.96	22.96	1.30
Within Groups	18	318.24	17.68	
Total	19	341.20		

G. 14L6 and 13L-8L

Source	df	ss	ms	F
Between Groups	1	10.91	10.91	1.91
Within Groups	12	68.65	5.72	
Total	13	79.56		

*Significant 0.05 level of confidence

TABLE 8.

Results of Duncan's new multiple range test for the combined ovary weights as a percentage of body weight for Anolis carolinensis. Means underscored by the same line do not differ significantly at the 0.05 level of confidence.

A. Initial Controls and Regimen I

Group*	14L6	14L2	14L4	IC
Means	1.92	2.50	4.92	5.22

*See Legend, Table 1.

TABLE 9.

Analyses of variance of the combined oviduct weight as a percentage of body weight for *Anolis carolinensis*.

A. Initial Controls and Regimen I

Source	df	ss	ms	F
Between Groups	3	4.39	1.47	3.08*
Within Groups	32	15.22	0.48	
Total	35	19.61		

B. Initial Controls and Regimen II

Source	df	ss	ms	F
Between Groups	3	8.63	2.88	4.72*
Within Groups	30	18.36	0.61	
Total	33	26.99		

C. Regimen I

Source	df	ss	ms	F
Between Groups	2	0.24	0.12	0.29
Within Groups	24	9.82	0.41	
Total	26	10.06		

D. Regimen II

Source	df	ss	ms	F
Between Groups	2	7.07	3.54	6.00*
Within Groups	22	12.98	0.59	
Total	24	20.05		

TABLE 9, cont.

E. 14L2 and 13L-12L

Source	df	ss	ms	F
Between Groups	1	3.60	3.60	4.39*
Within Groups	16	13.04	0.82	
Total	17	16.64		

F. 14L4 and 13L-10L

Source	df	ss	ms	F
Between Groups	1	0.01	0.01	0.11
Within Groups	18	1.53	0.09	
Total	19	1.54		

G. 14L6 and 13L-8L

Source	df	ss	ms	F
Between Groups	1	0.09	0.09	0.13
Within Groups	12	8.24	0.69	
Total	13	8.33		

*Significant 0.05 level of confidence

TABLE 10.

Results of Duncan's new multiple range test for the combined oviduct weights as a percentage of body weight for *Anolis carolinensis*. Means underscored by the same line do not differ significantly at the 0.05 level of confidence.

A. Initial Controls and Regimen I

Group*	14L4	14L6	14L2	IC
Mean	1.72	1.83	1.94	2.61

B. Initial Controls and Regimen II

Group*	13L-8L	13L-10L	IC	13L-12L
Mean	1.61	1.76	2.61	2.83

C. Regimen II

Group*	13L-8L	13L-10L	13L-12L
Mean	1.61	1.76	2.83

*See Legend, Table 1.

TABLE 11.

Analyses of variance for the mean number of previtellogenic follicles for Anolis carolinensis.

A. Initial Controls and Regimen I

Source	df	ss	ms	F
Between Groups	3	32.90	10.97	3.14*
Within Groups	32	111.65	3.49	
Total	35	144.55		

B. Initial Controls and Regimen II

Source	df	ss	ms	F
Between Groups	3	94.48	31.49	10.68*
Within Groups	30	88.49	2.95	
Total	33	182.97		

C. Regimen I

Source	df	ss	ms	F
Between Groups	2	31.09	15.54	4.77*
Within Groups	24	78.10	3.25	
Total	26	109.19		

D. Regimen II

Source	df	ss	ms	F
Between Groups	2	87.63	43.81	17.55*
Within Groups	22	54.93	2.56	
Total	24	131.56		

TABLE 11, cont.

E. 14L2 and 13L-12L

Source	df	ss	ms	F
Between Groups	1	0.89	0.89	0.24
Within Groups	16	58.22	3.64	
Total	17	59.11		

F. 14L4 and 13L-10L

Source	df	ss	ms	F
Between Groups	1	0.45	0.45	0.22
Within Groups	18	36.10	2.01	
Total	19	36.55		

G. 14L6 and 13L-8L

Source	df	ss	ms	F
Between Groups	1	35.29	35.29	10.94*
Within Groups	12	38.71	3.23	
Total	13	74.00		

*Significant 0.05 level of confidence

TABLE 12.

Results of Duncan's new multiple range test for the mean number of previtellogenic follicles for Anolis carolinensis. Means underscored by the same line do not differ significantly at the 0.05 level of confidence.

A. Initial Controls and Regimen I

Group*	14L4	14L6	IC	14L2
Mean	11.00	12.38	12.78	13.56

B. Initial Controls and Regimen II

Group*	13L-8L	13L-10L	IC	13L-12L
Mean	9.17	11.30	12.78	14.00

C. Regimen I

Group*	14L4	14L6	14L2
Mean	11.00	12.38	13.56

D. Regimen II

Group*	13L-8L	13L-10L	13L-12L
Mean	9.17	11.30	14.00

*See Legend, Table 1.

TABLE 13.

Analyses of variance of the mean diameter of the largest previtellogenic follicle for Anolis carolinensis.

