Junior Academy of Science

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Sensory Cues in the Feeding of the Ornate Box Turtle

ALICE V. FITCH

Introduction

Although many observations have been made on the behavior of box turtles, little is known concerning olfaction in these animals. As far as the writer has been able to determine, Allard (1949: 147–148) is the only author who has actually tested olfaction in box turtles, but no definite conclusions were drawn from his experiment. Carr (1952: 17) commented that there are few experimental data to support the oft-repeated assertion that the sense of smell is acute in turtles. Pope (1955:66) stated, "The sense of smell in turtles has not been carefully studied, but apparently it is good at close range. Pet turtles often appear to smell objects before eating or rejecting them."

During August, September, and October, 1964, ornate box turtles (*Terrapene ornata*) were collected for the purpose of testing the relative importance of olfaction and vision in feeding. Each was identified by a number painted with fingernail polish on the carapace. The turtles were measured within two weeks after capture and again on February 7, 1965 (see Table 1). The main experimental group numbered 15, and was a random sample as far as locality of capture, size in weight and length, and sex were concerned. Unfortunately, the larger turtles (numbers 8, 10, 12 through 18) are not well represented in the experimental results because they seldom demonstrated any eating interest. Allard (1948: 311) mentioned the tendency of full grown box turtles to show a greatly reduced interest in food in the autumn as early as September or October. Eating habits varied; many of the turtles were avid eaters, while other individuals habitually or occasionally demonstrated a marked indifference to food. These eating habits are clearly reflected by the weight gain or loss during the winter (see Table 1). Of course, only those that displayed an interest in eating are represented in the experimental results. Many of the experiments were made during the period when these animals normally are hibernating. However, it has been assumed that the results are valid because (1) only those turtles that displayed interest in eating have been included in the experimental results, and (2) the same type of behavior was demonstrated in mid-winter (after the turtles had been warmed) as had been observed in August, September, and October. Neill (1948:114) observed, "With the advent of cool weather, the [Carolina box] turtles began to dig holes, usually in concealed spots . . . should the weather again turn warm, they abandon the excavations and commence foraging again."

The experiments performed also involved many related questions

such as acuity of vision and olfaction, color perception, possible conditioning of turtles, effect of age on feeding habits, and use of tactile sense in testing food. A definite determination of the relative use of various senses in a turtle's feeding is complicated by many variables,

Table 1. Information concerning turtles used in study

No. of individual	Sex	Date of collection	County in which collected	Size soon after capture*		Size on Feb. 7, 1965	
				Weight in grams	Length of carapace in millimeters	Weight in grams	Length of carapace in millimeters
1	?	Aug. 6, 1964	Douglas Co., Kansas	30.8	51	28.8	51
2	?	Aug. 7, 1964	Douglas Co., Kansas	88.7	73	55.8 (dead)	73 (dead)
3	♀ (?)	Aug. 10, 1964	Ellsworth Co., Kansas	112.9	83	134.7	83
4	♀	Aug. 10, 1964	Ellsworth Co., Kansas	124.5	92	127.9	90
5	♀	Aug. 10, 1964	Rice Co., Kansas	189.2	91	204.1	91
6	♂	Aug. 10, 1964	Rice Co., Kansas	238.6	99	234.5	100
7	♀	Aug. 10, 1964	Reno Co., Kansas	246.3	103	270.0	107.5
8	♀	Aug. 19, 1964	Osage Co., Oklahoma	285.2	106	288.5	107
9	?	Aug. 21, 1964	Douglas Co., Kansas	15.5	42 (released)	----------	----------
10	♂	Aug. 21, 1964	Douglas Co., Kansas	374.0	113	299.6	119
11	♂ (?)	Sept. 7, 1964	Douglas Co., Kansas	84.8	75	74.8	76.5
12	♂	Sept. 8, 1964	Douglas Co., Kansas	319.2	115	275.3	117
13	♂	Sept. 8, 1964	Douglas Co., Kansas	408.0	121	335.0	123–124
14	♂	Sept. 9, 1964	Douglas Co., Kansas	284.6	109	267.4	111
15	♂	Sept. 9, 1964	Douglas Co., Kansas	352.7	120 (escaped)	----------	----------
16	?	Sept. 15, 1964	Douglas Co., Kansas	327.0	118 (escaped)	----------	----------
17	♀	Oct. 29, 1964	Douglas Co., Kansas	178.2	90	163.5	90
18	♂	Oct. 29, 1964	Douglas Co., Kansas	----------	(released)	----------	----------
19	♀	Oct. 29, 1964	Douglas Co., Kansas	303.2	118	285.6	116

