ming existence. Similar sounds were also heard when two equally matched individuals fought in the ritualized manner of the species. Sounds were not heard when the pair was alone with eggs, larvae, or free-swimming young, or when a group of adults swam about showing no aggression.

The frequency range strongly indicates that the sonic mechanism is of a stridulatory type, with little or no resonance.

Our observations indicate that in cichlid fishes sound production is closely correlated with aggression rather than with a particular period in the life cycle (such as during territory formation, courtship, parental periods, or feeding) as found in certain other species (*8*). Aggression can occur, however, without sound production. Schneider (*9*) found that sounds produced by various species of *Amphiprion* (family Pomacentridae) also are apparently only of an agonistic nature.

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4. We thank Dr. W. M. Schleidt for his help with the spectrography. The spectrograms presented in the text were produced by an apparatus described elsewhere by Dr. Schleidt [*Rohde Schwarz Mitt.* **18**, 155 (1964)].
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Orientation of Ambystoma maculatum: Movements to and from Breeding Ponds

Abstract. *Migrating* Ambystoma maculatum *tend to utilize the same track on entering and leaving breeding ponds. The movements are usually accomplished at night in rain, fog, or cloudy weather when visible celestial cues may not be available. The sensory basis for the orienting ability is unknown.*

In eastern Massachusetts during March and April, the salamander *Ambystoma maculatum* migrates at night from terrestrial retreats to specific ponds for breeding and oviposition. Anderson(*1*) indicates that adult ambystomatids returning to ponds to breed may use the same tracks as they used when they first left the ponds as newly metamorphosed juveniles. My study was designed to determine whether individual adult *A. maculatum* use the same track in leaving the breeding pond as they use during migration to the pond.

As part of a larger investigation of salamander orientation, I devised a method for determining the direction from which the animals arrived at a pond and the direction in which they departed by fencing a breeding pond approximately 15 m in diameter with screenwire. The screenwire was buried from 10 to 15 cm in depth, extended 30 to 35 cm above ground, and was about 1 m from the pond border. Deep tin cans sunk along the inner and outer faces of the fence at 16 compass points (about 3 m apart) served as traps (Fig. 1). Animals moving to and from the pond encountered the fence, moved along it, and fell into the first trap encountered. Trapped animals could not escape.

The pond, which is bordered by trees (Fig. 2), is in an irregularly shaped open field. On the western, northern, and eastern sides of the field are woodlands situated from 35 m to more than 100 m from the pond. There are no obvious topographic features of the area that would influence the migration of salamanders. Some animals move uphill and others downhill to reach the pond.

Animals collected in traps on the outer face of the fence were marked and released on the other side. This process was reversed as the animals moved away from the pond. The traps were checked during March, April, and May 1964, two to three times each night and twice each day. During nights of heavy migration the traps were checked continuously. Although all traps caught animals, the majority were caught in traps located on the western, northern, and eastern borders of the pond. Most of the animals were trapped during rain, fog, or cloudiness. During 1964, 155 animals were encountered; of these, 99 were trapped only as they

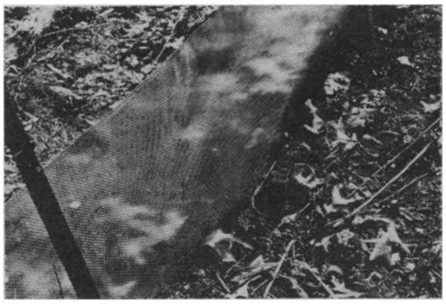

Fig. 1. A view of a trap and the fence around the pond border.

Fig. 2. A view of the breeding pond showing tree border and surrounding open field.

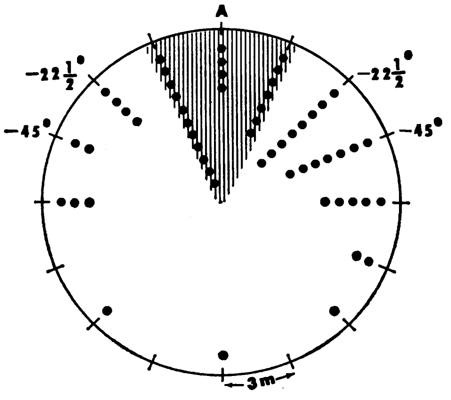

Fig. 3. Pooled data for correlation of arrival and departure directions of 56 salamanders. Point *A* represents the point where the animals were trapped on arrival (not north). The solid circles represent the departing individuals, and the shaded area includes those animals taking consistent departure headings.

entered or left the pond. This indicates that they probably climbed the fence on entering or leaving the enclosure. One of these animals died at the top of the fence when it became entangled. In 1965 a plastic fence has eliminated the climbing problem; all members of the breeding population are trapped at entrance and exit.