A. Initial Controls and Regimen I

Source	df	ss	ms	F
Between Groups	3	0.31	0.10	1.09
Within Groups	32	2.98	0.09	
Total	35	3.29		

B. Initial Controls and Regimen II

Source	df	ss	ms	F
Between Groups	3	3.00	1.00	20.00*
Within Groups	30	1.54	0.05	
Total	33	4.54		

C. Regimen I

Source	df	ss	ms	F
Between Groups	2	0.11	0.06	0.56
Within Groups	24	2.38	0.10	
Total	26	2.49		

D. Regimen II

Source	df	ss	ms	F
Between Groups	2	1.62	0.81	19.04*
Within Groups	22	0.94	0.04	
Total	24	2.56		

TABLE 13, cont.

E. 14L2 and 13L-12L

Source	df	ss	ms	F
Between Groups	1	0.00	0.00	0.00
Within Groups	16	1.21	0.08	
Total	17	1.21		

F. 14L4 and 13L-10L

Source	df	ss	ms	F
Between Groups	1	0.92	0.92	12.51*
Within Groups	18	1.32	0.07	
Total	19	2.24		

G. 14L6 and 13L-8L

Source	df	ss	ms	F
Between Groups	1	0.71	0.71	10.69*
Within Groups	12	0.80	0.07	
Total	13	1.51		

*Significant 0.05 level of confidence

TABLE 14.

Results of Duncan's new multiple range test for the mean diameter of the largest previtellogenic follicle for Anolis carolinensis. Means underscored by the same line do not differ significantly at the 0.05 level of confidence.

A. Initial Controls and Regimen II

Group*	13L-10L	13L-8L	13L-12L	IC
Mean	0.86	0.96	1.42	1.54

B. Regimen II

Group*	13L-10L	13L-8L	13L-12L
Mean	0.86	0.96	1.42

*See Legend, Table 1.

TABLE 15.

Analyses of variance of the mean number of yolked follicles for Anolis carolinensis.

A. Initial Controls and Regimen I

Source	df	ss	ms	F
Between Groups	3	5.41	1.81	8.77*
Within Groups	32	6.59	0.21	
Total	35	12.00		

B. Initial Controls and Regimen II

Source	df	ss	ms	F
Between Groups	3	2.52	0.84	2.47
Within Groups	30	10.21	0.34	
Total	33	12.73		

C. Regimen I

Source	df	ss	ms	F
Between Groups	2	3.04	1.52	8.37*
Within Groups	24	4.36	0.18	
Total	26	7.40		

D. Regimen II

Source	df	ss	ms	F
Between Groups	2	0.97	0.49	3.27
Within Groups	22	7.99	0.36	
Total	24	8.96		

TABLE 15, cont.

E. 14L2 and 13L-12L

Source	df	ss	ms	F
Between Groups	1	0.50	0.50	3.27
Within Groups	16	2.44	0.15	
Total	17	2.94		

F. 14L4 and 13L-10L

Source	df	ss	ms	F
Between Groups	1	0.80	0.80	2.77
Within Groups	18	5.20	0.29	
Total	19	6.00		

G. 14L6 and 13L-8L

Source	df	ss	ms	F
Between Groups	1	0.72	0.72	1.84
Within Groups	12	4.71	0.39	
Total	13	5.43		

*Significant 0.05 level of confidence

TABLE 16.

Results of Duncan's new multiple range test for the mean number of yolked follicles for *Anolis carolinensis*. Means underscored by the same line do not differ significantly at the 0.05 level of confidence.

A. Initial Controls and Regimen I

Group*	14L6	14L2	14L4	IC
Mean	0.38	0.89	1.20	1.44

B. Regimen I

Group*	14L6	14L2	14L4
Mean	0.38	0.89	1.20

*See Legend, Table 1.

TABLE 17.

Analyses of variance of the mean diameter of the largest yolked follicle for Anolis carolinensis.

A. Initial Controls and Regimen I

Source	df	ss	ms	F
Between Groups	3	94.05	31.35	6.98*
Within Groups	32	143.75	4.49	
Total	35	237.80		

B. Initial Controls and Regimen II

Source	df	ss	ms	F
Between Groups	3	37.97	12.66	1.91
Within Groups	30	199.10	6.34	
Total	33	217.07		

C. Regimen I

Source	df	ss	ms	F
Between Groups	2	64.16	32.08	5.74*
Within Groups	24	134.12	5.59	
Total	26	198.28		

D. Regimen II

Source	df	ss	ms	F
Between Groups	2	19.58	9.79	1.14
Within Groups	22	189.47	8.61	
Total	24	209.05		

TABLE 17, cont.

E. 14L2 and 13L-12L

Source	df	ss	ms	F
Between Groups	1	5.04	5.04	1.55
Within Groups	16	51.89	3.24	
Total	17	56.93		

F. 14L4 and 13L-10L

Source	df	ss	ms	F
Between Groups	1	23.89	23.89	3.13
Within Groups	18	137.29	7.63	
Total	19	161.18		

G. 14L6 and 13L-8L

Source	df	ss	ms	F
Between Groups	1	33.77	33.77	3.01
Within Groups	12	134.42	11.20	
Total	13	168.19		

*Significant 0.05 level of confidence

TABLE 18.

Results of Duncan's new multiple range test for the mean diameter of the largest yolked follicle for Anolis carolinensis. Means underscored by the same line do not differ significantly at the 0.05 level of confidence.

