ences, as if they were indifferent to the occurrence of shock. This behavior contrasted sharply with that of animals in the other two groups: every rat easily learned to reverse its choice as the conditions changed.

Since rats are known to have position preferences in many choice situations, a nonreversal control group was added to determine the extent of position preference (fixation) in the present apparatus. Nine rats were given 25 choice sessions corresponding to the 25 reversal days. These rats chose between two equally rewarded levers. They were never exposed to conflict or to shock. Under these conditions, a few rats developed position preferences, but only two rats showed extreme preference; a majority continued to choose both levers. The average fixation for this food-food control group (0.749) was significantly less than the fixation found in the conflict-reversal group (0.907) \( t = 2.81, P < .02 \), and the distributions of scores in these two groups were noticeably different.

Thus, the occurrence of fixed behavior in the conflict-reversal situation is considerably greater than the position preference that would occur without punishment. Further, the extremely fixed behavior must be considered as a direct result of the conflict situation, since other groups reversed normally. Evidence of stereotyped responding was observed in earlier experiments that used the conflict procedure with a single response (9). This latest indication of response fixation is a much more striking instance of strange behavior. Animals choose to endure conflict and punishment when they could easily avoid it by choosing a rewarded alternative, which is always available. This peculiar fixed behavior is not predicted by current reinforcement or conflict theories (10).

EILEEN B. KARSH

Department of Psychology,
Temple University,
Philadelphia, Pennsylvania 19122

References and Notes

Brood Care in Halictid Bees

Knerer (1) found that mature larvae of the social halictine bee, Eulayas malachurus, weighed 60 percent more than provisions bearing eggs. He suggested that this weight gain was due to progressive provisioning by the adult bees, although such behavior apparently was not observed.

We report a similar gain in total weight of cell contents during the larval growth of the solitary halictid Nomia melanderi, the adults of which have no contact with healthy larvae (2). This weight gain is evidently due to the intake of atmospheric water by the provisions. The hygroscopic nature of honey and of the provisions of several species of wild bees is known (3).

Cell contents of N. melanderi changed in total weight with larval development as follows: cell contents, placed in sealed tared vials in the field, after initial weighing were oven-dried at 100°C to a constant weight to determine free water content. Tabulation of results showed:

1) Egg or small larva with provisions: \( N = 48 \); live weight mean \( (\bar{x}) \), 0.1369 [range \( (R) \), 0.0866 to 0.1777] g; dry weight \( \bar{x} \), 0.0829 (R, 0.0606 to 0.0942) g; water content 39.5 percent.

2) Half-grown larva with provisions: \( N = 24 \); live weight \( \bar{x} \), 0.2131 (R, 0.1897 to 0.2548) g; dry weight \( \bar{x} \), 0.0724 (R, 0.0615 to 0.0881) g; water content 66.0 percent.

3) Mature larva before defecating, all provisions consumed: \( N = 40 \); live weight \( \bar{x} \), 0.2342 (R, 0.1883 to 0.2695) g; dry weight \( \bar{x} \), 0.0661 (R, 0.0442 to 0.0743) g; water content 71.8 percent.

Mature larvae of N. melanderi weighed 58.5 percent more than provisions bearing eggs. There was an average gain in live weight of 0.0973 g during larval growth, but there was a mean loss in dry weight of 0.0168 g, perhaps due to respiration.

Although a species of social halictine has been seen touching provisions bearing eggs with its glossa, this possible provisioning behavior occurred rarely and several other social halictines did not do this (4). The large size of the mature larvae of these and other halictine bees relative to the size of the provisions (5) is probably due to the hygroscopic nature of the provisions as in N. melanderi and probably is not due to any significant amount of progressive provisioning.

S. W. T. BATRA
G. E. BOHART

Entomology Research Division, Agricultural Research Service, and Utah Agricultural Experiment Station, Logan 84321

References

9 February 1970

Interaction of Plant Hormones: Abscisic and Gibberellic Acids

Drury has recently proposed that the definition of interaction used by statisticians should be used to describe results of physiological experiments (1) but states it in a restricted form. The statistical definition he quotes confines the term interaction to a numerical value which is the difference between a measurement \( R \) of the response of a system to the action of two factors (A and B) applied together, when compared with the sum of the measurements of responses \( R_A \) and \( R_B \) to the two factors applied separately; the interaction \( I_{AB} \) is defined by the equation:

\[
R = R_A + R_B + I_{AB}
\]

(1)

Defined in this way, interaction has a precise meaning for the statistical analysis of received measurements and has been fully discussed by Lockhart (2). Drury's application of this statistical definition of interaction to physiological phenomena is, however, oversimplified. This is because the statistical operations generally work with the data on the scales in which they are pre-
Brood Care in Halictid Bees
S. W. T. Batra and G. E. Bohart

Science 168 (3933), 875.
DOI: 10.1126/science.168.3933.875