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The Beneficial Effect of Mucin and Chondroitin in Experimental Liver Damage.

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Kim and Ivy¹ have observed that mucin prevents ulcers and greatly reduces weight loss in biliary fistula dogs while alkali therapy also prevents peptic ulcer but does not moderate the impairment of nutrition. This, together with improvement in nutrition observed by those who have employed mucin in the therapy of human peptic ulcer, suggests that this substance, in addition to having a local action in the bowel, may play a rôle in metabolism. Of interest in this connection is the fact that many of the conditions in which chronic ulcer develops in the dog are associated with liver damage, biliary fistula, bile duct ligation, pancreatic duct ligation, Eck fistula, and cinchophen poisoning. It seemed worthwhile to study more specifically the effect of mucin on the nutritional state of animals with hepatic damage in which ulcer does not occur as frequently as in biliary fistula dogs.

A series of 9 dogs with ligation of the common bile duct were studied. Of these, 4 were kept as untreated controls and 5 were given 60 gm. of mucin once daily. In addition, 2 Eck fistula dogs that had lost weight post-operatively were given the same amount of mucin daily. All were kept on the stock diet of corn-meal made to a mash with bone soup and bread, and with a small amount of horse-meat added.

This series is too small to allow of definite deductions. However, in view of our previous experience with such animals, the results are so striking that it is felt a preliminary report is warranted. The control animals ran the usual course, losing 30, 33, 26, 35%, average 31%, of their weight in 30 days, while the mucin-fed dogs lost 11, 7, 7, 2, 10, or an average of 7.3%, in the same time. The increases in weight of the Eck fistula dogs fed mucin are given in Table I.

This effect of mucin could be due to its local action in increasing absorption from the gastro-intestinal tract. It seemed more likely, however, that it is due to some constituent of the mucin. Since glucuronic acid is contained in the mucoitin fraction of the mucin molecule and since glucuronic acid is used by the liver in detoxifi-

¹ Kim, M. S., and Ivy, A. C., *PROC. SOC. EXP. BIOL. AND MED.*, 1932, **29**, 686.

TABLE I.
Eck Fistula Dogs on Mucin and Chondroitin Feeding.

	Mucin		Chondroitin	
	No. 1 kg.	No. 2 kg.	No. 3 kg.	No. 4 kg.
Preop.	17.7	11.4	15	22.4
Before mucin	15.4	8.6	11.4	18.1
After mucin				
Days				
14	15.6	8.7		19.2
18			12.6	19.5
30			13.6	
44	18.4	9.7		
80	19.1	10.5		
110		11.3		

cation, we attempted to prepare mucoitin from mucin. This procedure was unsatisfactory since the yield is small. Chondroitin sulphuric acid, however, was prepared from cartilage in large amounts by modification of the method of Levene which avoided the use of barium carbonate, since we found it impossible to remove the last traces of barium when the material was prepared by the original method.

Chondroitin sulphuric acid was fed to 2 Eck fistula dogs in amounts of 1 gm. per day and resulted in weight increases as given in Table I. The usual course of the Eck fistula dogs, as observed in more than 60 animals in this laboratory by one of us (L.A.C.) in the last few years, is a progressive post-operative loss of weight which may proceed to death or may stabilize when the animal has lost from 10 to 40% of its original weight. The animals used in the present experiment were either maintaining their weight at considerably below the pre-operative level or were still losing. A spontaneous gain in weight in such animals is extremely rare.

In addition to the weight gains marked changes in the appetite and activity were observed and the dogs fed with mucin or chondroitin sulphuric acid became more vigorous and ate much better than did the controls.