A. Initial Controls and Regimen I

Group*	14L6	14L2	14L4	IC
Mean	1.96	4.42	5.73	6.28

B. Regimen I

Group*	14L6	14L2	14L4
Mean	1.96	4.42	5.73

*See Legend, Table 1.

TABLE 19.

Analyses of variance of the mean number of atretic follicles for *Anolis carolinensis*.

A. Initial Controls and Regimen I

Source	df	ss	ms	F
Between Groups	3	10.71	3.57	3.86*
Within Groups	32	29.60	0.93	
Total	35	40.31		

B. Initial Controls and Regimen II

Source	df	ss	ms	F
Between Groups	3	9.41	3.14	5.63*
Within Groups	30	16.71	0.56	
Total	33	26.12		

C. Regimen I

Source	df	ss	ms	F
Between Groups	2	2.92	1.46	1.38
Within Groups	24	25.38	1.06	
Total	26	28.30		

D. Regimen II

Source	df	ss	ms	F
Between Groups	2	0.06	0.06	0.25
Within Groups	22	12.49	0.57	
Total	24	16.24		

TABLE 19, cont.

E. 14L2 and 13L-12L

Source	df	ss	ms	F
Between Groups	1	0.06	0.06	0.25
Within Groups	16	3.56	0.22	
Total	17	3.62		

F. 14L4 and 13L-10L

Source	df	ss	ms	F
Between Groups	1	0.20	0.20	0.16
Within Groups	18	22.60	1.26	
Total	19	22.80		

G. 14L6 and 13L-8L

Source	df	ss	ms	F
Between Groups	1	0.01	0.01	0.01
Within Groups	12	11.71	0.98	
Total	13	11.72		

*Significant 0.05 level of confidence

TABLE 20.

Results of Duncan's new multiple range test for the mean number of atretic follicles for Anolis carolinensis. Means underscored by the same line do not differ significantly at the 0.05 level of confidence.

A. Initial Controls and Regimen I

Group*	IC	14L2	14L4	14L6
Mean	0.56	1.33	1.50	2.13

B. Initial Controls and Regimen II

Group*	IC	13L-12L	13L-10L	13L-8L
Mean	0.56	1.22	1.30	2.17

*See Legend, Table 1.

TABLE 21.

Analyses of variance of the mean number of follicle scars for Anolis carolinensis.

A. Initial Controls and Regimen I

Source	df	ss	ms	F
Between Groups	3	234.93	78.31	6.96*
Within Groups	32	359.82	11.24	
Total	35	594.75		

B. Initial Controls and Regimen II

Source	df	ss	ms	F
Between Groups	3	158.06	52.69	3.75*
Within Groups	30	421.39	14.05	
Total	33	529.75		

C. Regimen I

Source	df	ss	ms	F
Between Groups	2	56.03	28.02	3.01
Within Groups	24	223.60	9.32	
Total	26	279.63		

D. Regimen II

Source	df	ss	ms	F
Between Groups	2	64.28	32.14	2.48
Within Groups	22	285.16	12.96	
Total	24	379.44		

TABLE 21, cont.

E. 14L2 and 13L-12L

Source	df	ss	ms	F
Between Groups	1	2.72	2.72	0.33
Within Groups	16	132.22	8.26	
Total	17	134.94		

F. 14L4 and 13L-10L

Source	df	ss	ms	F
Between Groups	1	80.00	80.00	6.20*
Within Groups	18	232.20	12.90	
Total	19	312.20		

G. 14L6 and 13L-8L

Source	df	ss	ms	F
Between Groups	1	0.02	0.02	0.002
Within Groups	12	144.33	12.30	
Total	13	144.45		

*Significant 0.05 level of confidence

TABLE 22.

Results of Duncan's new multiple range test for the mean number of follicle scars for *Anolis carolinensis*. Means underscored by the same line do not differ significantly at the 0.05 level of confidence.

A. Initial Controls and Regimen I

Group*	IC	14L2	14L4	14L6
Mean	11.56	14.67	17.70	17.75

B. Initial Controls and Regimen II

Group*	IC	13L-10L	13L-12L	13L-8L
Mean	11.56	13.70	15.44	17.83

*See Legend, Table 1.

Figure 1. A comparison of the body weight changes in Anolis carolinensis subjected to a constant or decreasing photoperiod.

Regimen I*: solid circles

Regimen II*: open circles

*See Legend, Table 1.

Legend- The following sampling regimen was used for all parameters examined.

2 weeks-14L2 and 13L-12L were killed
4 weeks-14L4 and 13L-10L were killed
6 weeks-14L6 and 13L-8L were killed