* These measurements taken within a period not exceeding two weeks after capture.

and this project does not pretend to answer all of the many questions implied by the problem.

Grateful acknowledgments are made to Dr. Henry S. Fitch and Mr. Stanley D. Roth for their helpful advice offered during the course of the project and for their critical reading of the manuscript.

Materials and Methods

The turtles were distributed, according to size, into five cages. It was hoped that this division would limit the spread of disease and discourage fighting. Although it is believed that fights between Carolina box turtles are a rare occurrence in nature (Stickel, 1950:362), individuals of my test group of ornate box turtles were observed biting at one another.

All of the tests were made in one of two similar cardboard boxes, about 15 inches × 18 inches, the floors of which were covered with one to two inches of soil. In each box, two water cans were set diagonally across from one another. The turtles were always tested individually, but because they were often slow, two were generally observed at the same time—one in each box.

During August, September, and October, the test boxes were set outdoors for all experiments. However, as the temperature grew cooler, most turtles evinced less interest in eating, and after November 1, most experiments were done indoors with artificial lighting and heating. Until the early part of January the turtles were kept in a cool laboratory with a minimum temperature of 40°F. at night. Before being tested the turtles were warmed by an infra-red lamp until they became active. Because their vision seemed ineffective in dim light, tests were carried out under a sunlamp or two 100-watt bulbs. Air temperature during the tests was usually no lower than 68°F.

In the early part of January, nine of the smaller turtles were moved indoors because of their decreased interest in food. It was hoped that the higher temperatures would increase their metabolic rates. Within the next few weeks an increase in eating-interest occurred in those turtles that had been good feeders previously.

The turtles were exposed to four major experimental procedures but with many variations. Most individuals accepted avidly both grasshoppers and chicken livers. In the first test series, a group of grasshoppers was caught and killed, and half of them were completely lacquered with clear acrylic spray. Even after the spray was completely dry, a faint lacquer odor could be detected. There was little difference in appearance between the lacquered and unlacquered grasshoppers although the lacquered might have been slightly more shiny. Lacquered and unlacquered grasshoppers were set or dropped simultaneously at approximately equal distances from the turtle but near enough together so that it could see both.

In the next series of tests, grasshoppers were enclosed in a transparent glass jar (4½ inches tall, 1½ in diameter) placed in one corner of the box, and diagonally across from it an empty covered jar of the same dimensions served as a control. In some of these tests live grasshoppers (usually three) were used in the jar, and for the remaining tests dead grasshoppers were used (usually six).

The third series of tests entailed presenting a turtle simultaneously with two burlap packets (two to

three inches long), one containing chicken liver, the other, a stone or red rubber ball. The bundles were wrapped as closely alike as possible and each was bound with the same color of rubber band. In later tests the red rubber ball was substituted for the stone in the control bundle with the idea that the turtles may have been able to see through the burlap and recognize the liver by its color; however, this is unlikely. The bundles were usually set in the test box about three inches apart from each other. The turtle was usually given a small piece of "free" liver before being tested.

In the final series of tests the turtles were presented with fragments of glass, mostly between 1 and 1½ inches long and 1/16 to ⅛ inch thick, colored either with orange or dark red finger nail polish or grayish blue or bright yellow enamel paint. The paint neither dried as quickly nor left as nice a sheen as the fingernail polish. All colors were applied to both sides of the glass.

