tropic substances, such as methionine or choline, used for the prevention of hepatic cirrhosis, require relatively higher doses to be effective.

Aminothiazole was found to be without any significant benefit in doses which on the basis of food intake and molecular weight were about 3.5 times higher than those used for propyl-thiouracil.

Successful prophylaxis of hepatic cirrhosis with goitrogenic substances such as thiouracil in the previous[1] and with propyl-thiouracil in the present studies does not necessarily lead to the conclusion that the same approach may be successful in the therapy of this condition. As a matter of fact, in unpublished experiments thiouracil appeared to exert no effect or even a slightly deleterious one on a *pre-existing* cirrhosis in rats.

As an unexpected indirect result of our studies the excellent general nutritional state of the experimental animals receiving propyl-thiouracil deserves special attention. This observation supports the view expressed in another connection by several authors[8] that goitrogenic substances could play an important role in the feeding and fattening of farm animals, and especially in the feeding efficiency, an all-important economic factor. Older experiments were carried out mainly with thiouracil. Our own studies seem to give propyl-thiouracil a definite edge over thiouracil. The practical problem as to whether goitrogenic substances are stored and, if so, how long in animals receiving them with their feed, and whether the ingestion of such animal products may exert a toxic (goitrogenic) effect on the consumer is beyond the scope of this presentation.

*Summary.* Admixture of propyl-thiouracil (.05%) with a cirrhosis-producing synthetic diet will prevent effectively the production of dietary cirrhosis in rats. This result is achieved with simultaneously reduced food intake and is manifested not only in the absence of cirrhotic changes in the liver but also in the improved general condition of the experimental animals and increased feeding efficiency.

Aminothiazole in the dose used (3½ times the equivalent of propyl-thiouracil) was without any significant effect on the production of dietary cirrhosis, on food intake, survival rate and weight changes.

For the goitrogenic substances tested efficiency in prevention of cirrhosis seems to parallel goitrogenic potency.

8 Kempster, H. L., and Turner, C. W., *Poultry Sc.*, 1945, **24**, 94; Andrews, F. N., and Schnetzler, E. E., *ibid.*, 1946, **25**, 124; Glazener, E. W., and Jull, M. A., *ibid.*, 1946, **25**, 236; Mixner, J. P., Tower, B. A., and Upp, C. W., *ibid.*, 1946, **25**, 536; Reineke, E. P., Davidson, J. A., Wolterink, L. F., and Barrett, F. N., *ibid.*, 1946, **26**, 410; Andrews, F. N., Beeson, W. M., Herrick, E. R., and Harper, C., *J. Animal Sc.*, 1947, **6**, 3; Beeson, W. M., Andrews, F. N., and Brown, P. T., *ibid.*, 1947, **6**, 16; Muhrer, M. E., and Hogan, A. G., PROC. SOC. EXP. BIOL. AND MED., 1945, **60**, 211; Van der Noot, G. W., Reece, H. P., and Skelley, W. C., *J. Animal Sc.*, 1947, **6**, 12; McMillen, W. N., Reineke, E. P., Bratzler, L. J., and Francis, M. J., *ibid.*, 1947, **6**, 305.

## 16207 P

## Observations on Ureteral Peristalsis in Unoperated Dogs.

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Up to the time Trattner[1,2] developed the hydrophorograph for the graphic recording of peristaltic activity in the human ureter, investigations on ureteral peristalsis were carried out on excised ureters, or on exposed ureters *in situ* in anesthetized and operated