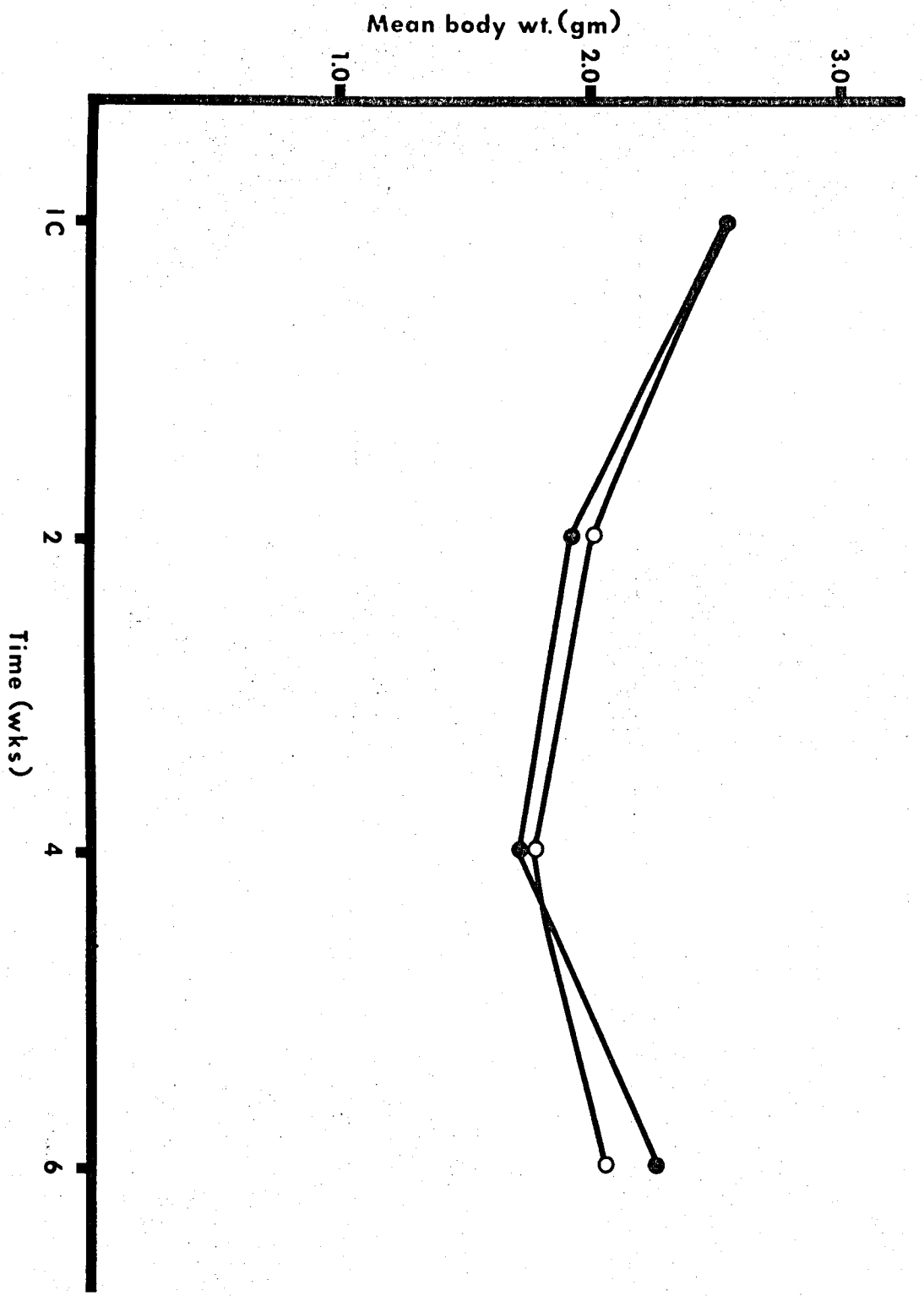

Mean body wt. (gm)
1.0
2.0
3.0
Time (wks)
IC
2
4
6

Figure 3. A comparison of the ovary weight changes (Regimen I*: solid circles, solid line and Regimen II*: open circles, solid line) and oviduct weight changes (Regimen I*: solid squares, broken line and Regimen II*: open squares, broken line) in Anolis carolinensis subjected to a constant or decreasing photoperiod. For sampling regimen see Legend Fig. 1.

*See Legend, Table 1.

