

development of the gross symptoms, it seems to us that the gross symptoms of scurvy are secondary changes arising as a result of the altered metabolism of the vitamin C deficient animal. The reduction test is a convenient qualitative method for testing for scurvy and for anti-scorbutic substances. We have found that vitamin C is rapidly returned to the adrenals when orange juice is fed to animals with scurvy. This indicates that the cortex of the adrenals has not changed in scurvy enough to interfere with storage. The gross symptoms disappear as a result of the restoration of normal metabolism incident to vitamin C replacement.

Quantitative studies are in progress for determining the amount of vitamin C in the adrenals under varying conditions.

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**Spontaneous Duodenal Ulcers in Dogs with Chronic Mild Icterus and Hepatitis.**

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We reported a method<sup>1</sup> for the plastic reconstruction of the common bile duct in which a viable tube was made from a flap of the pyloric mucosa. The tube was connected to either the gall bladder or the common duct, the gastric orifice of the tube being constructed to prevent regurgitation.

Seven dogs were kept to observe chronic effects. Of the 7, five (Dogs 1, 5, 7, 8, 9) have developed duodenal or gastric ulcers after 3 months. After 3 months all dogs showed an elevated icteric index, even though bile could be detected easily in the feces or gastric contents. On autopsy all dogs except one, which is still alive at 21 months, had varying degrees of biliary cirrhosis and hepatitis. Four of the 7 (Dogs 3, 4, 5, 9) developed ascites.

Very brief protocols of the 7 dogs will be given. Dog 1 died at 9 months from a perforated gastric ulcer and 2 duodenal ulcers. Dog 7 died at 5½ months with a duodenal ulcer. Dog 8 died at 3 months from a perforated duodenal ulcer. Dog 4 developed ascites (5 liters) and died without an ulcer at 7 months. At this

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<sup>1</sup> Schrage, Ivy and Morgan, *Surg. Gynec. and Obstet.*, 1932, **54**, 613.

time the 3 remaining dogs were started on "gastric mucin" (30 gm. daily by mouth). Dog 3 at 7 months post-operatively had ascites but no ulcer when started on mucin. The ascites disappeared and the icteric index decreased from 5 to 3. This dog is now fat and well at 21 months and is still on gastric mucin. Dog 5 at 7 months had such a huge ascites that he could not stand. He had an ulcer as demonstrated by tarry stools. The ascites disappeared in one month after institution of mucin, the blood disappeared from the stools and the dog became fat. Mucin was stopped. The ascites and icterus returned and the stools became tarry. Mucin was started again and the blood disappeared from the stools and the icterus and ascites decreased. After 3 weeks the dog was etherized and only 300 cc. of ascitic fluid was found. Two duodenal ulcers were present with healing edges, only one of which bled on manipulation. Multiple gall stones of the pigment variety were present in the gall bladder, one of the stones measuring 10x8x7 mm. Dog 9 at 6 months had a slight ascites and an icteric index of six. The stools were not tarry, but ulcer was suspected but not proven by operation. On mucin, the ascites disappeared and the icteric index decreased to 1.5. After 17 months while on mucin, the dog developed cord symptoms, which rendered walking impossible. An enteritis developed and the dog was sacrificed at 18 months. A healed duodenal ulcer was found. The stomach was filled with bile. The cord and brain were examined by a neuro-pathologist, Dr. Weil, who found a chronic spinal meningitis with degenerative changes in the lumbar region. Acute cholecystitis was not present in any of our dogs.

Spontaneous duodenal ulcer associated with hepatitis has also been observed by Halperin<sup>14</sup> in dogs following plastic surgery on the common duct. Ulcers resulted in 7 of 9 dogs in which incomplete stenosis of the common duct was found at autopsy. Our observations parallel his findings and indicate that biliary stasis is the primary predisposing cause of the ulcer formation.

The association of spontaneously occurring duodenal and gastric ulcer with hepatitis and liver insufficiency in the dog is becoming more and more apparent. Ulcer develops spontaneously in dogs with biliary fistula,<sup>2, 3</sup> common bile duct obstruction,<sup>4, 5</sup> cincophen,<sup>6</sup> borneol,<sup>7</sup> and salicylic acid poisoning,<sup>8</sup> pancreatic duct ligation,<sup>5, 9</sup> partial hepatectomy,<sup>10</sup> Eck fistula,<sup>5, 10</sup> and adrenal insufficiency,<sup>11, 12</sup>

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<sup>14</sup> Halperin, *Surg. Gynec. and Obstet.*, in press.

<sup>2</sup> Berg and Jobling, *Arch. Surg.*, 1930, **20**, 997.

<sup>3</sup> Kim and Ivy, *J. Am. Med. Assn.*, 1931, **97**, 1511.

<sup>4</sup> Mann and Bollman, *Arch. Surg.*, 1932, **24**, 126.

in which there is a hepatitis or disturbance of liver function. (In dogs operated according to the Mann-Williamson method, Fauley and Ivy have not found evidence of histologic change in the liver, but liver function tests have not been used.) Whether an hepatic disorder is associated with the occurrence of ulcer in man cannot be stated, since as far as we have been able to find, no studies of liver function and histology have been made in ulcer patients. In this connection it is of interest that Shapiro and Lifvendahl<sup>13</sup> found at autopsy 4 duodenal ulcers in 15 cases of tumors of the extra-hepatic ducts, in which there occurs, of course, a progressive icterus with liver damage.

## 6637

### Time Factors Concerned in the Germicidal Action of Ultraviolet Light.

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The effect of radiant energy has long been known to be the result of a certain intensity working in a given period of time, during which period a definite amount of energy is being transferred to the object irradiated. Bunsen and Roscoe<sup>1</sup> have correlated these factors and state that identical effects are obtained if the product of the intensity and time is kept constant. This, however, is merely a modification of the Schwartzschild law which states that intensity multiplied by the time to the exponent K must equal a constant. The factor K is a number slightly less than one, whereas the Bunsen-Roscoe law is a special case where the exponent is equal to one, and holds true for a certain limited range of the factors (intensity

<sup>5</sup> Ivy and Fauley, *Am. J. Surg.*, 1931, **11**, 531.

<sup>6</sup> Van Wagoner and Churchill, *J. Am. Med. Assn.*, 1932, **99**, 1859.

<sup>7</sup> Quigley and Helm. Unpublished. (3 ulcers in 10 dogs.)

<sup>8</sup> Thomson. Unpublished.

<sup>9</sup> Berg and Tucker, *PROC. SOC. EXP. BIOL. AND MED.*, 1931, **29**, 68; 1932, **30**, 330.

<sup>10</sup> Bollman and Mann, *Arch. Path.*, 1927, **4**, 492.

<sup>11</sup> Oldberg, *Am. J. Physiol.*, 1930, **9**, 275.

<sup>12</sup> Stewart and Rogoff, 1926, **78**, 693.

<sup>13</sup> Shapiro and Lifvendahl, *Ann. Surg.*, 1931, **94**, 61.

<sup>1</sup> Bunsen, R., and Roscoe, H., *Ann. Physik.*, 1862, **117**, 529.