1 Trattner, H. R., *J. Urol.*, 1924, **11**, 477.
2 Trattner, H. R., *J. Urol.*, 1932, **28**, 1.

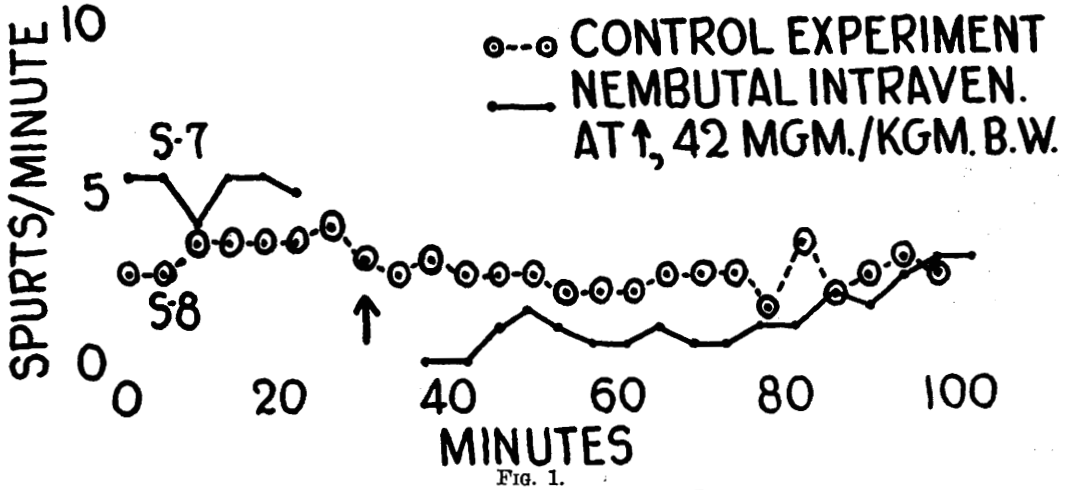


FIG. 1.
Ureteral Peristalsis in Unoperated Dog.

animals. Trattner's method resulted in a more physiologic approach to the study of ureteral peristalsis in that anesthesia and operative manipulation were eliminated. The present work likewise eliminated all operative trauma, and also anesthesia except in those experiments in which the effects of the anesthetic *per se* were being investigated. It goes one step further to realize the ideally physiologic experiment in that no catheter is introduced into the ureter. Although the presence of a catheter in the lower end of the ureter may have very little, if any, effect on the activity of the upper part of the structure, the absence of the catheter is a closer approach to the normal state.

*Materials and Procedure.* Well-trained female dogs, weighing approximately 11 kilograms, were loosely restrained lying supine on a dog-board. The animals had been without food for 24 hours but had free access to water. The urinary bladder was catheterized with a hard-rubber catheter and was washed free of urine with distilled water. This preliminary catheterization dilated the urethra so as to facilitate the passage of the cystoscope (No. 16 Fr. children's cystoscope). After several washings of the bladder the catheter was removed and the cystoscope introduced into the bladder without difficulty. No local anesthetic was used. One cubic centimeter of a sterile 4% aqueous solution of indigo carmine was injected intramuscularly. Three to fifteen minutes later the ejection of the dye from the ureteral orifice was observed. Although only one ureteral orifice could be watched because of the limited visual field of the cystoscope, in a few experiments the 2 ureteral orifices were so located that the spurting of dye from both could be observed simultaneously. (The curves and the table give data for one ureter in each experiment, however.) The bladder was always distended with about 50 cc of water to facilitate the observations of the spurts of dye.

After the dye entering the bladder became distinctly visible, the number of spurts of dye was counted, usually for a 2-minute period, followed by a 2-minute rest period for the observer. This alternation of counting and rest periods was continued throughout the experiment. If the dog was restless the counts were made for one minute, followed by a 2-minute rest period. The dye was frequently washed from the bladder with distilled water through the cystoscope, the water entering from a reservoir suspended above the animal. Only the observers who began the experiment and who were known by the animals were allowed in the room during the experimental period on the unanesthetized animals so as to minimize emotional disturbance of the animals.

The cystoscopic observation of dye entering the urinary bladder of unanesthetized dogs was reported by Milliken and Karr[3] in their studies

[3] Milliken, L. F., and Karr, W. G., *J. Urol.*, 1925, **13**, 1.

TABLE I.
Effects of Anesthesia on Ureteral Peristalsis.