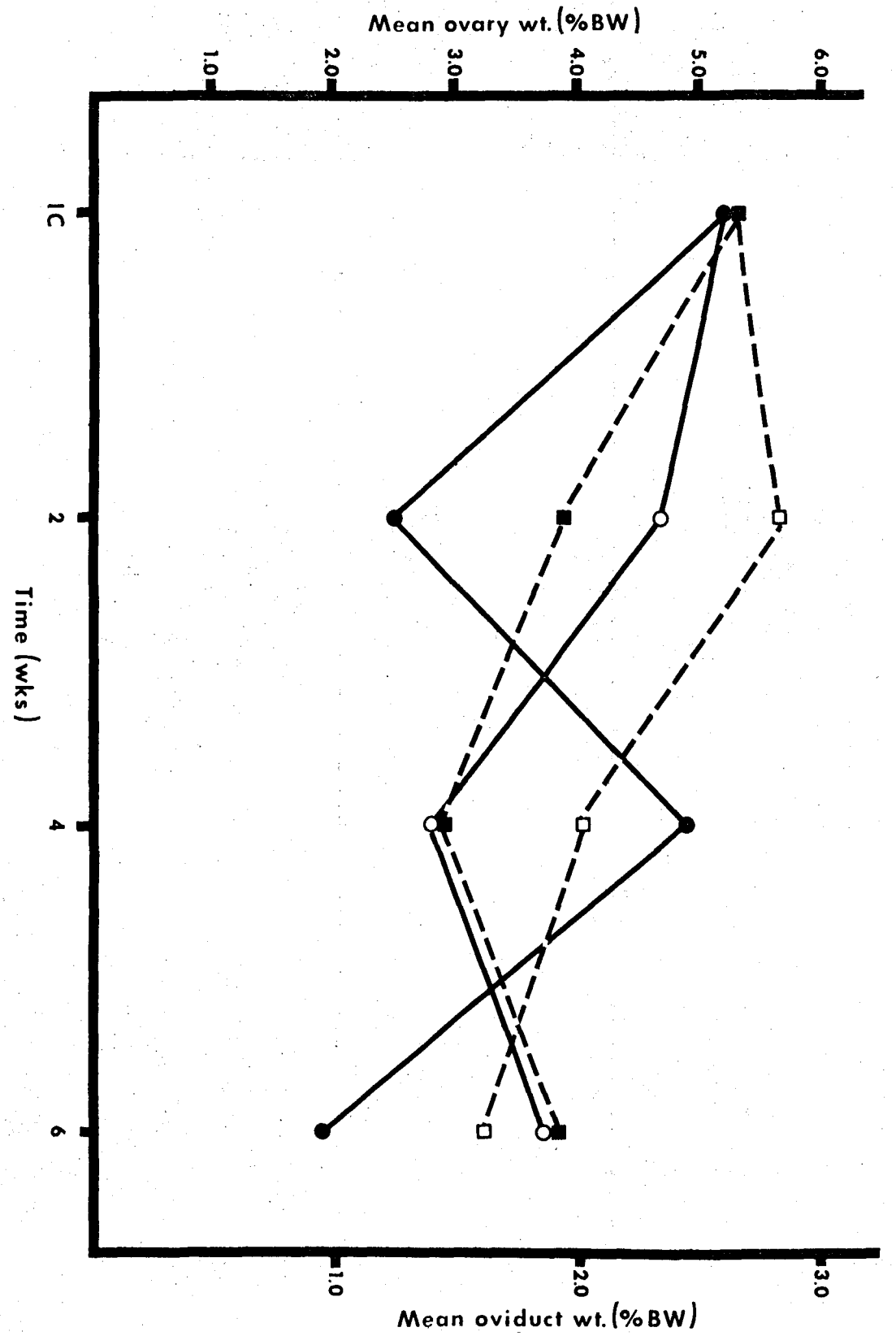

Mean ovary wt. (%BW)
1.0
2.0
3.0
4.0
5.0
6.0
IC
2
4
6
Time (wks)
1.0
2.0
3.0
Mean oviduct wt. (%BW)

Figure 4. A comparison of the number of previtellogenic follicles (Regimen I*: solid circles, solid line and Regimen II*: open circles, solid line) and the diameter of the largest previtellogenic follicle (Regimen I*: solid squares, broken line and Regimen II*: open squares, broken line) in Anolis carolinensis subjected to a constant or decreasing photoperiod. For sampling regimen see Legend, Fig. 1.

*See Legend, Table 1.

