TABLE II

	No.	Mg. % Tot. N	Mg. % Prot. N	Mg. % NPN
Gall bladder bile				
Stone-containing bile				
Acute change (round cell infilt., edema, etc.)	1		521.4	
	2		28.0	
	3	24	10.7	
	4	207	111.0	88.0
Chronic change (hypertrophic processes, fibrous thickening, etc.)	5		37.5	
	6	75	34.1	41.6
	7		pract. none	
	8	285	136.5	125.2
	9	251	115.0	125.0
About normal (very little cell reaction) distended gall bladder	10	222	30.0	
	11	157	55.0	
	12	414	222.0	157.0
Liver bile	13	44	12.0	28.0

13 human operation biles.

For the sake of comparison the average figure for dog biles taken from the gall bladder was found to be 340 mg. of total nitrogen, while in experiments where the common duct was ligated, it was found that in some cases this total nitrogen rose and in others it fell, there being no consistency in its fluctuation even if several weeks elapsed.

8261 P

Bile Salt Cholecystitis.*

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Pancreatic juice, in the case of obstruction at the ampulla of Vater may become activated by some unknown factor and develop a marked proteolytic activity in the pancreatic tissues. In the same manner the digestive power of gastric juice may become so enhanced that a gastric ulcer will be produced. Whatever other factors are active, it is clear that pure gastric juice *per se* may have the power to erode the gastric mucosa. It has been suggested recently

* This work was done in part under a grant from the Douglas Smith Foundation for Medical Research of the University of Chicago.

by one of us[1] that similar respect may be due the bile and that it may under certain circumstances acquire a destructive power in the same manner as the gastric juice. The most obvious constituent of the bile which has a toxic and destructive power on body tissues is of course the bile salts, which may exist in solution in the bile in concentrations higher than any other material in the body fluids. As the bile is concentrated in the gall bladder the bile salt content frequently rises to 7 or 8%. While our own studies have indicated that these figures are seldom exceeded, the analyses given in two textbooks of physiological chemistry, Hawk's[2] and Hammarsten's,[3] give the normal concentration of bile salts at about 10%.

Protocols. Two forms of bile salts were used: (1) so-called Purified Bile Salts (Armour and Company); (2) the same material freed by alcohol extraction from the very large percentage of non-alcohol-soluble material which it contains. The injections were all made by the non-traumatic technique discussed above. Twenty-two dogs were operated upon, six of these serving as controls. Sixteen dogs received 20-35 cc. of 10-15 or 20% bile salts. The controls consisted of the introduction of the catheter alone (4 dogs) and the introduction of a catheter plus a washing of the gall bladder with normal salt solution (2 dogs). All the controls showed normal gall bladders with the exception of one which revealed a little bleeding on the serosa. The purified bile salt injections, in every concentration used, gave inflammatory reactions of the gall bladder. The commercial bile salt preparation gave positive results regularly in a concentration of 15-20%, whereas in a concentration of 10% the results were two positive and two negative. Thus the purified form seems the more active.

The result of these injections was the production of an acute cholecystitis more closely resembling that found in the human being than any the authors have ever encountered experimentally. The gall bladders were enormously enlarged and very hard, while the cystic ducts were obviously sclerosed and shut. The color of the gall bladder was greyish-white, streaked with hemorrhages and bile-stained spots, as found in the acute form of human cholecystitis. Several of the dogs died of bile peritonitis without any demonstrable macroscopic opening in the gall bladder. The adjacent viscera in many cases were fastened to the gall bladder by fresh, fibrinous adhesions. The gall bladder walls were as much as 7 or 8 mm. thick,

1 Andrews, E., *Surg. Gyn. Obst.*, 1935, **60**, 239.

2 Hawk, Practical Physiological Chemistry.

3 Hammarsten, O., Textbook of Physiological Chemistry.

and stiff and unbending. On microscopic examination the mucosa appeared normal or as nearly so as it usually does in human cholecystitis. The muscularis was moderately edematous and contained a considerable number of large and small mononuclear cells with a marked scarcity of polymorphonuclear leucocytes. The reaction appeared to take place mostly in the serosa which was 8 to 10 times its normal thickness, being tremendously edematous, showing marked hyperemia and a number of punctate hemorrhages, together with the characteristic dilatation of lymphatics and moderate infiltration of round cells. The picture was similar but very much more marked than that produced by protein injection and resembled with a surprising accuracy that of acute human cholecystitis, differing markedly from the effects of bacterial injection.

Considering the relatively slight increase in bile salt concentration beyond the 6-10% supposed to be normal for the human, these results may be looked upon as decidedly significant and further experiments are being undertaken to investigate the effect on this phenomenon of changes in the acid base equilibrium, variations of the osmotic pressure of its contents and other factors which might influence it.

8262 P

Non-Bacterial Cholecystitis. The Mechanism of Acidification of Bile in the Gall Bladder.*

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Okada[1] called attention to the marked acidification of the bile during its concentration in the gall bladder. However, the mechanism by which this acidification takes place has never been completely elucidated. Ravdin[2] studied the question and found that dog's liver bile had a pH of 7.1 or even higher and attributed the acidification in the gall bladder to some unknown anion. This present study has consisted of parallel analyses of the gall bladder and liver bile

* This work was done in part under a grant from the Douglas Smith Foundation for Medical Research of the University of Chicago.

1 Okada, S., *J. Physiol.*, 1915, **1**, 114.

2 Ravdin, G. G., Johnstone, C. G., Riegel, C., and Wright, L. L., *Am. J. Physiol.*, 1932, **100**, 317.