weighing between nine and fifteen kilograms each were selected. Both the fasting nitrogen elimination and the effect of glucose feeding on this excretion were determined. During the fasting period the animals received only 40 c.c. of water per kilo. On the sugar days they received in addition 15 gm. of glucose per kilo. An after-period during which the glucose feeding was withdrawn was then introduced. Dr. Allen, of the Rockefeller Institute, then removed surgically about 90 per cent. of the pancreas. The wounds healed aseptically and the animals were allowed from two to five weeks to recuperate. The procedure consisting of fore-glucose and after-periods just described was repeated. In spite of the large loss of pancreatic tissue the protein-sparing action of glucose was not diminished in any of the animals. It appears that pancreatic tissue is provided far in excess of actual requirements or that this gland is not solely responsible for the protein-sparing action of carbohydrates. Dr. Ringer found this function intact in dogs made completely diabetic by means of phlorizin.

150 (1328)

Studies in experimental shock.

By **T. S. GITHENS** and **S. J. MELTZER.**

[*From the Department of Physiology and Pharmacology of the Rockefeller Institute for Medical Research.*]

The experiments were made on etherized dogs. The intestines and stomach were dislocated and frequently handled. Two manifestations were studied, the blood pressure and the pain sense. We shall state merely the facts obtained.

About one third of the dogs were given a preliminary injection of morphin. Some of the animals were given ether by cone, others by the method of intratracheal insufflation. These factors had no apparent influence on the results.

There were 42 dogs which received surgical narcosis. In 15 the blood pressure never reached a level below 95 mm. even when the experiment lasted 4 hours or longer, and sensation returned as soon as the animals came out of ether. In 13 dogs the blood pressure reached a level below 70 mm. of mercury within two and

a half hours and there was no return of pain sense. In 8 dogs the blood pressure sank to a low level but sensation of pain returned when ether was discontinued. In the remaining 6 dogs sensation was lost while the pressure was still above 95 mm. of mercury.

In 10 other dogs etherization was pushed to the point of intoxication. Interpretation of the results of this series is not simple, but it may be stated that the blood pressure, which fell in some instances to 42 mm. often continued to rise for as much as two hours after stopping the ether, eventually reaching a level above 90 mm. Pain sense sometimes returned after an even longer interval, but eventually recovered more completely than the blood pressure.

151 (1329)

Further observations on the nutritive factors in animal tissues.

By LAFAYETTE B. MENDEL and THOMAS B. OSBORNE.

[*From the Sheffield Laboratory of Physiological Chemistry in Yale University, and the Laboratory of the Connecticut Agricultural Experiment Station, New Haven.*]

A recent communication[1] reported that the proteins of meat (dried skeletal muscle) and of a glandular tissue, liver, are adequate for the needs of nutrition in growth. The muscle contains a comparatively small quantity only of the water-soluble vitamine that is an essential dietary factor, whereas liver tissue, on the other hand, was found to be much richer in this. We have further observed a similar adequacy of the proteins of heart, kidney and brain tissue. The growth of rats to adult size has been secured upon diets in which these tissues, used desiccated, furnished the sole source of protein and water-soluble vitamine. In the cases of the liver, kidney and heart, at least, fat-soluble vitamine also seems to be present. The ether extract of pig's liver—liver oil—has manifested growth-promoting properties comparable to those described for butter fat and cod-liver oil; and it appears to be efficient as a curative agent for the type of eye disease which we

[1] Osborne, T. B., and Mendel, L. B., "Nutritive Factors in Animal Tissues," I, *Jour. Biol. Chem.*, 1917, XXXII, 309.