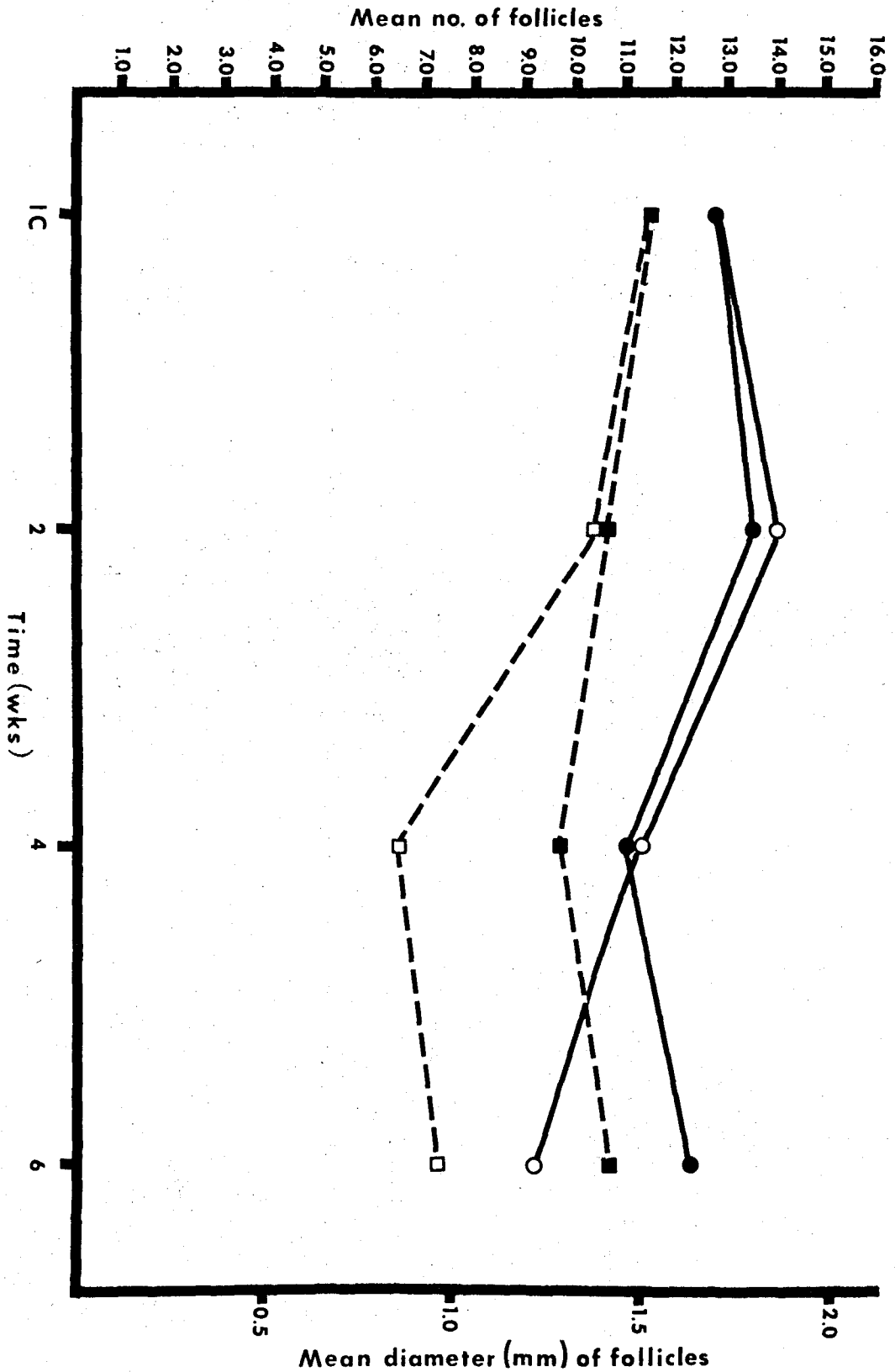

Mean no. of follicles
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
IC
2
4
6
Time (wks)
0.5
1.0
1.5
2.0
Mean diameter (mm) of follicles

Figure 5. A comparison of the percentage of Anolis carolinensis subjected to a constant or decreasing photoperiod that had yolked follicles.

Regimen I*: solid circles

Regimen II*: open circles

For sampling regimen see Legend Fig. 1.

*See Legend, Table 1.

