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Changes in reflex thresholds following experimental shock from intestinal manipulation.

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Insensibility and apathy are common clinical observations in traumatic or surgical shock. Meltzer and others have reported similar observations when the shock is produced experimentally by withdrawing the intestines from the abdominal cavity and cooling or manipulating them. I have repeated this procedure with spinal cats and have subjected to quantitative measurement the effects produced on the cord. The cats are made spinal by pithing the brain through the foramen magnum. The flexion reflex is elicited by stimulation of the posterior tibial nerve and recorded by contractions of the tibialis anticus muscle. The Martin system of measuring the break shocks to the nerve is used. In such a preparation, left to itself at normal temperature, the threshold of the flexion reflex remains very constant for long periods of time, changing, if at all, very gradually. Ordinarily the changes between successive readings are fractions of a single unit of measurement. If, now, the intestines be withdrawn from the abdominal cavity and manipulated, in about 50 per cent. of the animals operated on, this threshold rises very promptly—within two or three minutes ordinarily—and within ten minutes it may have reached a value 50 per cent. greater than before manipulation. It commonly remains at this high level during manipulation. Upon cessation of the manipulation the threshold drops, and within ten minutes or less, it may be at its original level and continue at this level, showing as slight variations as before the manipulation. In such cases it may be possible to repeat the procedure on the same animal.

To take a specific case:

EXPERIMENT OF JULY 10, 1917.

3.13	Threshold	15.5	Z units.
4.36	Threshold	14.3	Z units.

(Frequent readings between 3.13 and 4.36. Change between successive readings never equal to a whole unit of stimulation.)

4.37	Intestines withdrawn and manipulated.		
4.38	Threshold	16.8	Z units.
	Threshold gradually rose.		
5.07	Threshold	20.3	Z units.
5.08	Intestines returned.		
5.16	Threshold	14.1	Z units.
6.00	Threshold	14.5	Z units.

The changes in threshold I have found to bear no relation to changes in blood pressure. The threshold may return to its original level with a lower blood pressure than at the time it went up.

The threshold of crossed-extension, obtained by stimulating the same nerve and recording the contractions of the quadriceps group of muscles, has a much more variable threshold than the flexion reflex before manipulation of the intestines, but quite evident changes in this threshold follow manipulation (Exp. of July 24). I have found the reflex in a number of cases to disappear for a few moments or longer as the result of the manipulation. The high threshold produced is less likely to return to its original level than the flexion threshold. The rise in threshold is just as prompt as in the case of flexion. In one case I have found a complete return to the original threshold, but only after an interval of an hour and a quarter after the manipulation of the intestines had ceased.

These results are of interest in connection with the present work on the shock problem. Pike has emphasized recently the probability of some physical injury to the central nervous system in shock. W. T. Porter has done the same in his theory of fat embolism. The injury I have studied is better described as physiological rather than physical. The prompt and complete return of threshold to its original value in some cases indicates that the injury cannot be so gross as the fat embolism of Porter. It is an inhibition, in the words of Meltzer, or an increase in synaptic resistance, as Cannon has recently referred to it.

The problem which immediately suggests itself is whether it

would be found possible to alter, by intestinal manipulation, the threshold of reflexes of more vital importance to the animal than flexion and crossed-extension. Porter has shown that the vaso-motor center is still in active operation in shock; it is by no means exhausted. It is still capable of giving as great percentile changes of blood pressure as before. It might still turn out to be true, however, that following intestinal manipulation the center is more inaccessible than before to the nerve impulses which ordinarily play upon it and properly control its activities. The writer hopes to test this out in the near future. At any rate it is evident that intestinal manipulation sends impulses to the central nervous system which disturb its normal functioning, and Crile's contention that such impulses should be prohibited from their pernicious activity would seem to be justified.

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On the influence of some antipyretics on the neuro-muscular coördination test of "tapping."

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In connection with a psycho-pharmacological study of the antipyretics including observations on their effect on the reaction-time, blood pressure, vision, and hearing, some observations were made on the influence of these drugs on the well-known psychological coördination test of "tapping." This test consists briefly in the continuous tapping by the subject with a brass stylus upon a brass plate so adjusted that each tap or contact of the stylus on the brass plate is electrically registered on a counter. The number of taps made over a definite period of time is a rough index of the neuro-muscular coördination of the arm muscles. In the present investigation, observations were made upon the authors and occasionally on other subjects. The subject was required to tap continuously for three minutes at a time, and the number of taps registered was noted at the end of each minute. Having noted the normal tapping number in any one experiment,