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Neutralization of Gastric Acidity Following Pyloric Closure.

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In previous experiments from this laboratory[1] it was shown that the neutralization of gastric acidity, studied by means of an acid test meal, was definitely accelerated by division of the pyloric sphincter. The present experiments show that closing the pylorus, partially or completely, produces the opposite effect, *i. e.*, a delay or complete absence of neutralization of the acid test meal.

Two series of experiments were performed. In one a silk ligature soaked in 25% $AgNO_3$ was tied around the pylorus so that occlusion short of complete obstruction was achieved. The only animals studied were those which remained in good condition and did not vomit following the operation (6 dogs). For periods as early as a few days and as late as several months a marked and sometimes complete delay in the neutralization of the acid test meal (200 cc. of 5% HCl fractionally aspirated) was found over the control curve obtained before operation. Preoperative curves were obtained in all but one of these dogs. In 5 other dogs operated on as controls no changes were noted.

In 7 dogs a pyloric snare was installed at operation. This could be closed or opened at will by means of a silver tube brought out through a separate stab wound. Several days or weeks after recovery the acid solution was introduced and it was possible in 8 successful experiments by tightening or loosening the snare to produce definite changes in the curve of neutralization. During periods when the pylorus was occluded the acid was neutralized incompletely or not at all; on its release the acidity dropped as promptly and rapidly as in the normal animal.

These experiments add further evidence to the idea previously expressed that there is an actual pyloric control of gastric acidity presumably because the sphincter influences the degree of regurgitation of alkaline duodenal contents particularly pancreatic juice into the stomach. Of additional interest is the finding in many of our experiments of hyperaemia of the gastric mucosa and definite inflammatory changes in the duodenum most marked just

[1] Elman, Robert, and Rowlette, A. P., *Arch. Surg.*, 1931, **22**, 426.

distal to the partly occluded pylorus. In one dog a perforated ulcer at this point, with death from peritonitis, was found.

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Concentration of Calcium Ions in Biological Fluids.

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The sensitivity of the frog's heart to changes in the calcium content of a nutrient fluid has long been known[1, 2]. Utilization of this property for the estimation of calcium ions in biological fluids has, however, not been generally considered feasible, because considerable doubt has existed[3] as to whether the known sensitivity is to calcium ions or to total calcium. The method here presented is based upon (1) the demonstration, simultaneously reported, that the reaction of the frog's heart is specific for calcium ions, bound calcium being without effect, and (2) elimination or control of other factors which may influence the behavior of the heart.

The method consists essentially of recording the amplitude of the contraction of the frog's heart, suspended from a modified Straub cannula inserted through the aorta into the ventricle. After taking certain precautions to standardize the procedure, the concentration of calcium ions in the unknown solution or biological fluid is taken to be that of the known solution which produces an amplitude of contraction most nearly matching that produced by the unknown. A satisfactory preparation is sensitive to changes of 0.1 millimol per liter of calcium ions (0.4 mg. per 100 cc.) or less, so that the theoretical accuracy of the method is to within $\pm$0.1 mM per liter.

The method is applicable to such solutions or biological fluids as will sustain the action of the frog's heart without toxic effects. It can be used in artificially prepared salt solutions of widely varying composition, and has been found suitable for serum, plasma, cere-

[1] Straub, W., *Verhandl. d. Gesellschaft deutscher Naturforscher und Aerzte*, 1912, **84**, 192.

[2] Trendelenburg, P., und Goebel, W., *Arch. f. exp. Path. u. Pharm*, 1921, **89**, 171.

[3] Klinke, K., *Ergebnisse der Physiol.*, 1928, **26**, 235,