parently always begins with the male's chin resting on the female's body. Our impression of the function of the stroke is that it serves to test the readiness of the female to mate. Except on the last day of courtship, when the tail-straddling walk was successfully performed, the female invariably fled after each rough stroke.

During the tail-straddling walk the male *Pseudoeurycea belli* often turned to touch the pelvic region of the female. Similar turning was also observed by Organ in *Plethodon glutinosus*, but in this species the male turned to the female's head. No foot movements akin to those in the large *Plethodon* were noted at any time in *Pseudoeurycea*, and undulations of the tail were infrequent.

Three different sequences of behavior were noted in this study, possibly related to different degrees of cooperation by the female. When the female seemed most reluctant to participate the sequence was (a) the male rubbing and striking the female's back while working his way towards her head, (b) mutual head-rubbing, and (c) the male moving out under the female's chin with which contact is maintained, but only to resume the back rubbing. As the female became more responsive, the pattern was identical in (a) and (b), but in (c) the attraction of the female to male's head resulted in her clasping his shoulder and pressing her chin to his head and being half carried forward as the male led her about. When the female appeared to have reached her peak of interest there was a diminishing of both (a) and (b), a slipping of the female's chin from the male's head to the dorsum of his tail root, and following in the typical tail-straddling walk. — STANLEY N. SALTHE AND BARBARA M. SALTHE, *Graduate Department of Biochemistry, Brandeis University, Waltham 54, Massachusetts.*

EFFECTS OF PREY SIZE AND MOVEMENT ON THE FEEDING BEHAVIOR OF THE LIZARDS *ANOLIS CAROLINENSIS* AND *EUMECES FASCIATUS*.— Little is known about the precise role of the various sense modalities in the life of any reptile. In the lizards, especially, most of what is said seems to be extrapolated from anatomical studies (Bellairs 1949, *J. Anat.* 83:116–146; Stebbins 1948, *Am. J. Anat.* 83:183–221) and little experimental behavioral evidence has been advanced. Evans (1959, *Copeia* 1959:109) stated: "Among the autarchoglossids, the vomeronasal and olfactory tracts play a major role in food-getting and social behavior (Abel, 1951:123–4; Bellairs, 1949:140–3), whereas in the Iguania (iguanids and agamids) vision, not olfaction, is of chief importance (Evans, 1938; 1938*a*:487; 1953)." Fitch (1954, *Univ. Kans. Mus. Nat. Hist. Publ.* 8(1):1–156), in uncontrolled observations of captive *Eumeces fasciatus*, noted that "active and hungry" skinks failed to notice moving prey a foot away.

This report describes the results of a study using representative species from each group. They were tested under similar choice situations in an attempt to order the releasing values of size and movement of prey in the consummatory phase of feeding behavior.

Materials and methods.—The subjects used were *Eumeces fasciatus* and *Anolis carolinensis*. The skinks are considered typical autarchoglossids, with a well-developed Jacobsen's organ and nasal structures (Stebbins 1948, *Am. J. Anat.* 83:183–221). In the Carolina anole Bellairs (1949, *J. Anat.* 83:116–146) reported that Jacobsen's organ was smaller and less conspicuous than in most lizards. That these species are ground dwelling and arboreal, respectively, indicates that there may be ecological as well as phylogenetic reasons for differences in the mechanisms for locating food. That both species are of approximately the same small size and eat similar food was also a factor in their selection.

Ten anoles (snout–vent length 6.0–7.0 cm) and 10 skinks (snout–vent length 6.5–8.0 cm) were kept in alternate individual glass tanks 33 × 22 × 21.5 cm covered with clear plastic and wire screening attached to wood frames. The cages for each species contained the following: a 22 × 15.5 × 1.25-cm piece of plywood slid against one wall, a Petri dish for water in the front of the tank next to the plywood, and a thin layer of dried sphagnum moss covering the remaining exposed bottom. The plywood was in the north end (the left side), the tank fronts were facing west, and in the afternoon sunlight came in through the front glass. There was only one difference between the facilities for the 2 species. The

TABLE 1. RESPONSES OF *Anolis carolinensis* AND *Eumeces fasciatus* TO CHOICES OF MEALWORMS.

Test	Choice		Anoles		Skinks	
	A	B	A	B	A	B
1	large moving	large nonmoving	10	0	10	0
2	large moving	small moving	10	0	9	1
3	large nonmoving	small moving	1	9	0	10
4	large nonmoving	small nonmoving	9	1	9	1
5	large nonmoving	small moving	1	9	2	8

skinks' cages had a small piece of bark (13 × 5 cm) placed on the plywood. In the anoles' cages was a green-painted ¼-in. dowel, 41 cm long with 6 plastic leaves attached with wire. It was placed with one end in the bottom left front corner and rose to the upper right rear corner. Cardboard partitions were placed between the tanks to prevent any lizard from seeing his neighbor on either side. The moss was kept wet in all cages and water was sprinkled daily on the plastic leaves. One anole and 1 skink cage had both bark and leaves. Sometimes the animals were fed insects outside of the testing periods and these included mealworms (and pupae), crickets, and cockroaches. Ultraviolet light was provided at intervals.

