individual dog are relatively constant over the period of one month of controlled conditions, and that there may be large differences between one dog and another. The lowest values for cholesterol and total fatty acid were given by young dogs, and the highest values were obtained from an old dog.

If the values are arranged in order of magnitude, the sequence for total fatty acids and cholesterol are roughly the same.

5046

Accumulation of a Precursor of Lactic Acid in Muscle After Epinephrine Injections.

C. F. CORI AND G. T. CORI.

From the State Institute for the Study of Malignant Disease, Buffalo.

It has been found recently[1] that the glycogen content of the rat gastrocnemius diminishes on an average by 101 mg. % 30 minutes after an epinephrine injection, while the lactic acid content of the muscle increases by only 29 mg. %. Part of the lactic acid formed in muscle diffuses into the blood but even if one allows for this on the basis of the increase in blood lactic acid (which amounted to 21 mg. %), one arrives at a total of only 40 mg. % lactic acid. Hence, 61 mg. % of the muscle glycogen which disappears remains to be accounted for.

Three hours after an epinephrine injection, when the blood lactic acid has returned to the original level, a much larger portion of the disappearing muscle glycogen can be accounted for.[2] The liver glycogen formed from blood lactic acid including that part which is mobilized again, makes up for 83% of the glycogen lost from the muscles. The rest is such a small amount that it might have been oxidized without appreciably affecting the R.Q. which was 0.715 for the 3 hour period after the injection. Since most of the muscle glycogen which remains unaccounted for 30 minutes after the injection eventually (within 3 hours) yields liver glycogen by way of blood lactic acid, it seemed desirable to look for a substance, intermediary between glycogen and lactic acid, which might have accumulated in muscle owing to the fact that the conversion of glycogen

[1] *Am. J. Physiol.*, in press.

[2] Cori, C. F., and Cori, G. T., *J. Biol. Chem.*, 1928, lxxix, 309.

into the precursor proceeds more rapidly than the conversion of the latter into lactic acid.

It seems fairly well established that the lactic acid precursor in muscle is a hexose-phosphoric acid ester. A fall in the inorganic phosphates of the blood and in phosphate excretion in the urine has been observed after epinephrine injections[3] but the nature of this decrease has not been explained. In the experiments referred to above[1] a decrease in the inorganic phosphates of muscle amounting on an average to 5.8 mg. % has been found 20 minutes after the epinephrine injection, while there was no change in phosphocreatine. If one assumes the formation of a hexose-monophosphoric acid, this would account for the disappearance of 24 mg. of glycogen.

The methods for the determination of hexose phosphoric acid in tissues have not been worked out completely and in view of the difficulties experienced in the past great caution should be exercised. Embden and Jost[4] made use of the fact that hexose phosphoric acid is precipitated by ammoniacal alcohol in the presence of an excess of magnesium ions. Their method is being subjected to a thorough examination and this will be reported later. Since the magnesium precipitate includes varying amounts of other phosphorus compounds only the hexose can be determined with any degree of certainty at the present time.

Rats, starved previously for 24 hours, were anesthetized with amytal and one gastrocnemius muscle was removed by cutting it at the tendons. The second muscle was extirpated one half hour later. The muscle was immediately thrust into a tared tube containing ice-cold trichloracetic acid, was thoroughly ground with sand and the filtered extract was allowed to stand until the next day. The precipitation of the hexose phosphoric acid was carried out as described by Embden and Jost and the reducing power was determined by means of the Hagedorn and Jensen method. The following values given in mg. of glucose per 100 gm. muscle were obtained in 6 control animals.

Muscle I—61.0; 55.3; 41.2; 41.7; 47.5; 53.2; ave. 50.0.

Muscle II—64.8; 55.8; 38.8; 43.0; 48.6; 52.3; ave. 50.5.

When 0.02 mg. of epinephrine per 100 gm. rat was injected subcutaneously immediately after removal of muscle I and muscle II extirpated 30 minutes later, the following results were obtained:

Muscle I—42.3; 55.3; 45.6; 39.2; 46.2; 45.5; 48.8; ave. 46.1.

[3] Perlzweig, D. A., Latham, E., and Keefer, C. S., PROC. SOC. EXP. BIOL. AND MED., 1923, xxi, 33.

[4] Embden, G., and Jost, H., *Z. Physiol. Chem.*, 1928, clxxix, 24.

Muscle II—65.5; 94.0; 59.0; 86.5; 85.7; 71.7; 88.3; ave. 78.7.

Lactic acid (40 mg.) and its precursor (32 mg.) are thus seen to account for 73% of the muscle glycogen which disappears in 30 minutes after the epinephrine injection. Since a deposition of liver glycogen from blood lactic acid occurs shortly after the injection, part of the remaining 28 mg. is probably accounted for by this process.

A decrease in the inorganic phosphates of the blood has also been observed after insulin injections.[5] Since muscle glycogen increases under these conditions, it seems possible that the same chemical transformations occur as after epinephrine injections but in the opposite direction. This is being investigated at the present time.

5047

Cinematography of the Vocal Cords.

CHARLES A. MORRISON. (Introduced by J. R. Murlin.)

From the School of Medicine and Dentistry, University of Rochester.

A new technique for making motion pictures of the vocal cords has been developed by the use of a quartz rod as the means of projecting a high intensity illumination within the larynx. The source of light consists of the two filaments of an overvolted automobile bulb. A laryngoscope, illuminating system and viewing finder are attached to a 16 mm. motion picture camera. This combination forms a self-contained, one-man-controlled unit, which permits motion pictures of the cords to be made at the standard rate of 16 frames per second. The field photographed is viewed constantly through the finder by the operator, who controls the spring motor of the camera by the usual release button. The pictures as projected fill the entire screen area. This is a magnification previously unattained under these conditions.

[5] Harrop, G. A., and Benedict, E. M., PROC. SOC. EXP. BIOL. AND MED., 1923, XX, 430.