THE CONTRIBUTION OF DIFFERENT RECEPTOR AREAS OF THE
GASTROINTESTINAL TRACT TO REFLEX CONTROL OF
RENAL FUNCTION

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Previously [8], we have demonstrated the extent to which the renal nerves are concerned in the continuous
and direct control of filtration, resorption, and secretion. It is important to follow up this work by finding what
determines the excitability of the renal nerves at any given moment.

In many recent works [3, 7, 9, 10, 11, 12] dealing with the physiology of the kidney, it has been found that
a change in diuresis occurs on stimulating receptor areas of the gastrointestinal tract.

In the present work, we have set out to determine as precisely as possible the contribution of the different
receptor fields of the gastrointestinal tract to reflex control of renal function.

METHOD

Usually, two methods are used to determine the nature and the extent of the reflex control of one organ by
another: one is to increase or to reduce the control, and the other is to eliminate it.

In order to increase the influence on the kidneys exerted by receptors of the gastrointestinal tract, we pro-
duced a moderate, almost natural stimulation of these receptors by irrigating the mucous membrane with water,
physiological saline, weak sodium carbonate solution, or with hydrochloric acid.

To reduce the effects of gastrointestinal tract receptors, we applied novocain to the mucous membrane,
and in experiments with a water load, we introduced the water directly into one section or another of the tract
by passing the higher sections. In this way we made the experimental conditions as close as possible to normal.

The experiments were carried out on 6 dogs, and of these 3 had ureteric fistulas and fistulas of various
parts of the digestive tract, while the remaining 3 had isolated intestinal loops in various parts, made by the
methods of Thiry-Vella, Pavlov, Shepoval'nikov, as well as fistulas of the ureters and various sections of the
intestine.

RESULTS

Gastric interoceptor control of the kidneys was studied in animals with gastric, duodenal, and ureteric
fistulas. Stimulation of the mucous membrane of the stomach was produced by gradually introducing 300-400
ml of water from the taps, heated to body temperature. The duodenal fistula was opened, and the amount of
fluid passing out from it was measured at 10-minute intervals. The water from the stomach was voided in 20-30
minutes. In all these experiments, a considerably increased diuresis was observed (Fig. 1).
In order to determine what receptors are concerned in this reflex, experiments were carried out in which the mucous membrane of the stomach was irrigated with physiological saline, or with a solution of 1-0.5% sodium bicarbonate in physiological saline. Here, we aimed to act on certain receptors: water was intended to stimulate chiefly the osmo- and mechano-receptors, while the physiological saline should stimulate mechanoreceptors, and the sodium bicarbonate solution the chemoreceptors.

The experiments produced the intended results. Irrigating the stomach with physiological saline brought about an increased diuresis, though this was much less than when irrigating with water (see Fig. 1). In most cases, irrigating with sodium bicarbonate solution caused a greater diuresis than was elicited by physiological saline.

Further confirmation was obtained by experiments where, after measuring the spontaneous diuresis, the gastric mucous membrane was treated with a 2% solution of novocain, and 10 minutes later, the stomach was again irrigated with the fluid under test.

It was found that when the receptors were put out of action by novocain, the gastric control of the kidney was eliminated, and the diuresis remained at the natural level.

Experiments in which intestinal interoceptor control of renal function was studied were carried out on animals with isolated loops of various sections of the intestine, and with ureteric fistulas.

To stimulate the mucous membrane of the isolated Thiry-Vella intestinal loop, or that of the gastric mucous membrane, water was introduced slowly through the length of intestine for 10-20 minutes. It passed out through the fistula at the caudal end to the outside.

In another set of experiments, a burette with a rubber tube was used to introduce water into the intestine, where it was kept under a constant pressure for 10-15 minutes. Irrigation of the mucous membrane of an isolated loop of small intestine always led to an increased diuresis.

The increase in the diuresis was more marked when irrigating isolated loops of jejunum than when equal lengths of ileum were used. No appreciable diuretic changes were observed in any experiment in which the large intestine was irrigated.

Irrigation of the mucous membrane of an isolated loop of the small intestine with physiological saline had no diuretic effect. Application of a 0.1-2% solution of hydrochloric acid in physiological saline caused a considerable increase of diuresis.

During the irrigation, 10-16 ml of fluid were absorbed. This amount, by itself, could not increase diuresis: if 10-16 ml of water, as a control, were introduced into the intestine through a fistula, no diuretic change resulted.

Application of a 2% solution of novocain to an isolated intestinal loop eliminated any reflex influence on the kidneys, and no diuretic changes were found. The amount of liquid absorbed in this case was the same as before (Fig. 2).