were synthesized[12] and their antistreptococcic and antipneumococcic activities compared to those of sulfanilamide and sulfapyridine: 2,6-diamino-3-p-sulfonamidophenylazopyridine; 2-N^4-acetylsulfanilamido-6-aminopyridine; 2-sulfanilamido-6-aminopyridine; 2-sulfanilamidothiazole; 2-sulfanilamido-4-methylthiazole.

The therapeutic activities of these compounds were determined by inoculating mice with a number of infecting doses just within or slightly beyond the effective range of sulfanilamide and sulfapyridine therapy and maintaining the treatment somewhat below the optimum level. In this manner, differences in drug efficacy are more readily seen than when all animals in two or more treated groups survive.[13] Thus, the values obtained do not indicate the maximum number of survivors which would have been obtained under optimum treatment but rather the relative values of the various drugs over an adequate period of observation.

Tables I, II, and III show sulfapyridine to be somewhat superior to compounds V, VI,‡ and VII,‡ which possess approximately the same degree of therapeutic activity as sulfanilamide, against streptococcic and Type II pneumococcic infection in mice.

Main, Shinn and Mellon[14] have reported that bacteriostasis and the accompanying increased accumulation of hydrogen peroxide per unit of growth were similar in cultures of Type I pneumococcus which contained comparable amounts of sulfanilamide, sulfapyridine, VI or VII.

10924 P

Associative Hysteresis in Larval Amblystoma.

A. R. MOORE AND J. C. WELCH.

From the Department of Psychology, University of Oregon, Eugene.

The object of the study was to determine whether larval amblystoma are able to establish associations with non-essential signals, *i. e.*, are capable of true learning. This necessarily rules out such effects of training as facilitation of primary reflexes. It was found

[12] Fosbinder, R. J., and Walter, L. A., *J. Am. Chem. Soc.*, 1939, **61**, 2032.

[13] Cooper, F. B., Gross, P., and Lewis, M., *J. Chemotherapy*, 1938, **15**, 31.

‡ These drugs, like sulfapyridine, produce renal concrements in rats. A detailed study of these, and other toxicological data will be published shortly.

[14] Main, E. R., Shinn, L. E., and Mellon, R. R., PROC. SOC. EXP. BIOL. AND MED., 1939, **42**, 115.

that the larvae of *Amblystoma paroticum* could form associations between food taking and the movement of an object in the visual field. In response to movement above them, as, passing the hand back and forth, they would rise from the floor to the top of the aquarium. In the dark room, they did not form associations with the turning on of a constant light, but did learn to respond to intermittent flashes, 52 to the minute. They also learned a simple T-maze of which one end was closed, the other open, allowing the animal to slip down into a dish of water. This constituted the reward. Five animals were given in all 537 trials in 9 experimental series. Each animal in at least one series learned to take the "correct" turn. The results of each series were subjected to statistical analysis, which showed that of the 9 experiments, 2 fall within the probability of the results being due to chance alone, the remaining 7 unquestionably show the effects of learning. The third type of reaction studied was the snap reflex. It was attempted to bring about inhibition of this reflex. For this purpose an earthworm was put into a large glass tube and, in a test, the preparation was held in front of the salamander for 5 minutes and the observer counted the number of strikes made during the period. Two tests a day were given. Two larval axolotls were used. On the first day one of them struck 14 times and the other 23. By the fourth day extinction of the reflex was almost complete, one animal striking once, the other not at all. After this inhibition had become established, holes were made in the glass tube to allow sapid substances from the worm to diffuse out. The salamanders now attacked more vigorously and repeatedly than they had done in the initial test, *i. e.*, to visual stimuli alone. It now required 12 days for extinction of the reflex. This shows the olfactory to be more powerful than the visual stimulus in exciting the snap reflex. Complete inhibition of the snap reflex to both types of stimulus can be brought about. It is concluded that three types of simple associations can be established in larval amblystoma.