Gastric Secretion. Surgical Forum, 12:268, 1961.
36. Thompson, J. C., H. J. Lerner and J. A. Tramontana: Inhibition of Cephalic and Antral Phases of Gastric Secretion by Antral Chalone. Am. J. Physiol., 202:716, 1962.
37. Thompson, J. C. and G. W. Peskin: The Gastric Antrum in the Operative Treatment of Peptic Ulcer. Inter. Abst. Surg., 112:205, 1961.
38. Wilhelmj, C. M., F. T. O'Brien and F. C. Hill: The Inhibitory Influence of the Acidity of the Gastric Contents on the Secretion of the Stomach. Am. J. Physiol., 115:429, 1936.
39. Woodward, E. R., R. R. Bigelow and L. R. Dragstedt: Effect of Resection of Antrum of Stomach on Gastric Secretion in Pavlov Pouch Dogs. Am. J. Physiol., 162:99, 1950.
40. Woodward, E. R. and L. R. Dragstedt: Role of the Pyloric Antrum in Regulation of Gastric Secretion. Physiol. Rev., 40:490, 1960.
41. Woodward, E. R., E. J. Lyon, J. Landor and L. R. Dragstedt: The Physiology of the Gastric Antrum; Experimental Studies on Isolated Antral Pouches in Dogs. Gastroenterology, 27:766, 1954.
42. Woodward, E. R., W. E. Trumbull, H. Schapiro and L. Towne: Does the Gastric Antrum Elaborate an Antisecretory Hormone? Am. J. Digest. Dis., 3:204, 1958.

Discussion

Dr. Lester Dragstedt (Gainesville): I had the privilege of visiting Dr. Thompson's laboratory and was greatly impressed with the skill and care with which this difficult experiment was carried out.

I am also impressed by the experiments of Dr. DuVal and those of Dr. Harrison, and as a result I am persuaded that there is an inhibitory agent liberated from the antrum of the stomach when acid of sufficient concentration is applied long enough to the antral mucosa.

How can we harmonize these data with the data from our own laboratory which led us to draw a conclusion almost opposite to the one here presented? (slide) Here is an experiment Dr. Edward R. Woodard and I reported some years ago, which was performed on an animal with a vagus denervated Heidenhain pouch and a vagus denervated antrum pouch. We found that when we put neutral food in the antrum we got an abundant secretion of gastric juice from the Heidenhain pouch, but when we acidified that food we got no stimulation of secretion.

It occurred to us that the interpretation of the experiment might be either that acid prevented the release of gastrin just as cocaine does when cocaine is applied to the antrum mucosa, or that an inhibitory hormone might be released from the antrum.

It seemed to us that if an inhibitory hormone was released, we ought to get an immediate stimulation, followed at some later period by inhibitions. The fact that we got inhibition immediately made us prefer the interpretation that acid had prevented the release of the hormone gastrin.

(slide) In a similar experiment we found that distention of the antrum with neutral salt solution would produce a stimulation of secretion from the Heidenhain pouch, but distention of the antrum with acid solutions caused no stimulation at all.

In a later experiment with two antrum pouches and a Heidenhain pouch the data decidedly favor the interpretation that acid in contact with the antrum prevents the release of the hormone gastrin. We prepared two pouches of the antrum, A and B. We could stimulate the secretion of gastric juice by putting food in either pouch A or B. While we had a secretion stimulated continuously by putting food in pouch A, we introduced acid in pouch B. But as you see, we got no inhibition of gastric secretion.

It seemed to us that if an inhibitory hormone of significance were liberated from pouch B, it should have inhibited the secretion induced by putting the food in pouch A. We then reversed the experiment putting food in pouch B, and acid in pouch A and again failed to demonstrate inhibition.

Prof. Schofield of Newcastle, England, has repeated this experiment and confirmed it in every respect, and in addition has done one rather important experiment that I regret we neglected to do. He pointed out that if he put food in pouch A and got a sustained plateau of secretion, and then put acid in pouch B, he got no inhibition of secretion; but if then he put the acid in pouch A containing the food there was prompt and immediate inhibition.

I cannot get away from the interpretation that under the conditions of this experiment, acid has inhibited the release of gastrin from pouch A that had been stimulated previously by the contact with food.

A possible harmony in these conflicting experiments is suggested by the work of Dr. Paul Jordan. He has pointed out that in a similar type of experiment a sustained plateau of secretion

may be secured by putting food in pouch A and then if pouch B is irrigated for one to three hours with hydrochloric acid solution, at the end of this long period profound inhibition of secretion occurs.