Glass colored red to resemble liver was used in the majority of tests. The turtle was presented simultaneously with two similar fragments of the red glass, one of which had been dipped in liver juice. These fragments were set about two inches apart at approximately equal distances from the turtle. In many of the earlier tests, in order to prevent conditioning, the glass was removed if the turtle bit it repeatedly. Other tests involved presenting the turtle with two pieces of glass, colored blue orange, or yellow, one unscented and the other scented. Another series of tests involved confronting the test animal simultaneously with unscented glass fragments of several colors.

Many miscellaneous tests were done with the turtles. These were generally not standardized or numerous enough to merit the calculation of percentages but served to provide further indications of behavioral trends for the major tests and to point the way to new experiments. The following are some of the test objects and procedures used in these experiments: two insects, one a green model of pliable plastic measuring about one inch in length, the other a brown model of only slightly pliable plastic, about 1¼ inch in length; small berry-size paraffin balls (maximum diameter, ½ inch) covered with red, blue or yellow poster paint; grasshoppers or other food objects buried immediately under the soil surface of the test box; various colors of plastic modeling clay; grasshoppers wrapped in cellophane; various meats, berries, insects; leaves smeared with liver juice. Another group of experiments involved dragging the test food object in the box containing the turtle, by means of a fine, springy, dark wire or fine thread to test the animal's reactions to the object in motion, as contrasted with his reactions to the same object either motionless or concealed.

Results and Discussion

Experiments with lacquered and unlacquered grasshoppers and related tests. In a total of 49 tests, turtles were presented with lacquered grasshoppers. Figure 1 shows the results in the 31 tests in which the turtle was presented with a definite choice between a lacquered and an unlacquered grasshopper and snapped at one or both. In 67.7 per cent of the 31 tests, turtles bit both the unlacquered and lacquered grasshoppers, in 29 per cent only

the unlacquered were bitten, and in the remaining 3.2 per cent a turtle snapped at only the lacquered grasshopper. There was a lack of consistency in behavior of the test group as a whole and of individual turtles. This trend is reflected in Figure 1 by the number of individuals that bit both the lacquered and unlacquered grasshoppers in one test but only the unlacquered in another. Five of the nine turtles that ate only the unlacquered grasshoppers were offered additional food and four of these refused it, indicating lack of hunger.

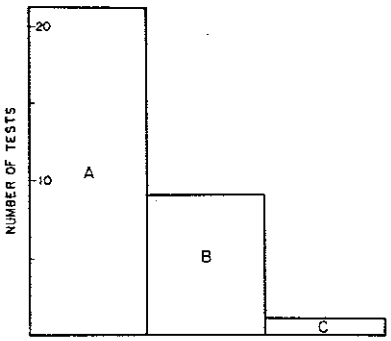

Fig. 1. Behavior of ornate box turtles toward dead lacquered and unlacquered grasshoppers: Column A—bit both lacquered and unlacquered; Column B—bit only unlacquered; Column C—bit only lacquered.

In order to determine whether the turtles formed a habit of biting only the lacquered or both the lacquered and unlacquered grasshoppers, behavior was compared in successive tests (see Table 2). Although in the majority of tests both unlacquered and lacquered were bitten, there seemed to be no specific pattern of behavior demonstrated by the turtles (except No. 3). In seven of the nine instances in which turtles bit only the unlacquered grasshopper, the individual actually touched its nose to the lacquered grasshopper but seemingly rejected the morsel. In the other two cases, one turtle inspected the lacquered grasshopper from a distance of ¼ to ½ inch but did not touch it; the other turtle ignored all further food offers after having bitten the unlacquered grasshopper.

Insects in glass jar and related tests. Legler (1960:619) observed, "Ornate box turtles ordinarily attempt to catch and without further examination, to eat, small objects moving on the ground, but are

Table 2. Behavior of turtles toward lacquered and unlacquered grasshoppers in successive tests.

