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.

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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

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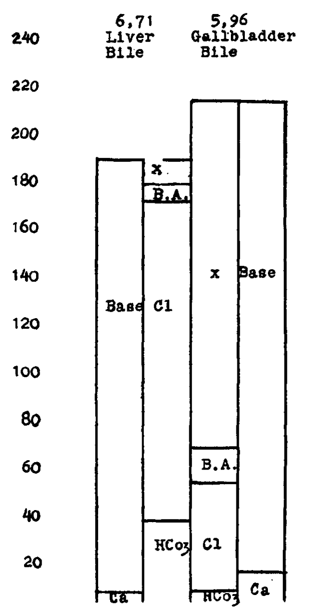
1 Okada, S., *J. Physiol.*, 1915, **1**, 114.

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

TABLE I.

	pH	CO_2	Mg. % Cl	Mg. % B.A.	Mg. % P	M Eq L Base	Mg. % Ca	Mg. % Mg	Mg. % Tot. N	Mg. % NPN	Mg. % Prot. N	G. % Solids
Liver bile	6.71	95.5	243.6	204.5	27.5	187.5	8.8	pract. none	178.4	12.4	166.1	6.6
Gall bladder bile	5.96	20.5	79.8	719.5	200.9	211.2	24.3	pract. none	382.7	43.5	339.1	21.1
Ratio of concentration	—	0.21	0.32	3.6	7.3	1.1	2.8	—	2.2	3.5	2.0	3.2



Anions and Cations in M Eq/L
CHART 1.

in which all of the principal factors affecting the acid-base equilibrium were estimated. (Chart I.)

Special stress is laid on the method of obtaining the bile because in many of the previously reported cases the effects of anesthesia and other extraneous phenomena could not be ruled out. In our dogs the liver bile was collected after first performing a laminectomy in the mid-dorsal region under local anesthesia and a trans-section of the spinal cord. Following this, when the dog had recovered from the shock, a laparotomy was performed, the cystic duct clamped, and the common duct cannulated, the cannula being connected with a tube leading to a glass container in which the bile was collected under oil. This elaborate technique was necessary as repeated attempts to secure bile under a number of different anesthetics showed us that the quality of the bile was markedly affected by the drug. This technique gave us a constant flow of clear bile without any admixture of air or blood, Special care was taken to determine the carbon dioxide and pH of the bile immediately. Standard methods of blood and urine analyses were used throughout except with the phosphorus, for which the specimens were ashed in a muffle furnace.

The averaged analytical results from 7 liver and 12 gall bladder biles are reported in the chart. The very high carbon dioxide content of liver bile (confirmed by a series of 30 separate analyses) undoubtedly explains why the pH level is distinctly lower than that reported by previous investigators,[2] who omitted the same precaution to avoid loss of gas. In the gall bladder bile the low CO_2 value is a reflection of the decreased pH. The concentration of total base is essentially unchanged, while the considerable loss of chloride is more than compensated by an even more marked rise in phosphorus content. This last, in conjunction with the increase in concentration of protein (which must possess notable base-binding power), therefore accounts for the acidification of the gall bladder bile. The rise in bile-acid concentration also contributes slightly to this effect.