and the animal is asphyxiated under conditions which permit the eye changes described above, there is a similar primary rise due to adrenal secretion, followed by the secondary thyroid effect.

7. If the thyroid glands have been previously removed, sensory stimulation and asphyxia induce only the increase of rate due to adrenal discharge.

53 (1513)

Studies in the absorption of fats.

By T. F. ZUCKER. (By invitation).

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The general impression of workers in the field of fat metabolism, with regard to the path of absorption, seems to be that while most of the fat enters the circulation by way of the thoracic duct, a smaller portion can be absorbed directly into the blood stream. The most recent discussion of the subject is by Bloor.[1] The results of previous workers are, briefly, as follows: Walther[2] recovered in anesthetized animals only a small fraction of the absorbed fat from the lymph of the thoracic duct. Munk and Rosenstein[3] recovered from the discharged lymph 60 per cent. of the fat fed to a patient with lymph fistula. Frank[4] tied off the thoracic duct after feeding fat and still found the fat of the blood to increase during absorption. Hamburger[5] tied off three equal-sized loops of intestine and in the central loop ligated all lymph vessels. Then after injecting an oil and soap emulsion, he noted that this was absorbed from the central loop despite the tying off of the lymph vessels, although it was distinctly less in amount than in the control loops. Munk and Friedenthal,[6] in a preliminary communication, describe experiments similar to those of Frank, but use more precautions, such as tying off the

[1] Bloor. *Jour. Biol. Chem.*, 1916, XXIV, 457.

[2] Walther, *Archiv. f. Physiologie*, 1890, p. 328.

[3] Munk and Rosenstein, *Virchow's Archiv*, 1891, CXXIII, 230.

[4] Frank, *Archiv. f. Physiologie*, 1892, p. 497; 1894, p. 297.

[5] Hamburger, *Archiv. f. Physiologie*, 1900, p. 554.

[6] Munk and Friedenthal, *Zentralb. Physiologie*, 1901, XV, 297.

ductus lymphaticus communis dexter, besides the thoracic duct, to avoid possible anastomoses. In general, their findings are the same as those of Frank and they also conclude that the blood can absorb products of fat digestion directly from the intestine.

d'Errico[1] approached the subject from a different angle. He determined the amount of ether extract in simultaneous samples of portal and jugular blood of an animal near the height of fat absorption after a meal. He finds more ether extract in the portal than the jugular blood and concludes that direct absorption by the blood takes place.

In criticizing d'Errico's work we must say that ether extract from blood and blood fat are not the same,[2] as d'Errico's own results show, since he finds even after feeding fat, not more than a maximum of 412 mg. of ether extract per 100 c.c. of blood, while the "total fat" of fasting blood is usually 600 mg. or more. d'Errico's ether extract was probably principally the cholesterol, plus small quantities of other lipoids. The work of the other authors mentioned above all has this in common, that the conditions of the experiment are far removed from the normal, and in several cases the analytical technique leaves much to be desired.

In connection with another research, our attention was called to the fact that this point had never been settled and we undertook a few experiments similar to those of d'Errico, but using the newer analytical procedures of Bloor[1] for the determination of cholesterol, fatty acids and phosphatides. In the phosphatide determination, Kober's strychinine molybdate reagent was used. Hemoglobin was determined by the acid hematin method using a Dubosq or Kober colorimeter. In the earlier experiments, ether was used as anesthetic, but since ether inhibits the absorption of fats quite markedly, we dispensed with the anesthetic and instead stunned the dog by a quick blow on the occiput. This, when properly executed, is quite humane and very suitable for the requirements of our experiments. The following is the protocol of one of the experiments of which there were five in all.

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[1] d'Errico, *Arch. fisiol.*, 1907, IV, 513.

[2] See Klein and Dinkin, *Zeitschr. physiol. Chem.*, 1914 (XCII), 302; Kumagawa and Suto, *Biochem. Zeitschr.*, 1908, VIII, 212; Hürthle, *Ztschr. physiol. Chem.*, 1895. XXI, 331.

A sample of jugular blood was taken from a dog of 14 kg. weight at 12:45, and then 50 c.c. of olive oil were given by stomach tube. Another jugular sample was taken at 3:45. At 4:45, the dog was stunned, the abdomen was opened and samples of portal and mesenteric blood taken. Then another sample of jugular was taken. The analyses of these samples are given in the table in gms. per 100 c.c. of blood. The cholesterol remains constant. The administration of 50 c.c. of olive oil raised the phosphatides 36 per cent. and the fatty acids 49 per cent. There is no difference, within the limits of error of the method (5 per cent.), between the jugular, mesenteric and portal. The absorption in this particular experiment was moderate. In another experiment, the fatty acids were increased 90 per cent. and still there was no difference between the portal and jugular.

	Cholesterol.	Phosphatides.	Fatty Acids.	Hemoglobin.
12:45. Jugular before giving oil...	.23	.42	.65	125%
3:45. Jugular.....	.22	.52	.93	123%
4:45. Animal stunned, portal.....	.23	.57	.98	126%
Mesenteric.....	.22	.56	.97	122%
Jugular.....	.23	.58	1.02	125%

To sum up the evidence then, we can safely say (1) that d'Errico's findings cannot be accepted because of the methods employed, and that they are not corroborated by our own data, (2) that in the experiments in which tying-off of lymph vessels was done, absorption may have been due to the lymph stasis, and (3) that the data here presented preclude the assumption of any very marked participation of the blood vessels in the absorption of fat leaving open the question of absorption of small amounts beyond the detection of the methods used.

54 (1514)

Studies in the diastatic activity of the blood and blood sugar curves indicating a decreased carbohydrate tolerance in hyperthyroidism.

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In studying the carbohydrate tolerance in hyperthyroidism and other conditions, three methods have been employed, the