Turtle number	First test	Second test	Third test	Fourth test	Fifth test	Sixth test	Seventh test
1	both[a]	both	unlac[b]	.....	.....	.....	.....
2	both	both	both	both	both	unlac	both
3	unlac	both	both	both	both	both	both
4	unlac	.....	.....	.....	.....	.....	.....
5	both	both	both	.....	.....	.....	.....
6	both	unlac	both	.....	.....	.....	.....
7	unlac	unlac	both	both	.....	.....	.....
8	lac[c]	.....	.....	.....	.....	.....	.....
11	unlac	.....	.....	.....	.....	.....	.....
17	unlac	.....	.....	.....	.....	.....	.....

[a] Turtle snapped at both lacquered and unlacquered grasshoppers.
[b] Turtle snapped at unlacquered only.
[c] Turtle snapped at lacquered only.

more critical of stationary objects." In my experiments, grasshoppers in a glass jar were used as test objects in a total of 47 tests. There were 20 instances in which turtles actually snapped at the jar, and in no instance was the empty control jar bitten. In the majority of the remaining 27 tests some less readily definable type of interest was demonstrated by the turtle, ranging from a casual passing glance to actual clawing at the jar. The jar was bitten in 11.7 per cent of the 17 tests using dead grasshoppers and in 66.7 per cent of the 30 tests in which live grasshoppers were used. Thus, in these tests based on reactions to visual stimuli, the live and moving food objects were more than five times as attractive as those that were motionless.

These tests indicated that perhaps turtles actually use tactile sense instead of olfactory, or at least a combination of the two. This idea is plausible because close inspection of food by the turtles generally includes prodding with the nose. Allard (1949:148) also observed, ". . . when a turtle is presented food, it almost invariably touches it with the nose before eating it."

Several miscellaneous tests and observations indicated the same trends as shown by the glass jar experiments. Frequently, a turtle was offered a stationary food object which it ignored or inspected but did not bite. However, if the food were moved in front of the turtle by means of a wire or thread, or even with forceps, the turtle could frequently be enticed to pursue and bite the moving object.

In one experiment a grasshopper was wrapped in "Saran Wrap" allowing it enough room to move about. When the grasshopper moved, the turtle bit it through the cellophane. In other tests turtles displayed definite interest in grasshoppers contained in a vial, grasshoppers wrapped in cellophane, and a grasshopper in a gelatin capsule. In none of these cases did the turtle bite the container. Several instances were observed in which a turtle futilely lunged and snapped at a grasshopper crawling on the outside of the turtle's glass-sided cage.

The turtles were tested with two plastic model insects (one brown, one green) dragged about in the test box on the end of a thread. In nearly all cases the turtles scrambled in pursuit and generally sustained their interest sufficiently to inspect and bite the insect after it was allowed to become stationary. Similar behavior was observed by Legler (1960:619). The turtles demonstrated no color preference.

Liver and stones wrapped in burlap and related tests. Liver and stones wrapped in burlap were used in a total of 43 tests. Twenty-two of these are represented in Table 3. The remainder were inconclusive because the turtles ignored both the stone and the liver bundles. Generally, the turtles were each given a piece of "free" liver at the beginning of the tests to ascertain whether they were hungry. In Tables 3 and 4 the entry "sniffed" indicates that the turtle actually placed its nose against the burlap. It was obvious that turtles usually did not at first recognize the burlap bundles as food objects, but in their wanderings about the test box sometimes crawled over or around a bundle and paused to inspect it. In 40.9 per cent of the 22 tests, turtles actually tore at the burlap containing liver (see Table 3), and in only one instance, or 4.5 per

cent, a turtle tore at the burlap containing a stone. In the same test this turtle tore at the liver bundle far more avidly and persistently than it had torn at the stone bundle.

There were a total of 17 instances in which only "sniffing" occurred. In 58.8 per cent of the instances, turtles seemingly sniffed the bundle containing liver, and in 41.2 per cent of the tests the stone bundle was "sniffed." Turtles ignored the liver bundle in 13.6 per cent of the 22 tests and ignored the stone bundle in 63.6 per cent. Turtles might have sufficiently keen olfaction to enable them to smell without actually placing the nostrils against a food object. Nevertheless, several individuals tested with either grasshoppers, or meat, covered with a thin layer of soil never succeeded in finding the food. Allard (1949:147–148) wrote that he had never been able to determine definitely that the box turtle possesses a sense of smell enabling it to detect distant objects.

