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Conditioned Motor Responses in Children.

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(Introduced by H. S. Liddell.)

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Pavlov's researches[1] upon the activities of the cerebral hemispheres in the dog have inspired a number of workers to employ his method of the "conditioned reflex" in the study of human behavior. Outstanding among these workers are Krasnogorski and Ivanov-Smolensky. In most of his work with children Krasnogorski uses the motor response of the opening of the mouth to receive a bit of candy, forming associations between this response and various stimuli, *e. g.*, the beat of a metronome.[2] Ivanov-Smolensky uses the motor response of squeezing a rubber bulb which operates a shutter, the shutter allowing a piece of candy to fall into a tray from which the child recovers it.[3]

Using Ivanov-Smolensky's apparatus,[3] we have begun a study of the behavior of children by the method of conditioned responses. We have established in two 6 year old children conditioned motor responses to 3 different stimuli, the beat of a metronome, the sound of an ordinary buzzer and the flash of a small red light. Eight or 10 joint stimulations with the metronome (buzzer or light) and the candy were sufficient to establish a conditioned response. After the joint stimulations, when the metronome (buzzer or light) alone was presented, the child would squeeze the rubber bulb. A much larger number (200-300) of joint stimulations was required to establish a conditioned response to the metronome in a 4 year old child. The development of the conditioned response in the 4 year old was inhibited (Pavlov's "external inhibition") by her responses to various

[1] Pavlov, I. N., *Conditioned Reflexes*, 1927, Oxford University Press.

[2] Krasnogorski, N., *Am. J. Dis. Child.*, 1925, 753.

[3] Ivanov-Smolensky, A. G., *Brain*, 1927, L. 139.

stimuli, objects in the laboratory at which she looked or nearby parts of the apparatus which she handled. No doubt, other factors would explain, in part, her failure to become conditioned sooner.

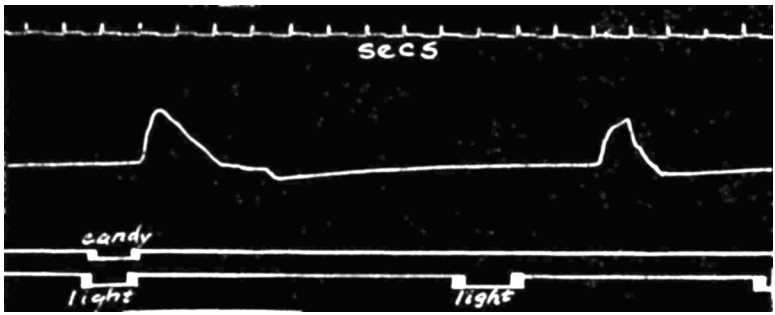

FIG. 1.

In the kymograph record (Fig. 1) the upper line is the time record in seconds, the line next below is the child's response. The third line from the top is the record of the signal lever for the candy stimulus, the fourth line is the record of the signal lever for the light stimulus to which the child is being conditioned. The response at the left of the figure (eighth or tenth joint stimulation) shows the light stimulus ("conditioned stimulus") accompanied ("reinforced") by the stimulus of the candy. The response at the right of the figure ("conditioned response") shows the child's reaction to the light stimulus ("conditioned stimulus") alone after 8 to 10 joint stimulations.

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Destruction of Botulinum Toxin by Bacillus subtilis.

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In previous papers[1, 2] it has been shown that a variety of bacteria have the ability to destroy the toxin produced by *Clostridium botulinum*. This power, though definite, is relatively slight as compared with the ability of certain organisms to destroy the toxin

[1] Sherman, J. M., Stark, C. N., and Stark, Pauline, PROC. SOC. EXP. BIOL. AND MED., 1927, xxiv, 546.

[2] Sherman, J. M., Stark, C. N., and Stark, Pauline, *J. Bact.*, 1928, xv, 35.