Gamble and McIver[2] reported that 2 dogs provided with pancreatic fistulae of the Pawlow type died in 15 to 42 days respectively and concluded that death was due to dehydration and acidosis resulting from the large loss of Na and Cl in the pancreatic secretion. Both Gamble and Elman later found that life could be prolonged by simply restoring the inorganic elements and water that were lost.

The present experiments were in progress when the paper by Elman and McCaughan appeared and they confirm their findings in all essential respects. Animals were provided with pancreatic fistulae of the type described in the preceding paper. They were given 2000 cc. of Ringer's solution intravenously for the first 5 days after operation at which time the fistula was secreting profusely and the dog was in good condition. From 500 to 1500 cc. of pancreatic juice were obtained in 24 hours, the very large amounts being doubtless due to the fact that all of the pancreatic ducts had their outlets into the duodenal sac undisturbed. The intravenous salt solution was then discontinued but the animals permitted food and water *ad libitum*. They promptly became progressively weak and depressed, lost weight markedly and either died or were moribund in 4 to 6 days. The secretion of pancreatic juice continued until death but was considerably reduced in volume. The following changes in the blood chemistry were found: a reduction in the total plasma base from 155 to 130 mM., a decrease in chloride from 101 to 84 mM., a decrease in HCO_3 from 23.0 to 8.3 mM., a shift in the pH from 7.35 to 6.95, and an increase in NPN from 33 to 55 mg., and urea N from 12 to 33 mg. The hemoglobin, red cell count and volume, and blood volume, determined by the dye method, remained within normal limits.

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Prolonging Life in High Obstruction by Administration of Salt Solution Below Point of Obstruction.

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The cause of death in acute intestinal obstruction has been most generally attributed to a toxaemia. The nature of this toxaemia has not been definitely established. Although the toxic theory has been used to explain death in all types of obstruction, recently some

[2] Gamble, J. L., and McIver, M. A., *J. Exp. Med.*, 1928, **48**, 859.

investigators have pointed ont that there is a difference between simple high obstruction in which vomiting is a conspicuous feature and obstruction with injury to the blood supply by distension or strangulation. They believe that the latter results in a toxemia; however the rapid death that occurs in the former they ascribe to loss of digestive secretions alone.

To determine the effect of salt solution administered into the bowel below the point of an uncomplicated high obstruction, dogs were obstructed from 3 to 24 inches beyond the duodeno-jejunal junction and the stump of bowel below the obstruction brought to the outside as a jejunostomy. Through this the animals were given daily a total of 1000 cc. of water with 50 gm. of glucose and 10 gm. of sodium chloride. This was divided into 10 feedings, at hour and a half intervals.

In a series of 19 animals most of them died during the first week from a complication such as pneumonia, peritonitis, or from pulling the bowel out through the jejunostomy wound. Five survived from 13 to 26 days but died from complications. One animal lived 52 days. The behavior of this animal throughout the period of obstruction was remarkable. He was lively and would run about like a normal dog until shortly before death. Vomiting occurred about every other day. On several occasions a watery diarrhea developed when more than 5% glucose was used. The weight gradually declined from 14.2 to 6.4 kg. The blood chemistry taken weekly showed a slight rise in chlorides from 472 to 520 during the first 6 weeks. On the forty-sixth day it was 565 and on the fifty-second day it was as high as 840. The CO_2 showed slight variation and was practically the same on the forty-sixth day as it was before operation. The N.P.N. fluctuated from 40 before operation to 53 on the fifty-second day. In the other animals which survived a week or longer the blood chemistry showed no tendency to fall in chlorides but rather a rise which in some instances was quite marked. At autopsy the animal which lived 52 days showed no evidence of a complication which could explain death other than the long standing obstruction and emaciation. The obstructed bowel measured 95 cm. from the pylorus. It was distended especially above the point of obstruction. The wall of the distal 15 cm. was several times thicker than the bowel higher up which was equally distended. The bowel from the jejunostomy down was collapsed.

White and Fender[1] in a similar experiment kept an animal alive with high obstruction for a month by introducing the vomitus along

[1] White and Fender, *Arch. Surg.*, 1930, **20**, 897.

with glucose and water into a jejunostomy. Several investigators have been able to keep dogs alive with high obstruction as long as 4 weeks by the daily injection subcutaneously of salt solution. The total loss of gastric juice and of pancreatic juice is rapidly fatal. When sodium chloride or Ringer's solution is administered to these dogs life is prolonged.

When digestive secretions are lost by vomiting in obstruction or by fistula experiments animals will rapidly die. When the secretions are replaced by salt solution the animals will survive for a considerable length of time. It appears very unlikely that salt solution introduced into the bowel would prevent any toxaemia that might occur from the obstruction.

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Studies in Capillary Fragility.

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(Introduced by A. C. Ivy.)
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One of us (Irving S. Cutter) has been interested for many years in the production of blood extravasations such as petechiae by trauma. We are all aware that the amount of force or injury necessary to produce such hemorrhagic extravasations varies greatly in different individuals. Investigation of such a problem naturally led us to a study of the blood vessels of the skin and specifically of the capillaries.

Using a Muller Weiss skin microscope (Zeiss) we first familiarized ourselves with the technic of capillary observations. The end of the nail bed is by far the most satisfactory location for observation. This, because there is a single row of capillary loops extending towards the finger tip, with no confusing venous network underlying. In this area one is able to follow the arterial and venous sides of the capillary loops for quite a distance and usually to see the blood flow.

It was our intention to produce ruptures of the capillary walls by means of measured negative pressure—thus measuring the capillary fragility.

This report and accompanying graph are based on 200 measured cases.