Table 3. Responses of turtles to liver and stone wrapped in burlap.

No. of individual	Ate meat prior to test	Response to liver in burlap bundle			Response to stone in burlap bundle		
		Ignored	Sniffed	Tore	Ignored	Sniffed	Tore
2	yes	.....	X	X	X	.....	.....
2	yes	.....	X	X	.....	X	.....
2	yes	.....	X	X	X	.....	.....
3	not offered	.....	X	.....	X	.....	.....
3	yes	X	.....	.....	.....	X	.....
4	not offered	.....	X	.....	X	.....	.....
4	No	.....	X	.....	X	.....	.....
5	not offered	.....	X	X	X	.....	.....
5	yes	.....	X	X	.....	X	.....
5	yes	.....	X	X	X	.....	.....
6	not offered	X	.....	.....	.....	X	.....
6	No	.....	X	.....	X	.....	.....
6	No	.....	X	.....	X	.....	.....
7	not offered	.....	X	X	X	.....	.....
7	Yes	.....	X	X	.....	X	X
7	Yes	.....	X	X	X	.....	.....
10	Yes	.....	X	.....	X	.....	.....
11	Yes	.....	X	.....	.....	X	.....
12	No	.....	X	.....	X	.....	.....
13	not offered	X	.....	.....	.....	X	.....
17	Yes	.....	X	.....	.....	X	.....
19	No	.....	X	.....	X	.....	.....

Individual behavior tended to be consistent in those individuals tested more than once with the bundles. Many individuals ignored both bundles every time tested (not represented in Table 3). Some of those that demonstrated only "sniffing" interest completely ignored the bundles other times and never displayed biting. Those that tore at a bundle often exhibited similar behavior during later tests using burlap bundles.

Several of the turtles that ate the "free" liver before being tested with the burlap bundles did not bite at either of the bundles. This behavior probably illustrates a lack of hunger or absence of olfaction. The fact that several turtles ate liver before being tested and then bit the liver bundle tends to negate the idea that liver given before the test decreases olfactory abilities.

During one burlap bundle test, a turtle was observed biting a leaf where a liver bundle had previously been set. Accordingly, four tests were made in which turtles were presented with a leaf smeared with liver juice. One turtle completely ignored the leaf, another sniffed it. The leaf was completely ignored by the two other turtles until the liver scent attracted flies. The turtles then snapped at the flies but continued to ignore the leaf.

Scented and unscented glass and related tests. The need for an experiment designed primarily to test the turtles' use of tactile sense as opposed to olfaction was suggested by the grasshopper-jar experiments (see pages 524 and 527). Therefore, it was reasoned that if turtles bit pieces of glass that smelled like liver but did not have the texture of liver, it would indicate that olfaction played a more important role than tactile sense. There were a total of 52 tests in which the turtle displayed some type of interest either in meat or the glass or both and was presented with only one color of glass (see Table 4). As can be seen in Table 4, the experiments may be divided into two main classes: color of the glass presented to the turtle, and whether turtles were given meat before being tested. The burlap bundle tests suggested that a turtle's olfaction may be dulled for a short time after eating a piece of food. Accordingly, turtles were sometimes given pieces of liver before being tested with the glass.

In a total of 23 tests turtles were offered both scented and unscented red glass. In ten of these tests no meat was offered beforehand. In eight of the ten the scented red glass was bitten, whereas the unscented red glass was bitten in only two. Turtles ate meat prior to the test in a total of ten instances: the red scented glass was bitten in seven and the red unscented in only three of these tests. It should be noted that exactly the same percentage of turtles bit the red unscented after having eaten meat prior to the test. In 71.4 per cent of 14 tests in which the turtle ate meat (not necessarily prior to the test), the scented red was bitten, and in 35.7 per cent the unscented red was bitten. In three instances turtles refused meat prior to the test; in none of these instances was either the scented or unscented glass bitten.