A provisional interpretation might be that both mechanisms are operative; that when the contents of the stomach become acid further release of gastrin is inhibited. If there is sustained presence of highly acid content in the stomach an inhibitory agent is released which stops stimulation of gastric secretion from all types of stimuli.

The problem is of great practical importance because if an inhibitory hormone is released from the antrum, vagotomy plus pyloroplasty or vagotomy plus gastroenterostomy, is obviously a better procedure than vagotomy plus antrum resection.

I think the problem is important. I hope that more people will work on it so that we get the correct final interpretation. I should like to repeat that if vagotomy plus a gastroenterostomy or pyloroplasty is chosen, special care must be observed so that all vagus fibers to the stomach are cut so that stasis of food in the stomach is prevented. Stasis of food as a result of gastric atony causes a hypersecretion of gastric juice of hormonal or gastric origins.

Dr. Merlin K. DuVal, Jr. (Oklahoma City): It is somewhat anticlimatic for me to try to say anything after that remarkable statement from Dr. Dragstedt. I would like, however, to tie in one other piece of information which I think is quite interesting, yet still unsolved. It has been almost 25 years since Dr. Brunschwig observed that the gastric juice from patients who had cancer of the stomach or pernicious anemia, if given intravenously, inhibited the secretion of hydrochloric acid in the recipient animal; and it has been about 15 years since Code noted that normal human gastric juice had the same capacity. Our group extended these observations by showing that if the intravenous injections of this gastric juice are continued, achlorhydria and finally gastric atrophy will supervene. We are still studying this strange characteristic of gastric juice.

In the meantime, it was inevitable that we would wonder whether or not this inhibiting property of gastric juice was related in any way to the so-called antral inhibitory hormone. Since the bulk of the available experimental evidence already cited is unfavorable to the thesis of antral inhibition, we took the position that only by cross-circulation between parabiotic animals could the question be finally resolved.

Two years ago before this society we presented our studies in cross-circulating dogs, whose aortas were interconnected. While our results supported the thesis that the antrum of the stomach does secrete a hormone which actively inhibits gastric secretion, our technic of cross-circulation was cumbersome, awkward, and vulnerable to criticism.

The sophisticated refinements in this technic that we have heard about from Dr. Thompson are excellent. Furthermore, I believe that their findings are the strongest current existing evidence in favor of the active antral inhibition thesis.

Dr. James C. Thompson (closing): Dr. Dragstedt mentioned the difficulty of squaring our conclusions with those derived from the studies of double antral pouches. When we first became interested in this problem, we set out, as many do, to explore the field by reviewing the literature. It seemed that the technic of double antral pouches was a very sticky one for any person to wander into; specifically, I remember that at the time we first reviewed our paper there were ten references in the literature to the use of the double antral pouch technic. Five of these contributions reached conclusions favoring the existence of an antral inhibitory hormone and five denied it. That box score has now been raised to six and six.

It seemed unlikely that any new contribution in that field would carry very much weight. I do not know the answer. I know that in the mechanical preparation of a single antral pouch we frequently end up with a little nubbin of semi-ischemic tissue that you worry about, and if I had to cut that in half I am not sure I would be happy with its physiologic integrity.

That is not a fair criticism to level at the work done by Dr. Dragstedt and his group since they demonstrated repeatedly that the gastrin mechanism in both the divided antral pouches was intact.

Dr. Dragstedt alluded to the clinical application of this. I think that there certainly is a strong possibility that this may give rise to, at least in our hands, a new evaluation of the vagotomy plus pyloroplasty technic. I would certainly think if anyone was going to utilize these data, he should use pyloroplasty since it would then afford the opportunity for the entire antrum mucosa to be bathed with acid. Unless you made the gastroenterostomy very far distal, just adjacent to the pylorus, you might lose this possibility and, furthermore, you might introduce reflux of alkaline small bowel content into the antral mucosa.

In regard to the remarks of Dr. DuVal on the inhibitory action of gastric juice, this is certainly a fascinating piece of study. Dr. Code's group divided the stomach into two portions and took gastric juice from the antral portion and from the fundic portion and found that the gastric juice that they extracted from the antral pouch had much greater inhibitory effect than did that from the fundus. We naturally question whether or not any of the antral inhibitory material might be released into the circulation and, therefore, raise the question again of whether or not the antrum might be both an exocrine and endocrine organ.