the pupils in both the normal and the parasympathectomized eyes were constricted down to the same size, approximately 1 mm. in horizontal diameter. The constriction began within 5 minutes, in both eyes, reached its maximum, in both eyes, at about 45 minutes and, in most cases, remained at this maximum more than 45 minutes.

Since it is probable that the nerve fibers and their endings had completely degenerated before the end of 14 days, and since Armstrong[1] has shown that acetylcholine does not depress the nerveless heart, the foregoing facts suggest that carbaminoylcholine in the given concentration, stimulates only the parasympathetic neuromuscular junctions.

In the later months after the operation, the drug in the normal iris still constricted the pupil down to a 1 mm. width, but in the parasympathectomized iris, it constricted the pupil only to about 8 mm. These findings in the later months are probably due to the degeneration of disuse, either in the denervated parasympathetic neuromuscular junctions or in the muscle fibers.

8202 P

Observations on Intra-Intestinal Pressure with Special Reference to Absorption of Saline.

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Measurement of the absorption of fluid from an isolated fistulous loop of intestine by the use of an ordinary manometer tube is unsatisfactory, since with absorption the manometer level falls progressively, and with it, the intra-intestinal pressure. The intra-intestinal pressure can, however, be maintained at a constant level by a manometer system built on principles similar to that used by White[1] for the measurement of the intracapsular pressure in the kidney. Inserted in a closed loop of small intestine previously prepared, is a rubber catheter, which is encircled close to its eye by an inflatable rubber balloon, which serves as a flange fitting snugly in the fistulous passage through the abdominal muscles and preventing

[1] Armstrong, P. B., *J. Physiol.*, 1935, **84**, 20.

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[1] White, H. L., *Am. J. Physiol.*, 1928, **85**, 191.

escape of fluid. The catheter is attached by a glass T tube to a long rubber connection, continuous in its turn with a fine glass tube. This glass tube, open at its other end, is kept horizontal at any required level above the loop. The system is filled with physiological saline by syringe through the third limb of the T tube, until the fluid reaches the horizontal glass tube, forming a meniscus there which is brought to a mark near the center of the tube. Movement of the meniscus away from this mark toward the rubber connecting tube indicates absorption of fluid from the system, movement towards the open end of the glass tube indicates secretion by the isolated bowel loop. The amount of fluid added to the system by syringe over a given period to hold the meniscus steady at the mark on the horizontal tube will now allow measurement of the rate of absorption from the intestinal loop. Peristaltic movements of the isolated loop, never very considerable, were greatest with each change in pressure but decreased to a stable level after 10 minutes. No readings were recorded during the first 10 minutes of each pressure period.

The rate of absorption of physiological saline has been measured by this method in 3 dog loops of ileum (8 to 12 inches in length) at various levels of intra-intestinal pressure. Anesthesia was unnecessary for these observations. In none of these animals did an appreciable absorption occur at a pressure of less than 250 mm. As the intra-intestinal pressure increased, so at first did the rate of absorption, to reach a maximum of 48 cc. per hour at 700 mm. of water in the first loop, 96 cc. per hour at 660 mm. in the second, and 125 cc. per hour at 500 mm. in the third. At higher pressures, the rate of absorption steadily fell, to reach zero at 900, 850, and 850 mm. of water in the respective loops. When the intra-intestinal pressure was still further raised beyond these levels, movement of the meniscus towards the open end of the horizontal tube indicated secretion by the loop mucosa. These observations were repeated and confirmed in the case of each loop.

An opportunity presented itself of making a similar series of observations on human intestine. A female patient in the course of a series of operations for a complicated small intestine obstruction, presented at one stage of her treatment an exposed 6-inch jejunal loop, completely isolated from the remainder of the bowel. The point of maximum absorption (8 cc. per hour) occurred at an intra-loop pressure of 400 mm. of water, and thereafter the rate fell till a pressure of 700 mm. was attained. At pressures of 800 mm. or more, definite secretion occurred into the loop. At 800 mm.

the loop became obviously cyanosed, and at that pressure only did an uncomfortable sensation of fullness ("like gas") occur. The peristaltic movements of the loop, occurring with each change in pressure, were never excessive, and did not prevent accurate centralization of the meniscus. The pulse beat was transmitted to the fluid in the system.

The curve of absorption in these experiments was a straight line in agreement with the observations of Wells,[2] who found that absorption of saline from closed loops was directly proportional to the intra-intestinal pressure. Wells's studies, however, included pressures up to 160 mm. water only.

The same patient at an earlier stage of her treatment presented a jejunal fistula. This fistula was efficiently drained by a tube which bore an inflatable balloon collar identical with that described for the experiments in dogs. By attaching this drainage tube to a manometer, a record was made of the spontaneous changes in intra-intestinal pressure. The pressure base line was 20 to 40 mm. throughout the course of the experiment. On 3 occasions, during 30 minutes, the pressure rose rapidly to 150, 250 and 275 mm. of water. Each of these excursions lasted 30 to 60 seconds. Minor waves up to 60 or 70 mm. were twice as frequent. With nearly all these upward excursions of the manometer, there was a complaint of mild hypogastric discomfort. Moderately intense umbilical colic was experienced whenever the pressure reached 200 mm. of water, this threshold level being exceedingly constant throughout the whole course of the experiment, and also observed on several other occasions in the same patient. These excursions were more frequent and more pronounced after the ingestion of water and of light food, reaching a peak on one occasion of 350 mm. of water.

8203 P

Dissimilation of Pyruvic Acid by Lactobacillus lycopersici.

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In view of the intermediary rôle assigned to pyruvic acid in bacterial metabolism, the mechanism of its breakdown by *Lactobacillus*

[2] Wells, H. S., *Am. J. Physiol.*, 1931, **99**, 209.