MOTTLED ENAMEL OF DECIDUOUS TEETH

MOTTLED enamel,[1] which we now know to be caused by the poisonous action of fluorine which is present in the water supply of the afflicted persons in the concentration of 1 part per million or above, has been considered primarily a defect of the second or permanent set of teeth. In 1916 McKay[2] said, "Mottled enamel in my experience has never been found upon the temporary teeth." Later, in 1932,[3] McKay modified this statement somewhat to say that "the temporary teeth have been found to be affected very rarely and then only the molars and *very slightly*."

The writers have personally examined the teeth of thousands of children in Arizona to determine the incidence of mottled enamel and in 1931[1] stated that "deciduous teeth more rarely show mottling, mottling being chiefly a defect of the permanent teeth, although a few cases on the temporary molars of Indian children have been observed." The explanation given for the almost complete absence of mottled enamel on temporary teeth was that in all probability fluorine in sufficient concentration did not pass through the maternal placenta, and hence the deciduous teeth, which were formed and largely calcified before birth, were spared.

It is the purpose of this note to report the occurrence of severe mottled enamel upon all the deciduous teeth of children in a community recently visited by the authors. The first cases noted were those of two sisters, aged 5 and 7, respectively. The condition of the temporary teeth was too severe to be considered typical of mottled enamel. The teeth did not show chalky white areas characteristic of mottled enamel, because most of the enamel was gone. The premolars were ground off almost down to the gum line. The parents of these girls had repeatedly sought dental advice, but the condition had completely baffled the dental profession. A Wassermann test had shown the absence of venereal infection. Analysis of the private well water supply of this family showed a fluorine content of 12.0 parts per million, as determined by the Foster method of analysis, by means of which 1 part per million has been established as toxic level.[4]

Subsequently, other cases of the same severe type of mottled enamel on the temporary teeth have been observed in the same general district. In each case, analysis of the water supply has revealed an extremely high fluorine content (from 12 to 16 parts per million). The fluorine concentration of the water in this district is higher than any reported heretofore.

In spite of the fact that deciduous teeth are largely calcified before birth and have a relatively short period of both prenatal and postnatal development, it would appear that use of water containing excessively high concentrations of fluorine during the period of their formation produces mottled enamel of an extremely severe type on the temporary teeth.

It is interesting to note also that mottled enamel of the permanent teeth has been observed in persons who had not used this high-fluorine-water for drinking, but had used it for cooking and other household purposes only.

MARGARET CAMMACK SMITH
H. V. SMITH
UNIVERSITY OF ARIZONA
AUGUST, 1934.

[1] M. C. Smith, E. M. Lantz and H. V. Smith, University of Arizona Technical Bulletin, No. 32, 1931.
[2] F. S. McKay and E. V. Black, *Dental Cosmos*, 58: 132, 1916.
[3] F. S. McKay, *Jour. Am. Dent. Assoc.*, 17: 15, 1932.
[4] H. V. Smith. Unpublished data. University of Arizona. *Jour. Ind. and Eng. Chem., Anal. Ed.*, 1935.

THE DISINHIBITION OF EXPERIMENTAL EXTINCTION IN THE WHITE RAT

THE phenomenon of the disinhibition of experimental extinction, described by Pavlov for the salivary reflex, is an important characteristic of behavior because it throws light on the conditions which control behavior. The terms inhibition (as exemplified in experimental extinction) and disinhibition refer primarily to the respective non-appearance and appearance of behavior under certain well-defined conditions. Just what the physiological processes concerned may be is still undetermined. It may well be that the phenomena described by Pavlov are quite different physiologically from the other inhibitory phenomena studied by physiologists. Leaving this question aside, however, it is still important to verify Pavlov's findings with the salivary reflex by experiments on such a laboratory animal as the white rat using overt bodily activity of the locomotor type.

The present note reports two experiments. In the first experiment, 4 normal untrained white rats of about 3 months of age were conditioned to a light. This response was then extinguished by withholding reinforcement; after which a buzzer was sounded at medium intensity at the moment when the light should have been presented. When the light was used one minute later, disinhibition was assumed if the rat now responded to the light. The second experiment was conducted with three other normal untrained white rats. In this case the rats were first conditioned to the sound of the buzzer; the response was then extinguished; and the effect of the light as a disinhibiting stimulus was then tested. The buzzer and the light were the same in the two experiments.