In 1965, 14 animals collected by hand as they migrated toward the pond were marked and released at the point of capture. They were from 10 to 44 m from the pond. All these animals were later trapped at the pond border nearest the original site of collection; therefore it is probable that the compass point at the pond border where the animals were trapped represents the direction from which the animals migrated.

An animal captured in the trap outside of the fence at "north" may have encountered the fence anywhere between NNW and NNE. Therefore, an animal leaving the pond might be trapped at any of these three stations should it choose the same track of exit as entrance. Thus, I judged a record "consistent" if a departing animal was trapped at any of these stations. This procedure was used for all compass points.

Fifty-six of the 155 animals were captured on entering and leaving the pond. These salamanders stayed from 4 to 20 days in the pond, and they distributed randomly while in the pond. Twenty-two chose consistent routes of departure; 12 were 22.5° from consistent; 9 were 45° from consistent; and 13 were 67.5° or more degrees from consistent (Fig. 3). The probability that the animals would choose a consistent heading by chance is 3/16 or 10.5 of the 56 animals. The probability that the animals would choose directions ranging from consistent to 45° from consistent is 7/16 or 24.5 of the 56 animals. The differences from the calculated probabilities are significant ($p <$ .01). The animals showed a marked preference in their direction of departure which was correlated with the direction from which they arrived. Results obtained in 1965 suggest that individuals use the same track in subsequent years.

That the migratory movements of ambystomatids involve some sort of orienting mechanism has long been obvious, yet studies of this phenomenon in any species of *Ambystoma* are few. Finneran (*2*) attributed the orientation of *A. maculatum* to breeding ponds to a rheotropic response in overflow brooks formed during heavy rains. Such a response fails to account for movements uphill and downhill, across meadows lacking temporary brooks, or during nights without rains—as I have observed in several species of migrating ambystomatids. Since the salamanders migrate during rain, fog, or cloudiness, they probably do not use visible celestial cues in orienting. Twitty (*1, 3*) indicates that *Taricha* may utilize olfaction in orienting to streams for breeding. The orienting mechanisms of *A. maculatum* are unkown.

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Lateral Hypothalamic Stimulation in Satiated Rats: T-Maze Learning for Food

Abstract. *It is well known that electrical stimulation in portions of the lateral hypothalamic area is positively reinforcing and induces eating in satiated rats. We have found that continuous stimulation of this kind can also motivate satiated and previously untrained rats to learn the location of food in a T-maze. Efficient acquisition and reversal of discriminations for food indicate that lateral hypothalamic stimulation exerts motivational effects which are functionally equivalent to those of food deprivation.*

Hungry rats will learn a large variety of instrumental responses in order to obtain food. Since the discovery that electrical stimulation in the lateral hypothalamic area elicits eating in satiated rats (*1*), interest has been aroused concerning the extent to which the motivational state induced by such stimulation is similar to normal hunger produced by food deprivation. So far, it has been shown in satiated goats, cats, and rats that lateral hypothalamic stimulation induces performance of food-seeking responses previously learned under conditions of food deprivation (*2*).

Since lateral hypothalamic stimulation can induce the performance of learned responses which, under normal conditions, are persistently made only by animals deprived of food, one might expect that such stimulation could also replace food deprivation as a motivational condition for the acquisition of food-seeking responses. However, there are two known factors which might be expected to interfere with such learning: (i) brain stimulation which induces eating is also positively reinforcing (*3*); (ii) positively reinforcing brain stimulation, delivered on a non-contingent basis during training, tends to interfere with learning (*4*).

In spite of these two factors, Coons (*2*) succeeded in training satiated rats receiving continuous lateral hypothalamic stimulation to perform a simple panel-pushing response to obtain food. The evidence for learning was a decrease in the latency of responding as trials progressed. Our purpose in the present experiment was to determine whether satiated rats receiving continuous stimulation in the lateral hypothalamus can learn a more complex, discriminative response for food. Specifically, under these conditions, will rats learn to choose consistently that arm of a T-maze which leads to food?

Six naive rats (five hooded and one albino) were selected from a group of 40 in which electrodes had been implanted in the vicinity of the lateral hypothalamus (Krieg coordinates: 0.8 mm posterior to bregma, 8.2 mm below the superior surface of the skull, and 1.5 mm lateral from the midline). The six rats selected were the only ones in which 60-cy/sec sine-wave stimulation reliably elicited eating in the satiated state (*5*). The animals were maintained individually in cages in which food pellets (Purina Lab Chow) and water were available continuously; at no time were they deprived of food or water.

Each animal was trained in a T-maze, of which the starting arm was gray, the left arm and goal box white, and the right arm and goal box black. On each trial the animal was placed at the beginning of the starting arm and stimulation was initiated. The intensity of stimulation used for each animal was the minimum which would induce eating in the satiated state (45 to 240 μa root mean square). The