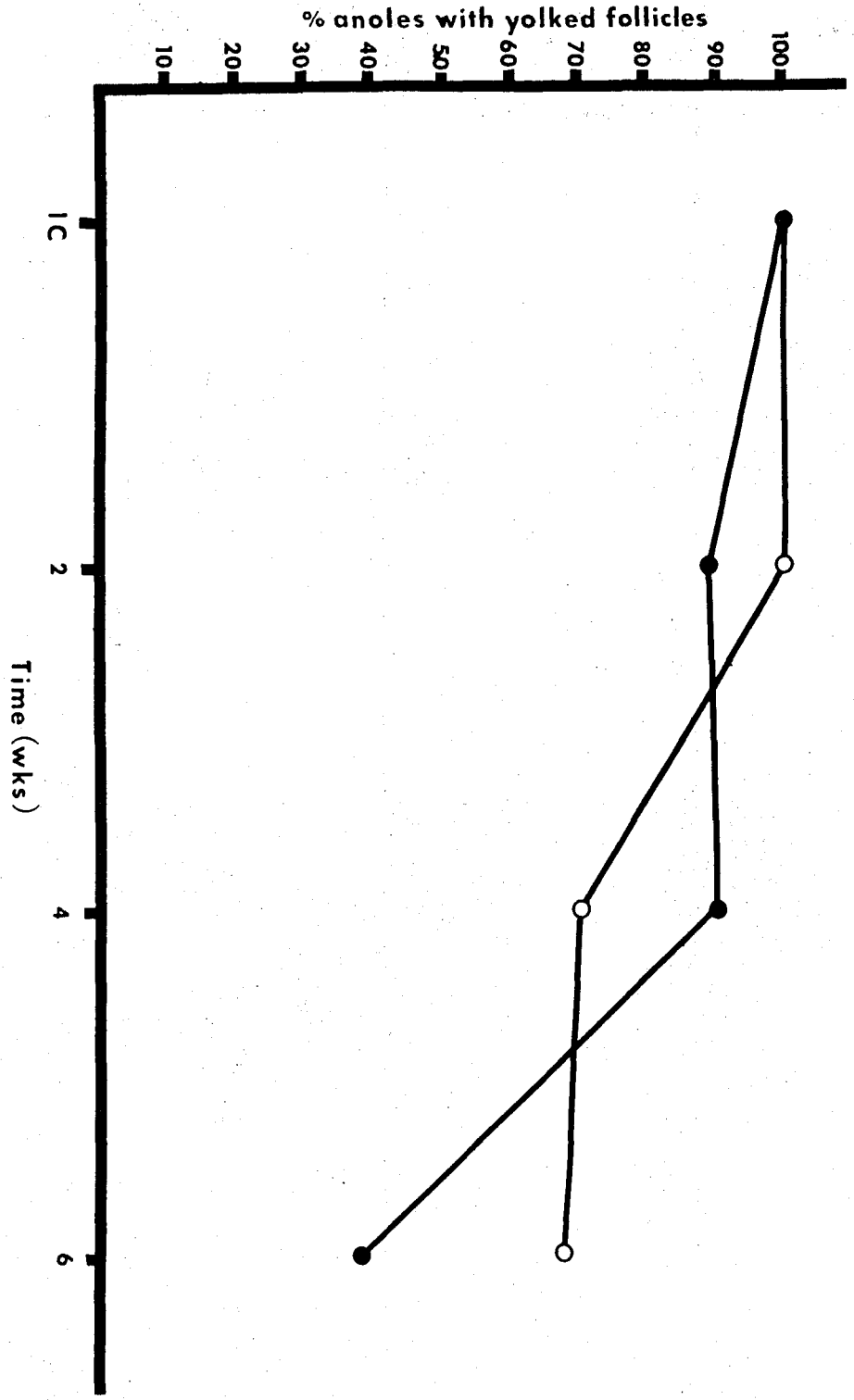

% anoles with yolked follicles
10
20
30
40
50
60
70
80
90
100
Time (wks)
1C
2
4
6

Figure 6. A comparison of the number of yolked follicles (Regimen I*: solid circles, solid line and Regimen II*: open circles, solid line) and the diameter of the largest yolked follicle (Regimen I*: solid squares, broken line and Regimen II*: open squares, broken line) in Anolis carolinensis subjected to a constant or decreasing photoperiod. For sampling regimen see Legend, Fig. 1.

*See Legend, Table 1.

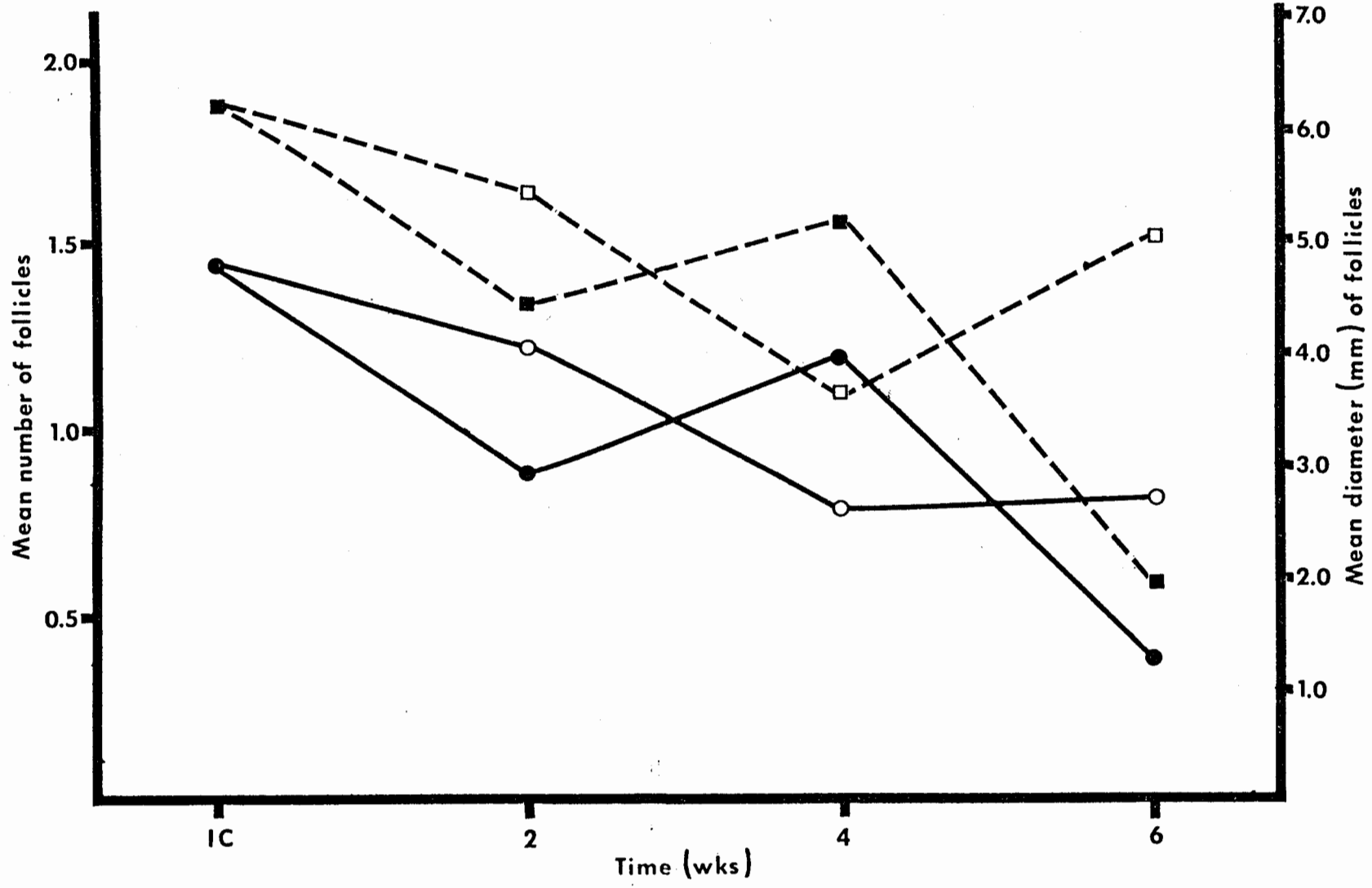
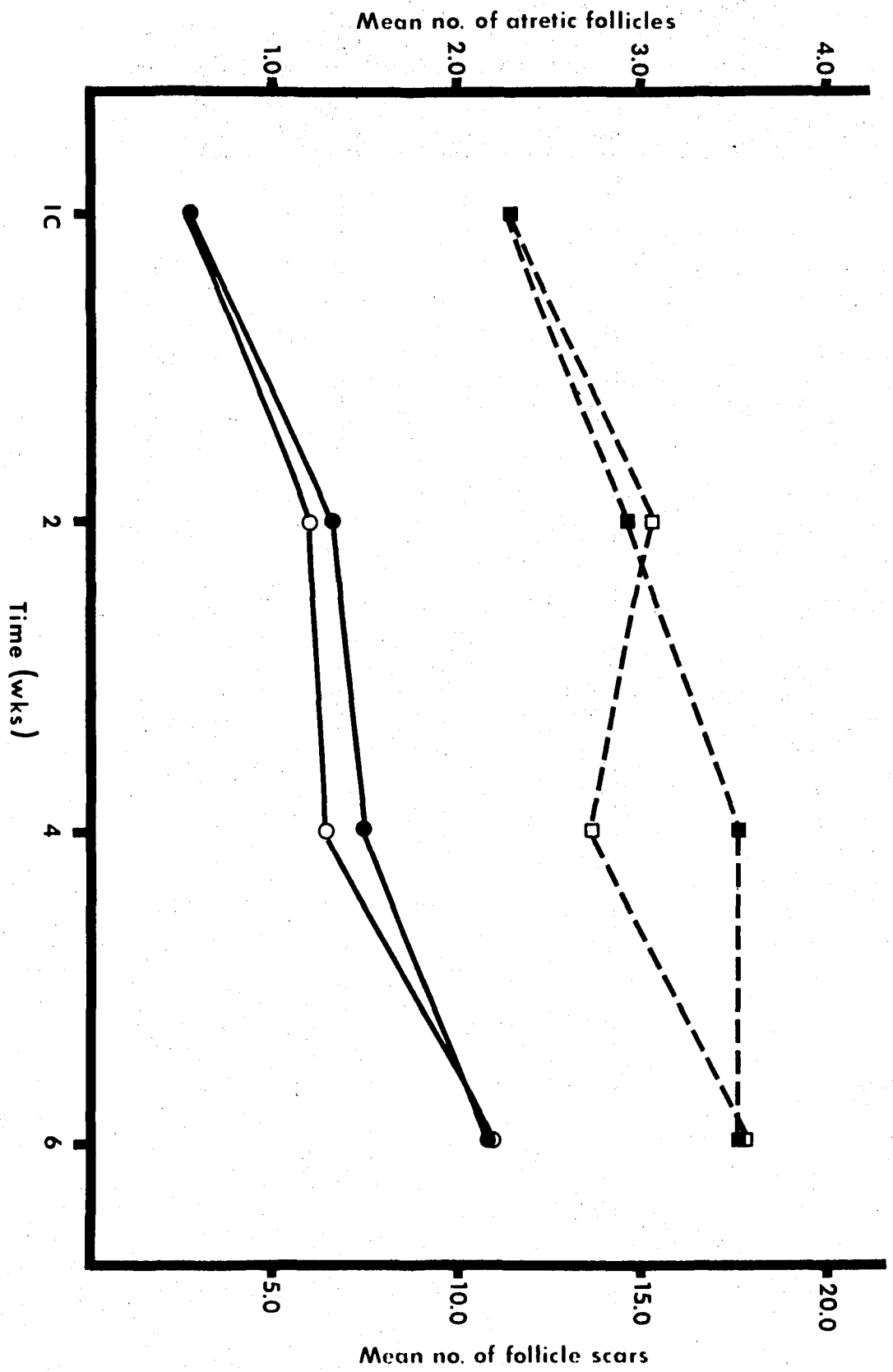

