obesity caused by the destruction of both. In accordance with this view is the observation that the excess weight gain over normal after successful unilateral lesions was about half of that observed in successful bilateral lesions. It must be noted that in the mouse, obesity follows bilateral but not unilateral destruction of the ventromedian nucleus (*7*).

References and Notes

1. A. W. Hetherington and S. W. Ranson, *Anat. Record* **78**, 149 (1940) ; J. R. Brobeck, *Physiol. Revs.* **26**, 541 (1946) ; J. Mayer, *ibid.* **33**, 472 (1953).
2. This work was supported in part by grants-in-aid from the National Institute of Arthritis and Metabolism (grant No. A49C2R), National Institutes of Health, U.S. Public Health Service ; Sugar Research Foundation ; Kellogg Co., Battle Creek, Mich. ; J. M. Kaplan Fund, New York ; Nutrition Foundation, New York.
3. W. G. S. Krieg, *Quart. Bull. Northwestern Univ. Med. School* **20**, 199 (1946).
4. ———, *J. Comp. Neurol.* **55**, 19 (1932).
5. J. L. Strominger and J. R. Brobeck, *Yale J. Biol. and Med.* **25**, 383 (1953).
6. B. K. Anand and J. R. Brobeck, *Proc. Soc. Exptl. Biol. Med.* **77**, 323 (1951).
7. J. Mayer, *et al., Am. J. Physiol.,* in press.

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Evidence for Echolocation in the Rat

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We wish to present evidence that rats can guide themselves in a maze by auditory cues—probably the echoes of sounds they produce.

Ten blinded rats were trained on an elevated maze (Fig. 1). On each trial, either path *L* or path *R* was blocked 20 cm from its beginning by a 15- by 15-cm metal barrier *B*. Each path was blocked on half the trials in a random sequence. A response was counted incorrect if an animal placed all four feet on the blocked alley so that its vibrissae could touch the barrier. Upon reaching the goal, the rat was allowed to eat briefly before starting the next trial.

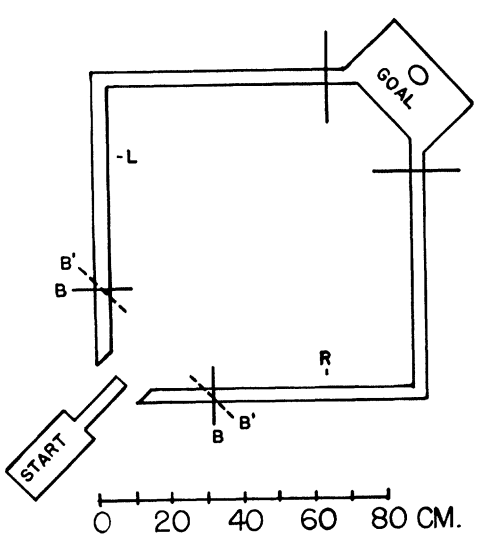

Fig. 1. Floor plan of the elevated maze used in the experiment.

The test situation was designed to prevent solution by nonauditory cues. Olfactory cues were excluded by the constant position of the food, and vibratory-tactile cues were excluded by suspending the barriers independently from the maze. Painting the barriers flat black did not alter the rats' behavior; this test thus excluded reflection of radiant energy as a cue. The orientation of the maze in the room was changed each day in order to vary possible extra-maze cues.

All the rats learned to select the correct path. Seven attained a level of 18 correct out of 20 successive trials. Two critical tests give positive evidence that the effective cue is auditory. (i) The angle of the barriers with respect to the pathways was changed from the usual 90° (*B* in Fig. 1) to 45° (*B'*). The performance of the six animals used in this test dropped to the chance level. Performance returned to normal when the barriers were again set at 90°. Presumably the performance deteriorated because sound was not reflected back to the rat but was reflected out to the side of the apparatus. (ii) Three of the animals were then tested with their ears occluded. Performance again dropped to chance.

Our initial hypothesis was that rats might guide themselves, as bats do, by the echoes of ultrasonic cries, since rats can hear sounds in the ultrasonic range (*1*) and can produce ultrasonic cries (*2*). Accordingly, we monitored their performance with a system consisting of a condenser microphone, amplifiers, and a cathode-ray oscilloscope (*3*). We were able to confirm the production of ultrasonic cries by the rats. However, these cries are given very rarely in the maze, and they do not seem to be related to maze performance.

The rat frequently does produce other sounds in the maze—it may sniff, sneeze, click its teeth, or scratch the floor, and even its footfalls are often audible to a nearby observer. On some trials the rat does not produce any sound that we can hear before making its choice, yet it performs correctly; this may indicate nothing more than our inability to hear all the noises that the rat does. Considering the present evidence, it seems likely that the rat, like the human being (*4*), can use the echoes of the incidental sounds that it produces in order to detect objects in its environment. This possibility should be considered in designing experimental situations in which the rat is to be used.

References and Notes

1. J. Gould and C. T. Morgan, *Science* **94**, 168 (1941).
2. J. W. Anderson, *ibid.* **119**, 808 (1954).
3. The condenser microphone was loaned to us through the courtesy of R. W. Leonard, University of California, Los Angeles.
4. R. S. Woodworth and H. Schlosberg, *Experimental Psychology* (Holt, New York, rev. ed., 1954), p. 359.

4 January 1955.