| Experiment No. | Ureteral peristaltic activity—per minute | | | | |
|---|---|---|---|---|---|
| | Pre-experimental | | Experimental (Intravenous nembutal) | | |
| | Period 1 | Period 2 | Period 3 | Period 4 | Period 5 |
| S-7 (42 mg/kg) | | 5.6 (4.5-6.0) | 1.2 (0.5-2.0) | 1.1 (1.0-1.5) | 2.1 (1.5-3.0) |
| S-5 (30 " ) | 4.2 (3.5-6.5) | 4.3 (3.5-5.5) | 4.7 (3.5-8.0) | 4.1 (3.5-4.5) | 4.0 (3.5-4.5) |
| S-4 (29 " ) | 4.8 (3.0-6.5) | 5.0 (3.0-6.0) | 2.2 (2.0-2.5) | 2.7 (2.5-3.0) | 2.9 (2.0-4.0) |
| S-5 (27 " ) | | 3.8 (3.0-4.5) | 2.0 (1.5-2.5) | 3.5 (1.5-4.5) | |
| Controls | | | | | |
| S-8 | 3.6 (3.0-4.0) | 3.7 (3.0-4.5) | 2.8 (2.5-3.0) | 2.7 (2.0-3.0) | 3.2 (2.5-4.0) |
| S-6 | 5.7 (4.5-7.0) | 4.3 (3.5-5.5) | | | |
| S-2 | 2.7 (2.0-3.0) | 3.1 (2.5-4.0) | | | |
| S-1 | 3.1 (2.0-4.0) | 2.5 (1.5-3.5) | 2.6 (0.5-4.5) | | |
| B-6 (42 mg/kg) | | 4.6 (4.0-5.0) | 5.8 (5.0-8.5) | 4.2 (3.5-5.0) | 3.9 (2.5-4.5) |
| B-3 (28 " ) | | 5.7 (5.0-7.0) | 4.2 (3.5-5.0) | | |
| B-5 (25 " ) | 4.7 (4.0-5.5) | 7.2 (6.0-9.5) | 4.9 (3.5-6.0) | 3.9 (3.5-5.0) | |
| B-4 (25 " ) | | 4.7 (4.5-5.0) | 5.3 (3.0-10.5) | 4.6 (4.0-6.0) | 4.1 (3.0-5.0) |
| B-2 (25 " ) | | 4.9 (4.5-5.5) | 3.5 (2.5-5.0) | | |
| Controls | | | | | |
| B-7 | 7.4 (5.0-9.0) | 8.9 (6.5-10.0) | 7.2 (4.5-10.0) | 6.2 (5.5-7.0) | |
| B-1 | 4.0 (3.0-4.5) | 3.4 (2.0-4.5) | | | |
| Q-3 (31 mg/kg) | | 3.9 (2.0-5.0) | 4.3 (3.0-10.0) | 2.7 (2.0-4.0) | 3.8 (3.0-5.0) |
| Q-4 (29 " ) | 6.2 (5.5-7.0) | 5.8 (5.0-7.0) | 4.6 (0.0-6.5) | 5.5 (5.0-6.0) | 6.0 (5.0-7.0) |
| Controls | | | | | |
| Q-2 | 3.2-(3.0-5.0) | 3.6 (3.0-5.0) | | | |
| Q-1 | 2.9 (2.5-3.0) | 3.0 (3.0-3.0) | | | |

The numbers given in the columns under Period 1, Period 2, Period 3, etc., are the averages usually of 5 or 6 two-minute periods for a 20-minute duration. The figures in parentheses give the range of peristaltic activity for that period. Between Period 2 and Period 3, the nembutal was injected and after a short delay the counts were again begun.

on the influence of renal sympathectomy on kidney functions, but a study of ureteral peristalsis *per se* under various physiologic and experimental conditions was not carried out by these authors.

*Results.* The responses of the ureters in 2 experiments are plotted in Fig. 1. Experiment S-8 is a control experiment on an unanesthetized dog and shows the relative constancy of ureteral peristalsis over 100-minute period. Experiment S-7 shows the effect of a single rapid intravenous injection of pentobarbital sodium (nembutal). Peristaltic activity was reduced from an average of 5.6 spurts per minute to 1.1, followed by a gradual recovery.

The results of 11 experiments with varying doses of intravenous nembutal and eight control experiments are summarized in Table I. The 19 experiments were performed on 3 dogs.

*Conclusions.* Observations of ureteral peristalsis can be made on unoperated and unanesthetized dogs and conclusions drawn as to the activity of the ureters. Although the series is small, results suggest that nembutal inhibits ureteral peristaltic activity. The mechanism of this inhibition may be through the influence of the anesthetic directly on the ureter; or the anesthetic may affect the urine production and thus the volume of urine passing down the ureter, since variations in urine volume will affect peristalsis of the ureters.