The apparatus used was developed in the Clark Laboratory some two years ago as a modification of

one described by Warner.[1] An essentially similar device has been independently developed and reported by Culler, Finch and Girden.[2] In the present apparatus the rat stands on a grill through which an induction current can be sent. In response to the shock, the rat runs in one direction or another along a narrow pathway. The buzzer used in the conditioning was placed over the center of the apparatus. The light used was furnished by two 100 watt bulbs so hung that the apparatus pathway in which the rat ran was essentially uniformly and brilliantly lighted. Throughout the work there was constantly present a low diffused illumination from a small light placed beneath the milk glass plate on which the apparatus stood. The entire apparatus was placed in a relatively soundproof double box through whose window the rat's behavior was observed. It was arbitrarily decided that the rat's response must equal a run of at least a body length before a response was to be counted. This all-or-none standard, although arbitrary, was based on experience and in actual practise proved satisfactory. A synchronous motor timer made possible the automatic presentation of the buzzer and shock stimuli. The buzzer sounded at one minute intervals. Two seconds after the buzzer, a shock was given the rat if no adequate response to the buzzer had been made. No shock was given if an adequate response was made within 2 seconds to the buzzer. Where the light was used either as a conditioning or as a disinhibiting stimulus, its presentation was timed by the clock, but its switch was manually operated. Otherwise the conditions were the same as they were where the buzzer was used.

The 4 rats who were initially conditioned to the light stimulus required 10, 10, 23 and 27 minutes, respectively, for this conditioning before they reached the stage where they would respond 10 times in succession. They required 72, 43, 66 and 74 minutes, during which the light was presented once a minute without reinforcement, before experimental extinction was established to the point where no response was made for 10 successive presentations of the light. At this point, in place of flashing the light, the buzzer was sounded once. No response was made to the buzzer; but when, one minute later, flashing of the light was again resumed at one-minute intervals without reinforcement, one rat responded 3 times to successive lights, one rat did not respond until the third flash, whereupon 6 successive responses were made, one rat responded on the third and fourth presentations of the light, and one rat failed to respond to the first three presentations. When the new (disinhibited) responses to the light were again extinguished to the point where the rats made no response for 5 successive presentations of the light, the buzzer was again sounded once. All four rats then immediately responded to the light for 2 or 3 presentations before extinction again appeared. The above tests were made at one experimental session per rat. Twenty-four hours later in 3 cases and 72 hours later in one case, the rats were again conditioned to the light, if necessary, to the point where they made 10 successive responses to the light; the response was again extinguished to 10 successive failures to respond; and the buzzer was used for disinhibition. Positive results of the above type were secured for all animals.

The 3 rats who were initially conditioned to run to the sound of the buzzer required 29, 17 and 10 minutes, respectively, before they responded 10 times in succession. They required 66, 58 and 54 minutes for experimental extinction of the response, during which time the buzzer sounded regularly at one-minute intervals, the standard of extinction being 10 successive failures to respond. Three, 9 and 10 days later, respectively, the rats were again conditioned to the buzzer, and again the response was extinguished. In the two series of tests, the light was used 9 times as a disinhibiting agent, used precisely as the sound had been used in the first experiment. In 6 of the 9 cases, the light clearly disinhibited the experimental extinction of the conditioned buzzer response, giving the same type of results as were described above where the buzzer disinhibited the extinguished light response. In the other 3 cases no evidence of disinhibition was present.

WALTER S. HUNTER

CLARK UNIVERSITY

[1] L. H. Warner, *Jour. Genet. Psychol.*, 41: 57–90, 1932.

[2] E. Culler, G. Finch and E. Girden, SCIENCE, 79: 525–526, 1934.

BOOKS RECEIVED

BRUCE, DONALD and F. X. SCHUMACHER. *Forest Mensuration.* Pp. xiv + 360. 97 figures. McGraw-Hill. $3.50.

HASLETT, A. W. *Radio Round the World.* Pp. vii + 196. Illustrated. Cambridge University Press, Macmillan. $1.75.

KAGAN, SOLOMON R. *Jewish Contributions to Medicine in America.* Pp. xxxi + 549. 69 illustrations. Boston Medical Publishing Company.

KNIGHT, CHARLES R. *Before the Dawn of History.* Pp. xiii + 119. Illustrated by the author. McGraw-Hill. $2.50.

MILLIKAN, ROBERT A. *Electrons, Protons, Photons, Neutrons and Cosmic Rays.* Pp. x + 492. 98 figures. University of Chicago Press. $3.50.

MILLS, CLARENCE A. *Living with the Weather.* Pp. 206. Caxton Press, Cincinnati. $1.50.

NEEDHAM, JOSEPH. *A History of Embryology.* Pp. xviii + 274. 40 figures. Cambridge University Press, Macmillan. $4.00.

Report of the Science Advisory Board, July 31, 1933, to September 1, 1934. Pp. 303. National Research Council.