

initiated. When introduced properly the dog uniformly falls to sleep.

The dog demonstrated has a pouch of the entire stomach with vagi intact and a jejunal fistula. The pylorus was cut across, the duodenal end closed and the gastric end brought to the outside. The jejunal fistula was made prior to this operation. This animal has been fed solely through the jejunal fistula for 18 weeks and has been losing all gastric juice (400-600 cc. daily) for a period of 16 weeks. He has received nothing subcutaneously or intravenously except $1\frac{1}{2}$ gr. ferric citrate subcutaneously during the past 3 weeks every other day because he became somewhat anemic. His blood is now normal. The blood chloride level can be varied at will by removing or adding sodium chloride to his diet. The dog now weighs as much as he did prior to operation (24 pounds). At $2\frac{1}{2}$ months a stomatitis with ulcers appeared, which disappeared as vitamins were added to the diet and the mouth was washed daily with lemon juice.

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Studies on the Specificity and Behavior of Blood and Tissue Lipases.

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It has long been known that the lipase normally present in the blood will not split true fats,¹ and that the pancreas contains much greater amounts of a true fat-splitting lipase than do any other organs. A search of the literature has failed to reveal any report of the appearance in the blood of a fat-splitting lipase in experimental pancreatic injury, although it is well known that such injury increases the blood diastase.

We have studied the blood lipases of 5 dogs with experimental pancreatic injury; in one of these animals, the pancreatic ducts were ligated, in one the tail of the pancreas was doubly ligated and severed from the body, and in the remaining 3 the body of the pancreas was removed, leaving the head and tail free in the mesentery. The blood lipases were followed in these animals, using olive oil and ethyl butyrate as substrates. In making determinations on olive

¹ Oppenheimer, C., *Die Fermente und ihre Wirkungen*, Leipzig, 1925, 5th ed., 489.

oil a 50% emulsion of the oil previously freed from fatty acid and containing 5% of acacia as an emulsifying agent and 0.2% of sodium benzoate as a preservative was used. One cc. of serum, 2 cc. of the olive oil emulsion, 3 cc. of distilled water, and 0.5 cc. of a normal phosphate buffer adjusted to pH 7.0 were shaken together and incubated at 40°C. for 24 hours. For ethyl butyrate determinations, 1 cc. of ethyl butyrate (absolute) was substituted for the olive oil emulsion. After incubation 3 cc. of 95% alcohol and 3 drops of 1% phenolphthalein were added and the mixture titrated with N/20 acid to a faint pink. Controls containing 1 cc. of serum inactivated by heat were run simultaneously. A lipase capable of hydrolyzing olive oil appeared in the blood of all animals very promptly, the highest values observed being attained within 24 hours. In the animal with ligation of the pancreatic ducts this lipase had completely disappeared within 20 days and in the animal with separation of the tail within 14 days. Of the 3 animals with removal of the body of the pancreas 2 are still living, 50 and 30 days after operation, and an olive oil lipase is present in the blood of both, although it has decreased steadily since operation. The esterase which hydrolyzes ethyl butyrate was not consistently changed; in the animal with duct ligation it first fell slightly, then as the olive oil splitting lipase disappeared, it rose somewhat above the control value. In one of the animals with removal of the body of the pancreas it rose suddenly to 3 times control value on the 30th day and has remained above normal since that time.

The blood lipases have been studied in 7 dogs with Eck fistulas, 51 determinations having been made on these animals. In 31 of these determinations positive values for an olive oil splitting lipase have been obtained. This lipase usually does not appear until 2 or 3 weeks after operation, and the longer the period since operation the more commonly the olive oil lipase is present. Even in the older animals, however, it is subject to marked variation which may be related to alimentation, since this lipase usually disappears on fasting. The highest values obtained for olive oil lipase in the Eck fistula animals have been about one-third of the values found in the dogs with pancreatic injury. For the most part the serum esterase (ethyl butyrate) determinations in Eck fistula dogs have yielded values well within normal limits, although we have occasionally found high values; similar findings for ethyl butyrate esterase have been reported by Whipple.²

Studies have been made on 5 dogs with complete obstructive

² Whipple, G. H., *Bull. Johns Hopkins Hosp.*, 1913, **24**, 357.

jaundice. In all of these relatively large amounts of an olive oil splitting lipase have appeared in the blood, while the ethyl butyrate splitting esterase has not changed. The olive oil lipase is present about 6 hours after the operation and reaches its maximum in about 48 hours. However, in one animal which refused food postoperatively no such lipase appeared in the blood until the 72nd hour.

Determinations of the lipases acting on olive oil and on ethyl butyrate have been made on glycerol extracts of brain, muscle, spleen, kidney, liver, intestinal mucosa, lung and pancreas. All of these extracts were active on ethyl butyrate, liver extract being by far the most potent. Pancreas, intestinal mucosa, liver, and spleen extracts were found to contain a lipase capable of splitting olive oil, activity being in the order named. A trace of olive oil lipase was present in the kidney extract.

The appearance in the blood of dogs with pancreatic injury of a lipolytic activity which is not normally present is best interpreted, we believe, as a demonstration of the specificity of pancreatic lipase. It could also be due to the appearance in the blood of a coenzyme which activates the normal blood lipase. The lipolysis of olive oil by serum after liver injury is more difficult of interpretation. It could be due to absorption of this lipase from the injured liver into the blood. The possibility that this lipase is normally passing into the blood from the gastro-intestinal tract and that the injured liver fails to remove it while the normal liver acts as a barrier to this substance must also be considered. We consider the latter supposition the more likely; further work will be done on this question.

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Presence of an Olive Oil Splitting Lipase in the Blood of Patients With Multiple Sclerosis.

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Recently Brickner¹ has reported that the blood of patients with multiple sclerosis causes a myelinolysis of the spinal cords of rats *in vitro*; he has also found that serum from these patients becomes less alkaline on standing than does serum from normal individuals;²

¹ Brickner, R. M., *Arch. Neurol. and Psychiat.*, 1930, **23**, 715.

² Brickner, R. M., *Bull. of the Neurol. Inst. of N. Y.*, 1931, **1**, 105.