Testing involved presenting the animal with 2 choices, both of which were in close proximity with each other inside a Petri dish cover. The dish was always placed in the middle of the plywood "shelf." The choice always involved *Tenebrio* larvae differing in some quality, in this case, size and movement were the variables. Mealworms were selected because they maintain the same proportions at different sizes and because their movements are quite slow and restricted. The most successful means of producing nonmoving mealworms was by injecting water into the head. After 5 min the needle and water were removed and the preparations were shaken in litter from the breeding box to eliminate any differential olfactory cues caused by handling.

It is true that olfactory cues were not eliminated with this procedure, but it had the technical advantage of direct reinforcement. Moreover, the physical proximity of the choices would also serve to minimize any *differential* responding to odor.

The experimental series consisted of 5 tests and each animal was only tested once for each situation. The 5 tests were: (1) equal size moving and nonmoving worms, (2) large moving vs. small moving worms, (3) large nonmoving vs. small moving worms, (4) large nonmoving vs. small nonmoving worms, and (5) repeat of test 3.

The length of large worms was 27 ± 2 mm and for small worms was 18 ± 2 mm. Widths were approximately 2.5 and 2.0 mm, respectively.

The cover of the tank was removed briefly while the dish was introduced. Precautions were taken so that the subject was never right next to the dish when it was placed on the wood. The skinks were either under the bark or in the moss while the anoles were at the opposite end of the cage, usually resting on the dowel or leaves. The time lapse between introduction of the dish and the attacking of the first choice was recorded. The subject was allowed to eat the second worm if it so desired. Sometimes the skinks would travel around the outside of the dish chasing and attacking the worm with open mouths through the glass, but not going over the low lip of the dish within the time limit. This behavior was considered as equivalent to actually eating the worm and was so scored. The dish was removed after 15 min if no response was made. If no response was made, the test was repeated at a later date and eventually responses from all subjects were recorded. Several days were allowed to elapse between successful tests; the period of testing averaged 3 weeks.

Results.—Table 1 shows the results of the 5 tests on the skinks and anoles. It is evident from the data that both species responded in the same way, at least they made the same "decisions." At first, only movement by the mealworms would bring the anoles (and to a lesser extent the skinks) to the dish, and the elapsed time averaged about 10 min. During the testing, the response time decreased and soon rarely exceeded 3 min and frequently was much less.

The results of test 1 showed the importance of movement in finding food. The normal worm was free to crawl anywhere in the dish and often the nonmoving worm was between the lizard and the moving worm.

Test 2 showed that a large moving worm was taken over a small moving worm. Was this because of the larger proportions of the large worm or because more movement was connected with the activity of the large worm?

Test 3 pitted a small moving larva with a large nonmoving one. Here the small one was the choice. This shows the greater importance of movement over large size.

By this time it was noted that neither the dish, nor movement, nor even mealworms were needed to attract the animals. This made it possible to eliminate moving worms entirely and test large nonmoving versus small nonmoving worms. Test 4 accomplished this and showed that the larger worm was almost invariably chosen, even if the lizard had to crawl over the smaller to get to it (worms were placed parallel to each other 2 cm apart in the middle of the dish for the anoles and on 5-cm squares of white paper for the skinks).

Test 5, a repeat of test 3, was run the day after test 4 and showed that the animals still preferred the smaller mealworm if it was moving, and thus possible "conditioning" effects were discounted.

The results show that both skinks and anoles prefer prey (at least mealworms, although informal experiments with other insects indicate that the results can be generalized) in the following order, assuming that the prey are in the appropriate size range: large moving, small moving, large nonmoving, small nonmoving. This should enable the experimenter to predict what will happen when he presents either of these species with mixtures of the above types of mealworms. Such tests were tried repeatedly on anoles kept together in a large terrarium under much more natural conditions, and the expected results were obtained. These data are not easily tabulated because each situation varied somewhat in the number and type of worm presented. Therefore, 2 protocols will be given.

17 July 1962: 6 *Anolis carolinensis* and 1 *Anolis sagrei* in large plant-filled terrarium. The mealworms were placed on a large cement block partially buried in dirt at one end of the cage. The worms consisted of 2 large moving, 3 small moving, and 2 small nonmoving. Within 15 min, the 2 large moving and then the 3 small moving worms were taken. After 5 more min, 1 small nonmoving worm was taken.

23 July 1962: Same situation as above. Four large moving, 3 small moving, 4 large nonmoving, and 3 small nonmoving worms were presented. In 10 min, 3 large moving worms were taken and 1 crawled out of sight. Then 2 small moving worms were taken, and by the end of 30 min 3 large nonmoving were taken. None of the small nonmoving worms were touched.

Discussion.—The results indicate that vision plays an important role in both the autarchoglossids and the Iguania and that basically the same mechanisms are at work in reactions to visual stimuli as far as feeding behavior is concerned. No one will deny the great importance of the chemical senses to the autarchoglossids, but whether this can be generalized to all species and all behavioral reactions is doubtful. Fitch (1954, *op. cit.*) mentioned the possibility that the reddish head of male skinks during the mating season releases fighting behavior in other males.

In the work reported here, all the offered prey were within the size range normally eaten by the subjects. It is conceivable that visual supernormal sign stimuli exist with the skinks. Webb (1949, *Copeia* 1949:294) and Fitch (1954, *op. cit.*) both reported *Eumeces fasciatus* attacking prey too large to be swallowed (crickets and spiders, respectively). The writer has raised baby *Eumeces fasciatus*, and they consistently chose the largest food, several even choking to death on mealworm pupae. Their active chasing of baby crickets at this age leaves little doubt about the value of vision.

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