TABLE I.
Strain Differences in Choline Requirements.

Sex	Strain	F_2 rats, No.	Incidence of kidney hemorrhage		Mortality	
			No.	%	No.	%
Male	LCR*	60	29	48.3	6	10.0
Male	HCR†	43	43	100.0	25	58.1
Female	LCR	66	13	19.7	1	1.5
Female	HCR	33	31	93.9	14	42.4

* Low choline requirement strain.
† High choline requirement strain.

Griffith[3] has shown that the choline requirement increases with increased rate of growth, which is not an explanation for the present results since the growth rate was identical in the 2 strains.

Lamoreux and Hutt[4] found that white Leghorn chicks survived longer on a thiamine-deficient diet than Rhode Island Reds. The same authors[5] developed strains of White Leghorn chicks which appeared to have different requirements for riboflavin.

So far as the author is aware, apart from a report by Light and Cracas[6] who observed differences in thiamine requirements in different strains of white rats, it has not previously been demonstrated that laboratory rats vary in their requirements for specific nutrients.

Summary. Two strains of rats were developed which in their second generation differed markedly in their requirement of dietary choline.

3 Griffith, W. H., *Biol. Symposia*, 1941, **5**, 193.

4 Lamoreux, W. F., and Hutt, F. B., *J. Agr. Res.*, 1939, **58**, 307.

5 Lamoreux, W. F., and Hutt, F. B., *Genetics*, 1943, **28**, 79.

6 Light, R. F., and Cracas, L. J., *Science*, 1938, **87**, 90.

14122

Cathartic Salts on Motility of Thiry-Vella Jejunal Loops.

E. WILLIAM LIGON, JR. (Introduced by George B. Roth.)

From the Department of Pharmacology and Therapeutics, School of Medicine, The George Washington University, Washington, D.C.

Intralumen pressures in, and flow through, Thiry-Vella jejunal loops of 3 trained unanesthetized dogs were recorded photokymographically by the open tube method of Brody, Werle, Meschan and Quigley.[1] The solutions studied were: water; isotonic solutions of NaCl, Na_2SO_4, and $MgSO_4$, respectively; hypertonic solutions of 5 times the isotonic concentration of the above salts. Apparatus used is shown in Fig. 1.

Effect of pressure. Perfusion of the jejunal loop with isotonic (0.9%) NaCl at an inflow pressure of 20 cm of water and an outflow pressure of zero produced basal pressures around 10 cm, average peak pressure around 40 cm, flow about 10 cc/min, and contractions 12 to 15/min. On lowering inflow pressure to zero, basal pressure fell to about 3 cm, average peak fell to about 10 cm, and flow ceased. On raising inflow pressure to 40 cm, basal pressure rose to 20 cm, average peak rose to 75 cm, and flow doubled. On clamping inflow and outflow and introducing 10 cc of 0.9% NaCl, basal pressure rose to 70 cm and average peak to 100 cm. Rate of contraction remained

1 Brody, Werle, Meschan and Quigley, *Am. J. Physiol.*, 1940, **130**, 791.

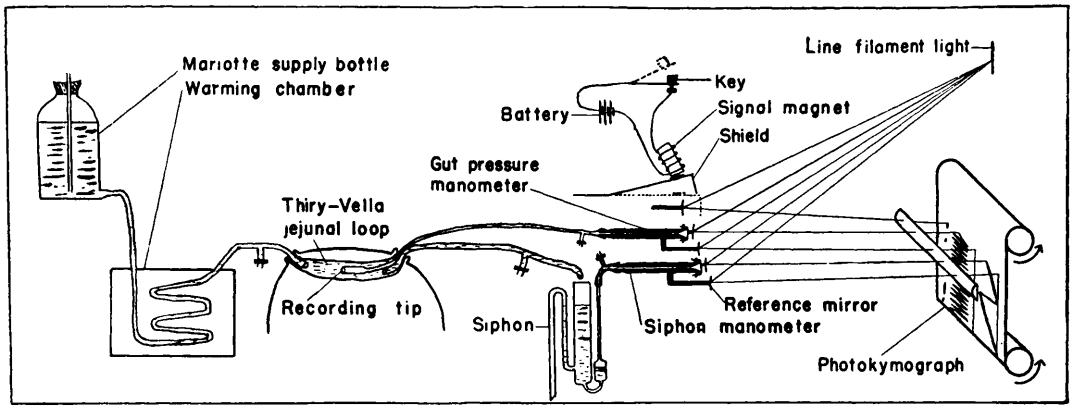

FIG. 1.
Diagrammatic representation of apparatus. The manometers are drawn disproportionately large.

unchanged throughout. Since motility of the jejunum varies directly with inflow pressure and an inflow pressure of 20 cm of water was required to cause a moderate flow, this pressure was routinely employed, with 0.9% NaCl as the control solution.

Effect of isotonic solutions (1.89% Na_2SO_4, 3.28% $MgSO_4$). Isotonic Na_2SO_4 usually caused a slight increase (15 to 25%) in average peak pressure and flow without change in rate (Fig. 2, A). However, if the control period was one of low motility and rapid flow, isotonic Na_2SO_4 caused a change toward the usual normal. The effects developed quickly and were maintained; return to isotonic NaCl brought return to previous levels of activity. Isotonic $MgSO_4$ usually caused about the same increase in motility as isotonic Na_2SO_4; when prolonged over 30 to 40 minutes, motility and basal pressures fell markedly and flow greatly increased.