2.0
1.5
1.0
0.5
Mean number of follicles
7.0
6.0
5.0
4.0
3.0
2.0
1.0
Mean diameter (mm) of follicles
IC
2
4
6
Time (wks)

Figure 7. A comparison of the number of atretic follicles (Regimen I*: solid circles, solid line and Regimen II*: open circles, solid line) and follicle scars (Regimen I*: solid squares, broken line and Regimen II*: open squares, broken line) in Anolis carolinensis subjected to a constant or decreasing photoperiod. For sampling regimen see Legend, Fig. 1.

*See Legend, Table 1.


Mean no. of atretic follicles
1.0
2.0
3.0
4.0
IC
2
4
6
Time (wks)
5.0
10.0
15.0
20.0
Mean no. of follicle scars

VITA

John Dickens Pinch was born on October 13, 1948 in Richmond, Virginia. He attended J. R. Tucker High School in Richmond and graduated in 1967. He then attended the University of Richmond receiving his Bachelor of Science Degree in Biology in June, 1971. He served for three years in the United States Army as an Intelligence Agent and was stationed at the Pentagon in Washington, D. C. While in the Army he attended George Washington University for three semesters. Upon discharge from the Army in June, 1974, he began graduate work at the University of Richmond and received his Masters Degree in August, 1976. He was initiated into Beta Beta Beta Honorary Biological Society in October, 1974. He will attend the School of Dentistry of Virginia Commonwealth University upon graduation.