

## MODIFICATION OF A TROPISM IN *LUMBRICUS TERRESTRIS*

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The present experiment deals with an attempt to produce modification of response in the night crawler. It is well established that earthworms react negatively to intense illumination and to galvanic shock. An earthworm introduced into a T maze of which one side is lighted and one side darkened might be expected to enter the darker compartment. If, however, the worm received a shock while in the dark and the shock were repeated as the worm progressed further or remained quiescent it might eventually leave the dark. This was found to be the case.

The subjects were large sized *Lumbricus terrestris* (10-12 inches). The maze was a T shaped box, each arm of which was 15 inches long. The bottom was covered with thick blotting paper which

was soaked with water before each trial run. The source of light was a 40 watt frosted bulb with a white reflector. The lamp was suspended 3 inches from the floor. A partition extended down to within three-eighths inches of the floor between the illuminated arm and the darkened arm. The starting arm was open. Each worm was kept in a separate container, was taken out, washed, placed in the starting arm, given a light shock and the time recorded. The shocks were administered by electrodes on the floor.

A worm was shocked further only if it advanced nine inches into the darkened chamber. Trial runs were made at the same time daily. Records were kept of elapsed time, number of shocks, and directions of movement both initially and

throughout the trip. Near the conclusion of the experiments the maze was reversed in an attempt to determine whether there had been learning or merely lateral muscle training.

The earthworms learned to avoid the dark and seek the light. This was indicated by the decrease in time required for the trial, decrease in number of shocks, an increase in the number of initial turns to the light, and finally by the behaviour in the maze. There were 17 worms used in the experiments at the start but some were killed by overshocking, and other accidents, before the trials were finished.

After 15 trips on successive days the average trip time was 2.5 minutes as compared with 5.2 minutes the first day. There are 98 chances out of a hundred that this difference was due to learning. The average number of shocks required to force the worms to the light decreased from 9 to 4 during 15 days. There are 99 chances out of a hundred that this is not fortuitous. On the first day no worm made an initial turn to the light without the compulsion of shock and the percentage of initial turns to the light for the first 6 days was 5.6 while from 15-19 days inclusive the initial turns to light averaged 44.3%.

After the fifth day the worms were more likely to leave the dark upon receiving a shock but as they drew near to the light they turned and re-entered

the dark where another shock was administered. This process was repeated until the worm went under the light. On the seventh day oscillating movements sometimes referred to as "selection by random movement" were noticed. Light and dark were equally repellent.

The individual record of worm No. 10 seems to substantiate the value of our criteria. The first trip required 20 minutes and 15 shocks while the 15th trip required 1 minute and 1 shock. For the first five trips the initial choice was dark and for the following 18 trips the initial choice of dark occurred only 4 times.

To avoid the criticism that the worms learned a direction or followed a slime trail the experimental set was reversed on the 20th day. The record of number 10 after the reversal showed an increased trip time. Trips had been consuming from one-half to one minute but the first day after reversal 3.5 minutes were needed and 8 shocks. On the 21st day the same trip was made in one-half minute and no shock was given. The initial turn to the light was voluntary.

#### CONCLUSIONS

1. Negative phototropism of *Lumbricus* is subject to modification and possible elimination under experimental conditions.

2. This would indicate that tropisms may be partially acquired rather than entirely inherent.