Effect of anisotonic solutions (H_2O, 4.5% NaCl, 9.45% Na_2SO_4, 16.4% $MgSO_4$). Distilled water showed little effect. Once, there was depression of motility and increased flow for 13 minutes followed by a two-minute period of spasticity, absence of flow, and symptoms of nausea.

Hypertonic solutions caused a marked decrease in motility with greatly increased flow in 5 to 15 minutes. Usually there was a development of a spastic period in the first 5 minutes, sometimes followed later by other spastic periods. During these spastic periods (Fig. 2, B and C) the contractions continued at the usual rate, but pressures were quite high, peaks often rising well over 120 cm water pressure, with incomplete relaxation so that basal pressures frequently remained over 30 cm. Associated with these spastic periods were symptoms of nausea—licking of chops, swallowing; often abdominal gurgling, stretching movements, increased respiration. Flow was always increased during low motility and decreased during spastic periods. Rate of contraction was constant.

With hypertonic NaCl there was usually one early spastic period; with hypertonic Na_2SO_4 often several within 20 minutes; with hypertonic $MgSO_4$ spastic periods were sometimes absent. On changing from hypertonic NaCl or Na_2SO_4 to isotonic NaCl recovery was obtained in 5 to 15 minutes, but after hypertonic $MgSO_4$ recovery never occurred in 15 minutes and often was incomplete at 45 minutes.

Discussion. From these experiments, in which the factor of distension was largely eliminated, it would seem that the stimulant effects of isotonic Na_2SO_4 and isotonic $MgSO_4$ in the jejunum would be insufficient to alone produce the vigorous catharsis which usually ensues from the oral administration of these salts; coupled with the retention of water in the lumen by these difficultly absorbable salts, the stimulant effect probably increases the rate of passage of material through the jejunum. The late depression of motility by isotonic $MgSO_4$ and the slow recovery after hypertonic $MgSO_4$ indicate that if catharsis

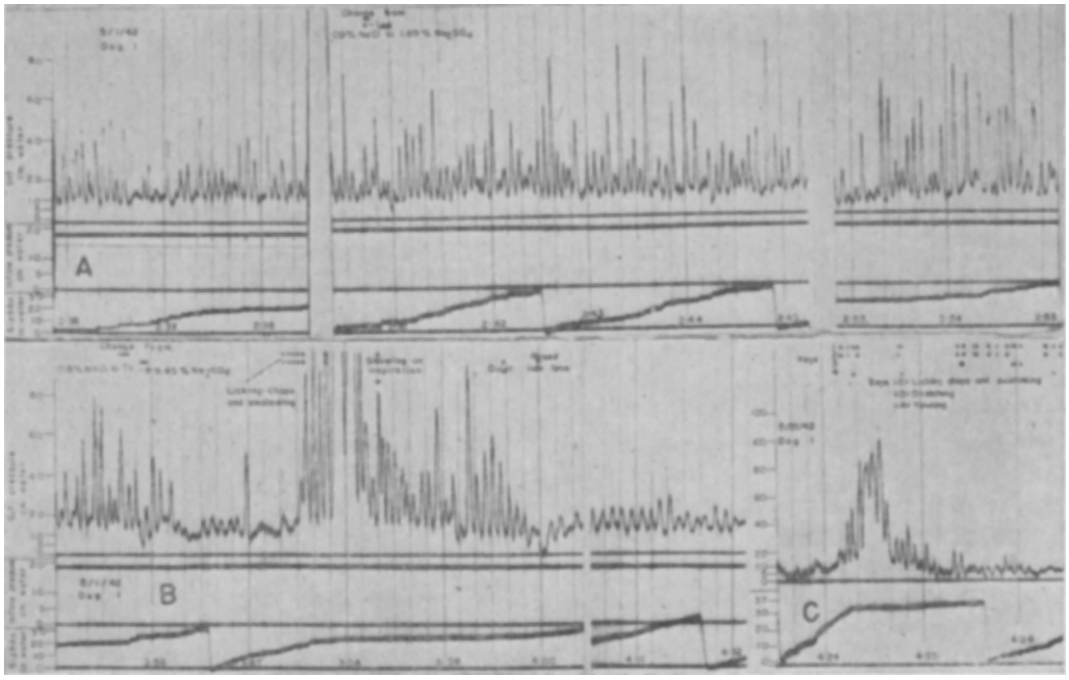

FIG. 2.

A. Typical record showing the moderate stimulation obtained with isotonic Na_2SO_4. B. Typical record showing an early spastic period at 3:58 and depression of motility at 4:11, using hypertonic Na_2SO_4. C. Typical record showing a late spastic period. Note that flow was very low during the spastic period.

failed to occur after oral administration, stasis of the solution in the jejunum would add to the danger of absorption of toxic amounts of the magnesium ion. Hypertonic solutions of these salines, should they reach the jejunum, would tend to remain stationary during periods of low motility; during spastic periods, material distal to the point of action would be driven faster and material proximal to this point would be held back.

Summary. 1. Isotonic Na_2SO_4 and isotonic $MgSO_4$ caused moderate stimulation of motility in Thiry-Vella jejunal loops; when prolonged, isotonic $MgSO_4$ caused depression of motility and tone. 2. Hypertonic solutions of NaCl, Na_2SO_4 or $MgSO_4$ caused depression of motility, with short periods of spasticity accompanied by symptoms of nausea. 3. Recovery after hypertonic NaCl or Na_2SO_4 was prompt, but after depression of motility by $MgSO_4$ recovery was slow. 4. Using a constant inflow pressure, flow bore an inverse relationship to motility. 5. Rate of contraction was unaffected by the agents employed.