Table 1. Numbers of individuals losing or not losing weight, and mean weight change at specified ages, in two subspecies of *Peromyscus maniculatus.*

Age (days)	Lost weight (N)	Gained weight (N)	Mean weight (g)	Percentage that lost weight
		P. maniculatus bairdii		
15	12	3	−0.4	80
16	8	5	−0.1	62
17	6	7	−0.1	46
18	4	9	0	31
19	5	8	+0.2	38
20	3	9	+0.2	25
21	2	11	+0.4	15
22	1	12	+0.2	8
23	1	6	+0.4	14
24	1	9	+0.6	10
Subtotal	43	79		
		P. maniculatus gracilis		
18	12	1	−0.6	92
19	13	0	−0.7	100
20	9	4	−0.3	69
21	9	4	−0.3	69
22	7	6	−0.2	54
23	4	9	+0.1	31
24	5	9	+0.1	36
25	3	10	+0.1	23
26	3	6	+0.1	33
27	3	7	+0.2	30
Subtotal	68	56		

gracilis ($r = .104$) was not significantly different from zero; also, the slope for total body weight in the foregoing equation for *bairdii* failed to reach significance ($t = .83$). Thus, the total-body-weight component appeared to be of little significance as a means of predicting weight change with isolation. This is demonstrated by a comparison of the multiple correlations (R) given above with the first-order correlations (r) between age and weight change: .564 for *gracilis*, .503 for *bairdii.*

Since the first-order correlations of mean weight change with age reveal as much as the multiple correlations, a linear regression analysis based on these variables was performed. The slopes illustrated in Fig. 1 are significantly different from zero ($t = 7.30$ for *gracilis,* 6.38 for *bairdii*) but are not significantly different from each other ($t = .39$; degree of freedom = 241). Tests of significance were made at the predicted values of 18 days for *bairdii* and 24 days for *gracilis* when the respective regression lines reached zero weight change rather than at the y intercepts, because the intercepts were for different days for the two subspecies. At 18 days of age *gracilis* lost significantly more weight than *bairdii* ($t = 3.599$; degree of freedom = 224). At 24 days of age *bairdii* gained significantly more weight than *gracilis* ($t = 3.970$; degree of freedom = 244). The regression lines suggest that 18 days may be accepted as the age of weaning in *bairdii* and 24 days in *gracilis.*

The amount of food consumed was not included in the multiple regression analysis because some values were discarded as representing tests in which consumption was atypical because the mice urinated on the food pellets. A product-moment correlation obtained from the remaining measures provided a positive correlation between weight change and food consumed in each subspecies (for *bairdii,* $r = +.78$; degree of freedom = 108; for *gracilis,* $r = +.74$; degree of freedom = 110). The behavioral measure of the amount of food consumed proved to be the best indicator of weight change with isolation, the criterion for age of weaning.

Weight change over 24 hours in isolation is an arbitrary criterion for age of weaning. Moreover, the technique of separating the young from the mother introduced many variables which would not occur under normal circumstances. Not only was the mouse deprived of the mother's milk but it was also removed from her warm body, from its littermates, and from the familiar cage when it was placed alone in a strange environment. It is possible that *gracilis* were more disturbed behaviorally by this change in environment than *bairdii* and thus were less able to maintain or gain weight in isolation. A previously reported differential response of the two subspecies to similar early environmental conditions supports the suggestion of a genotypic difference in behavioral responsiveness to isolation (*6*).

Peromyscus maniculatus gracilis is a forest-inhabiting subspecies and develops behaviorally and morphologically at a slower rate than the grassland-inhabiting *P. m. bairdii.* The more rapid development of *bairdii* and its earlier independence in getting food suggest that the grassland community and the forest community impose different selection pressures on the developmental and food-getting characteristics of *Peromyscus maniculatus* (*7*).

