presence of DNC may account for the aerobic glycolysis which dinitro compounds produce in tissues.[6]

In subsequent experiments with iodoacetate poisoned yeast, carried out in the manner described above with M/1500 iodoacetate in the pH 6 buffer, it was found that DNC gave no acceleration of cytochrome reduction even when lactate or glucose was present. Since others[7] have observed that iodoacetate blocks the acceleration by 2,4 dinitro phenol of respiration in yeast, it is likely that some sulfhydryl containing enzyme system is essential for the DNC action.[8]

We have also found that such non-specific dehydrase poisons as sodium pyrophosphate and narcotics inhibit to a limited degree the reactivity of tissues to DNC stimulation.

From the evidence available we believe it likely that DNC stimulates cellular respiration by accelerating the oxidation by cytochrome of some substrate previously or simultaneously acted upon by the anaerobic dehydrases of the cell. It is too early to say whether DNC acts as a diffusible oxygen carrier between cytochrome and the substances normally oxidized or as an artificial substitute for a co-enzyme in the activation of substrates which do not normally play an important rôle in respiration. We are continuing these studies with cell-free cytochrome and individual dehydrases in an effort to demonstrate the relation between the individual components of such a system, eliminating at the same time the complicating factors connected with variations in the permeability of the cell.

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Studies on Acholic Cachexia: IV. Relation of Biliary Diversion to Duodenal Ulcer Formation.*

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The occurrence of peptic ulcer of the duodenum after the exclusion of bile has been noted with a wide variation in frequency and the factors concerned are not clearly understood. Kapsinow and

[6] Dodds, E. C., and Greville, G. D., *Nature*, 1933, **132**, 966; Dodds, E. C., and Greville, G. D., *Lancet*, 1934, **1**, 398.

[7] Ehrenfest, E., and Ronzoni, E., PROC. SOC. EXP. BIOL. AND MED., 1933, **31**, 318.

[8] Dickens, F., *Biochem. J.*, 1933, **29**, 1141; Michaelis, L., and Schubert, M. P., *J. Biol. Chem.*, 1934, **106**, 331.

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Harvey,[1] using a cholecystnephrostomy, produced ulcer in 17 out of 43 animals. Bollman and Mann[2] by simply ligating the common ducts produced ulceration in about 60%. In the experiments of Berg and Jobling[3] in which a Rous type of fistula was used, ulcers resulted in 13 of 23. Kim and Ivy report 10% ulcers in one series[4] in which the common duct was tied, but 60% in cases of Rous fistula.

Besides the obvious acid factor, there is considerable evidence that other influences are at work. Ivy has suggested that the mechanical irritation of the tubing near the duodenum may be important. On the other hand Elman has seen but few ulcers resulting from bile fistula alone. Our own experience has been that simple duct ligature alone caused ulceration in numbers about one-half the rate usually suggested (60%), but that a very high percentage resulted from the Rous fistula which has proven very difficult technically in our hands. Berg suggests that the general condition of the dog is very important and found that animals kept under poor hygienic conditions developed ulcer in 100% while those better cared for showed only 30%.

Using the Dragstedt cannula for making the biliary fistulas we have been surprised at the freedom from this complication. Twenty such experiments have been made and not a single ulcer has developed, as evidenced either by post-mortem examination or presence of blood in the stools. These animals have been fed on various diets, some with large amounts of meat and others with high carbohydrate content. Some have undergone periods of starvation and several had one or more exploratory laparotomies. All had total fistulas in which no licking of bile occurred and all lost weight progressively. Several had lost as much as a third of body weight. Some lived over 5 months.

These experiences suggest that the general condition of the animal is not the deciding factor. It would be hard to find animals more cachetic than ours. Diet is evidently not important. In view of the fact that previously our bile fistula dogs prepared by cholecystnephrostomy or by Rous fistulas constantly developed ulcers, and that the incidence of ulcer among duct ligature dogs was high, it seems suggestive that the only common factor is concomitant liver damage. In all the above types of operations, in our hands at least, there has been a progressive development of degenerative and in-

[1] Kapsinow, R., Eagle, L. P., and Harvey, S. C., *S. G. O.*, 1924, **39**, 65.

[2] Bollman, I., and Mann, F. C., *Arch. Surg.*, 1932, **24**, 126.

[3] Berg, B. N., and Jobling, J. W., *Arch. Surg.*, 1930, **20**, 997.

[4] Ivy, A. C., and Fauley, L. N., *Am. J. Surg.*, 1931, **11**, 531.

fective changes in the liver parenchyma. In the successful type of Rous fistula (ours were usually failures) Elman found very few ulcers. Berg's experience was similar. His smoothly functioning Rous fistulas developed many ulcers while the unsuccessful ones developed many.

It appears, therefore, that the development of duodenal ulcer in the absence of bile from the intestine is partially dependent on some factor other than acid. Possibly the effect on the gastric motility of liver damage, as suggested by Still and Carlson,[7] is the deciding factor.

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Electrocardiographic Studies of Chemical Pericardial Irritation.

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Pericardial effusions, clinical or experimental, may result in electrocardiographic changes much like those of coronary occlusion or of ligation of the coronary arteries.[1–7] In experimental effusions, one must consider the effect of pressure and of possible chemical influence. Indeed, Wiggers[8] has demonstrated bizarre ventricular complexes, similar to those of effusions, resulting from applying a few cubic centimeters of potassium chloride solution to the visceral pericardium. Hence it seemed desirable to study the effects of various bland and irritating chemicals under conditions to exclude any pressure factor.

Dogs were used, with preliminary morphine sulphate 0.015 gm.

5 Kim, M. S., and Ivy, A. C., *J. A. M. A.*, 1931, **47**, 1511.

6 Elman, R., and Hartmann, A. F., *Arch. Surg.*, 1931, **23**, 1030.

7 Still, K. S., and Carlson, A. J., *Am. J. Phys.*, 1929, **89**, 34.

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1 Smith, F., *Arch. Int. Med.*, 1918, **22**, 8.

2 Smith, F., *Arch. Int. Med.*, 1920, **25**, 673.

3 Smith, F., *Arch. Int. Med.*, 1923, **32**, 497.

4 Barnes, A. R., and Mann, F. C., *Am. Heart J.*, 1932, **7**, 477.

5 Scott, R., Feil, H., and Katz, L., *Am. Heart J.*, 1929, **5**, 68, 77.

6 Bay, E. B., Gordon, W., Adams, W., *Am. Heart J.* 1933, **8**, 525.

7 Harvey, J., and Scott, J. W., *Am. Heart J.*, 1932, **7**, 532.

8 Wiggers, C., *Am. Heart J.*, 1930, **5**, 346.