Red seemed to be the most attractive color to the turtles, bearing out Allard's (1948:310) statement: "There is reason to believe that the box turtle reacts rather keenly to the color red, as seen in red meat, red tomatoes, or similarly colored material." On no occasion

was a piece of yellow glass bitten. Only the scented fragments of orange and blue were bitten. In contrast, red fragments, both scented and unscented were bitten. This suggests the possibility that the turtles had been conditioned to liver as the main source of food and inspected other colors far more closely before biting.

In a series of 13 tests the turtle was simultantously confronted with pieces of unscented glass, red, orange, yellow and blue respectively. The red glass was bitten in five of the 13 tests, but was completely ignored in four other tests, and orange, yellow, and blue pieces of glass were not bitten in any of the 13 tests. Blue was ignored in nine of the tests, yellow in eight, and orange in seven.

Table 4. Experiments using scented and unscented pieces of colored glass. Entries marked with asterisks indicate the turtles that bit the unscented glass only after the scented was taken away from them.

Number of turtle	Ate meat prior to test	Color of glass: red, yellow, orange or blue	Bit (B) or sniffed (S) scented glass; no reaction (Neg.)	Bit (B) or sniffed (S) unscented glass; no reaction (Neg.)	Ate meat after test
1	Yes	R	B	B	.....
1	.....	R	B	B	Yes
1	.....	R	B	.....	Yes
1	.....	R	B	S	.....
1	.....	R	B	.....	.....
2	Yes	R	S	S	No
2	.....	R	B	B	.....
3	Yes	R	S	B	Yes
3	Yes	R	B	B	.....
3	.....	R	B	B	Yes*
3	.....	R	B	S	Yes
3	.....	R	.....	B	.....
3	.....	R	.....	B	.....
4	No	R	S	S	.....
4	No	R	S	S	.....
4	.....	R	.....	S	.....
5	Yes	R	.....	S	.....
5	Yes	R	S	S	.....
5	.....	R	B	.....	.....
5	Yes	R	B	Neg.	.....
5	.....	R	B	S	.....
5	.....	R	B	S	.....
5	Yes	R	B	S	.....
5	.....	R	.....	S	.....
5	.....	R	.....	S	Yes
6	.....	R	Neg.	S	.....
7	Yes	R	S	.....	.....
7	Yes	R	B	B	Yes*
7	Yes	R	B	B	Yes*
7	.....	R	B	S	.....
7	Yes	R	B	S	.....
7	.....	R	.....	B	.....
7	.....	R	.....	B	.....
8	.....	R	.....	S	.....
11	.....	R	S	B	Yes
11	No	R	S	Neg.	No
1	.....	Y	S	S	.....
3	.....	Y	Neg.	S	Yes
5	Yes	Y	Neg.	Neg.	.....
7	Yes	Y	Neg.	Neg.	Yes
1	Yes	O	Neg.	Neg.	.....
3	.....	O	B	Neg.	Yes
3	.....	O	B	S	Yes
5	.....	O	B	S	.....
5	Yes	O	S	Neg.	Yes
6	.....	O	Neg.	S	.....
7	Yes	O	B	Neg.	Yes
7	Yes	O	Neg.	Neg.	Yes
1	Yes	B	Neg.	Neg.	.....
3	.....	B	B	S	Yes
5	Yes	B	S	S	.....
7	Yes	B	Neg.	Neg.	Yes

There were three tests in which turtles were presented with red and green modeling clay. One turtle accepted a piece of "free" liver but ignored both red and green clay. Another individual, after eating both "free" liver and liver that had been made green with food coloring, proceeded to place its nose against red clay but ignored the green clay. A third individual ate both "free" and green liver, bit at the red clay, but ignored the green clay. Thus, the green clay was ignored in all three instances, whereas the green liver was bitten both times that it was offered.