JOHN A. KING
Department of Zoology, Michigan State University, East Lansing
JOHN C. DESHAIES
1726 New Hampshire Avenue, NW, Washington, D.C.
RONALD WEBSTER
Louisiana State University, Baton Rouge

References and Notes

1. J. A. King and H. Connon, *Physiol. Zool.* **28**, 233 (1955); P. F. D. Seitz, *Psychosom. Med.* **21**, 353 (1959); R. Ader, R. Tatum, C. C. Beels, *J. Comp. Physiol. Psychol.* **53**, 446 (1960); R. S. Hoffmann, *Ecol. Monographs* **28**, 79 (1958).
2. J. M. Read, *Univ. Calif. (Berkeley) Publ. Zool.* **9**, 341 (1912).
3. J. A. King, *J. Mammol.* **39**, 177 (1958); *Animal Behavior* **9**, 142 (1961).
4. L. R. Dice and P. J. Clark, *Contrib. Lab. Vertebrate Biol. Univ. Mich.* **76** (1962).
5. We acknowledge the statistical advice of P. J. Clark and R. Weisman.
6. J. A. King and B. E. Eleftheriou *J. Comp. Physiol. Psychol.* **52**, 82 (1959).
7. This study was made at the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine, with support from the National Institute of Mental Health (research grants M-123 and M-5643).

19 October 1962

A Stonefly Aquatic in the Adult Stage

Abstract. *An undescribed species of stonefly (Plecoptera) of the genus* Capnia, *taken in Lake Tahoe, California and Nevada, appears to pass its entire life history at depths of nearly 200 to at least 264 feet.*

Among aquatic insects only the Coleoptera, Hemiptera, and Diptera include recorded species which are adapted in both adult and immature stages for living in water (*1*). The adult, and often the pupa, of other aquatic insects are usually terrestrial. Therefore, it is of considerable interest to record the discovery of a species of stonefly (Plecoptera) that evidently passes its entire life history at some depth in Lake Tahoe in the Sierra Nevada of California and Nevada.

This stonefly is an undescribed species in the genus *Capnia.* Both sexes are apterous, and pigmentation is apparently more limited than in other members of the genus. Although they are of rather rare occurrence, wingless, adult stoneflies have been reported for several genera, including two recently described species of *Capnia* from western North America (*2, 3*).

Unlike most aquatic insects, the adults of this species evidently do not respire at, or above, the water surface but acquire oxygen by absorption through the body covering as they crawl among the plants growing on the lake bottom. Certain bugs of the family Naucoridae depend on dissolved oxygen, and certain beetles—for example, some species of the family Dryopidae—capture and utilize bubbles of oxygen produced by submerged aquatic plants during photosynthesis. The actual mechanism by which this stonefly secures and utilizes oxygen is not known. There are no external gills in either nymph or adult.

Specimens were taken during the spring of 1962 in bottom dredge samples at three localities in the lake ranging in depth between 197 and 264 feet (*4*). Most of the specimens, nymphs and adults, were clinging to pieces of *Chara* and aquatic moss.

While the recent discovery of stonefly nymphs in a moist, terrestial habitat in New Zealand and in Argentina is a matter of much interest (*5, 6*), the discovery of this strictly aquatic species is even more noteworthy. The small order Plecoptera shows a remarkable ability to adapt to a very wide range of environmental conditions.

STANLEY G. JEWETT, JR.
7742 SE 27th Avenue,
Portland 2, Oregon

References and Notes

1. H. H. Ross, in *Ward and Whipple's Fresh-Water Biology*, W. T. Edmondson, Ed. (Wiley, New York, ed. 2, 1959), p. 903.
2. S. G. Jewett, Jr., *Pan-Pacific Entomologist* **38**, 15 (1962).
3. A formal description of the species is in preparation. Financial support provided by the National Science Foundation (grant NSF-G 12858).
4. I thank Ted C. Frantz of the Nevada Fish and Game Department and Almo J. Cordone of the California Fish and Game Department for sending material of this species to me for identification.
5. B. Wisely, *Records Canterbury Mus. (New Zealand)* **4**, 219 (1953).
6. J. Illies, *Mitt. Schweiz. Entomol.* **33**, 161 (1960).