The turtles ate the following berries that were offered to them: bittersweet, *Celastrus scandens* (orange); pokeberries, *Phytolacca americana* (purple); and Carolina nightshade, *Solanum carolinensis* (yellow). However, lettuce and grapes were ignored. Yellow, red, and blue paraffin balls were likewise ignored, perhaps because of the dull finish of the poster paint. In general, the turtles seemed to have rather good eyesight. If one began foraging for food, it often could find a grasshopper leg or very small piece of liver, which it immediately ate. There were instances in which it could definitely be concluded that turtles were capable of seeing grasshoppers or small pieces of liver from a distance of approximately 16 inches.

Summary and Conclusions

Observations were made of the behavioral responses of 15 ornate box turtles (*Terrapene ornata*) in order to determine the relative importance of vision and olfaction in feeding. The turtles were tested in four major experiments: lacquered and unlacquered grasshoppers, dead and live grasshoppers in glass jars, burlap bundles containing liver and stones, liver-scented and unscented fragments of various colors of glass.

In 67.7 per cent of the tests with lacquered and unlacquered grasshoppers both were bitten; in 29 percent only the lacquered grasshoppers were bitten, and in 3.2 per cent of the tests, only the lacquered was bitten. These percentages reflect definite ability to discriminate between the lacquered and unlacquered grasshoppers, presumably by olfaction. Those turtles that snapped at only the unlacquered grasshoppers rejected food that was subsequently offered, in four out of five instances. This reflects a lack of appetite that resulted in greater discrimination in food preference than occurred in the hungry turtles. A wide variety of responses was shown, with lack of consistent behavior by the turtles; evidently conditioning during the course of the tests was not a major factor in determining the trend of results.

Turtles tested with sealed jars containing either dead or live grasshoppers demonstrated a far greater interest in the live grasshoppers. Before biting, the turtles gave much less inspection to a live, moving object than to a dead, immobile one. Furthermore, stationary objects that had been ignored soon caught the turtle's attention if pulled around the test box; these objects were generally bitten if the turtle succeeded in overtaking them.

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—*Lawrence High School*
Mr. Stanley D. Roth, Jr.
Sponsorer

Skin Calcification Utilizing Calciphylaxis

JOHN FLEMING

Introduction

Recently, scientific journals have been giving a great deal of attention to a new experimental technique, calciphylaxis (a method of artificially inducing calcification), which could open up new vistas in medicine. Dr. Hans Selye, University of Montreal, Canada, who discovered the phenomenon, has pursued the study of calciphylaxis into many areas, among the calcification of internal organs, nerves, and the cutaneous layers (Selye, 1). This investigator became extremely interested in this specialized field of calciphylaxis (topical-dermal calcification) and decided to experiment with it.

The Problem Under Investigation

Calciphylaxis is basically a condition of induced hypersensitivity of the organism in which the tissues respond to adverse stimuli by calcifying the irritated area (Selye, 2). Calciphylaxis is produced by: a) the administration of a Vitamin D compound, called the sensitizing agent; and b) after a time interval described by all references as "critical," the application of a stimulus known as the challenger. This stimulus can be mechanical (e.g., a hard pinch), but in these experiments either fresh egg white or dried albumen provided the irritation.

The problem in this project was 1) to replicate part of Selye's work on topical-dermal calciphylaxis, and 2) to produce topical-dermal calciphylaxis using variables in the time interval and dosage in order to discover the effects of these variations in the calciphylaxis reaction.

The Significance of the Study

Topical-dermal calciphylaxis has several specific implications in the field of medicine. Its possible applications in the field of dermatology, if the toxicity to the human body of the chemicals involved can be reduced, are interesting: e.g., elimination of scars and tattoos and prevention of aging in the dermal tissues (Selye, 1). Further, it is apparent that cutaneous tissue, like skeletal tissue, can store calcium and other minerals, but only a few animal species do develop carapace calcifications or exoskeletons, among them armadillos and turtles (Selye, 2). Investigations with calciphylaxis could be very valuable in discovering the reason for such occurrences.

Experimental Procedure

Dihydrotachysterol (hereinafter DHT denotes this synthetic Vitamin D compound) was obtained commercially in capsule form, containing 0.125 mg. of DHT per capsule. This was used as the sensitizer.

The challenging agents used were fresh egg white (chicken) and dried egg albumen (chicken).