13 November 1962

Callosal Section: Its Effect on Performance of a Bimanual Skill

Abstract. *Four out of five monkeys showed no lessening of the ability to perform a motor habit requiring concurrent movement of the two hands in opposite directions when the callosum was cut after training. However, in only one animal was there significant transfer, between the hands, of a shape-discrimination habit learned postoperatively.*

A monkey trained to make visual discriminations through one-half visual field is able to make them also through the other. Similarly, a monkey that has learned tactile discriminations with one hand can perform them also with the second hand. However, such visual and tactile transfer generally does not occur if the corpus callosum is cut prior to the initial training. The relevant findings have been reviewed by Sperry (*1*). Myers (*2, 3*) has shown that the posterior body of the corpus callosum is predominantly involved in both visual and tactile transfer.

It is not yet known with what kind of behavioral function or functions the anterior body, and the genu, of the corpus callosum are concerned. Likewise, the pathways by which the motor systems of the left and right hemisphere are connected in the performance of a bimanual skill are not known. This report describes an experiment undertaken to ascertain whether lessening of the ability to perform a bimanual skill would result from section of the corpus callosum.

Five rhesus monkeys were used. Four of the animals (Nos. 1, 3, 6, and 8) had been used in earlier experiments (*4*); the fifth (No. 10) had had no previous training. These five animals were trained to manipulate simultaneously, with the two hands, the two sliding lids of an electrical device. This was placed upon the horizontal shelf of a modified Wisconsin General Testing Apparatus. The two lids, each fitted with a stout handle, were separated by a space 25 cm wide. Each lid was held immovable initially by a pair of solenoids. When the animal pulled the left-hand lid a distance of 2 mm horizontally toward itself and at the same time pushed the right-hand lid an equal distance horizontally away from itself, one solenoid of each pair was released. The animal could then slide the right-hand lid an additional distance of 5 cm away from itself and so expose a food well. The force required to make the initial 2-mm movement and so unlock the lids was 227 g; that required to hold the right-hand lid pushed open while securing a peanut from the food well was 708 g.

Forty trials were given each day. For each trial, performance was scored as correct when the animal, in its initial handling of the lids, took hold of both handles (in either order) and then made the required movements for unlocking the lids and exposing the food. Performance was scored as incorrect when the animal made any other initial response (for example, took hold of, and manipulated, only one handle; took hold of both handles but made the wrong movements, so that the lids remained locked; took hold of both handles, then released one), irrespective of subsequent movements on that trial. After training, three of the animals (Nos. 3, 6, and 10) were given 4 months' rest, retrained, given a week's rest, and then subjected to callosal section. Animals 1 and 8 were given a week's rest after the initial training, then subjected to callosal section. For all five animals, postoperative retraining was started 10 days after surgery.

Table 1. Effect of section of corpus callosum on a preoperatively learned bimanual skill.

Animal	Trials (*N*)		
	To learn bimanual skill	Pre-operative relearning	Post-operative relearning
1	700		10
3	930	0	0
6	260	110	440*
8	1030		30
10	610	120	50

*Criterion not attained.

The results are shown in Table 1 (*5*). Only animal 6 failed to relearn after surgery in fewer trials than it required before surgery.

Postoperatively, and after the animals had been retrained to perform the bimanual skill, they were trained to discriminate, in the dark, between two objects (cylinder and cube) with one hand, the other hand being restrained by attachment of a weight to the wrist. Standard apparatus and noncorrection procedure were used; correct choice of object was rewarded. Forty trials were given each day. The animals were observed through an infrared inspection device. After each animal had reached a level of performance of 90 correct responses in 100 trials, training was

Table 2. Effect of section of corpus callosum on transfer of tactile shape discrimination, learned postoperatively, between the hands.

Animal	Trials required to learn tactile shape discrimination (*N*)	Hand used for learning	Percentage of correct responses in 40 trials with other hand
1	210	Left	58
3	270	Left	70*
6	210	Right	55
8	210	Right	58
10	610	Right	55

$^*p = .008$ (one-tailed binomial test).