Western New York Branch.

University of Rochester School of Medicine and Dentistry, February 26, 1927.

3449

On the Carbohydrate Metabolism of Adrenalectomized Rats.

CARL F. CORI AND GERTY T. CORI.

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

It is known that adrenalectomized cats and dogs frequently have a blood sugar concentration below normal. These two species survive the operation only a short time, and the animals generally refuse to eat some time before death. It was, therefore, not certain whether the low blood sugar was a symptom of adrenal insufficiency, or whether it was due to the imminent death of the animals, since a low blood sugar before death from other causes is not uncommon. On the other hand, a larger percentage of adrenalectomized rats survive the operation for a long time. About 20 per cent of our operated animals 10 to 14 days after removal of both glands had maintained their original body weight or even surpassed it. Incidental to other work, it was noted that these rats showed a low blood sugar when they were fasted for 24 hours. Six rats showed a blood sugar ranging from 53 to 79 mg. per cent. A simultaneous analysis of the liver and the rest of the body tissues revealed that there was practically no liver glycogen present, while the rest of the body tissues, chiefly the muscles, showed a normal glycogen content. The absence of liver glycogen explains the low blood sugar of these animals, since the liver glycogen is the only source for blood sugar. There is good evidence that the muscle glycogen does not participate in blood sugar regulation. When normal rats are fasted for 24 hours, the blood sugar rarely falls below 0.1 per cent and there is from 0.4 to 1.0 per cent liver glycogen present. Even after a 48 hour fast there is sufficient liver glycogen present to maintain a normal blood sugar concentration. The lack of liver

glycogen in fasting adrenalectomized rats may have two causes. Either the polimerisation process or the new formation of glucose from proteins is disturbed. The first possibility has been tested experimentally by determining the rate of glycogen formation in the liver after feeding glucose by stomach tube. Five adrenalectomized rats, fasted previously for 24 hours, formed an average of 3.2 per cent liver glycogen during 4 hours of glucose absorption, while normal rats formed 3.7 per cent. Glycogen synthesis is, therefore, not disturbed in adrenalectomized rats. For this reason the blood sugar and the liver glycogen of non-fasting adrenalectomized rats are normal. The second possibility has not been tested experimentally so far. The question is whether the lack of liver glycogen during fasting has to be linked with the loss of cortical tissue, or with the absence of epinephrine secretion. It is of interest in this connection that small doses of epinephrine given to animals rendered free from liver glycogen lead to glycogen synthesis (Pollack,[1] Kuriyama[2]). While large doses of epinephrine produce glycogenolysis, small doeses have the opposite effect.

When fasting adrenalectomized rats received an insulin injection simultaneously with the glucose feeding, an average of 0.9 per cent liver glycogen was formed. This inhibition of glycogen synthesis in the liver following an insulin injection has been observed previously on normal rats.[3] In experiments where 90 per cent of the absorbed glucose could be accounted for by oxidation plus glycogen formation in the liver, and in the rest of the body tissues, the amount of glucose that failed to be deposited in the liver of insulinized rats appeared in the balance as oxidized. The interpretation was that due to an increased oxidation of glucose in the muscles, as the result of a surplus of insulin, not enough glucose was left for glycogen formation in the liver. Insulin effected a shift in the disposal of glucose from the liver into the muscles. In other words, the inhibition of glycogen formation in the liver was assumed to be a secondary phenomenon. On the other hand, the hypoglycemia produced by insulin seems to lead to an increased discharge of epinephrine. (Cannon, McIver and Bliss.[4]) It was, therefore, of importance for the interpretation of the mechanism of insulin action to repeat these experiments on adrenalectomized animals. There was no marked difference in the carbohydrate metabolism of normal and adrenalectomized animals. Emphasis is here laid on the fact that the inhibition of glycogen synthesis in the liver of insulinized animals is not due to the action of epinephrine. Insulin injections have also been shown to cause a diminution of liver gly-

cogen in animals in the post absorptive state. A repetition of these experiments on adrenalectomized mice gave the same result. This phenomenon is, therefore, not connected with an increased discharge of epinephrine.

This is a preliminary report.

[1] Pollack, L., *Arch. exp. Path. u. Pharm.*, 1909, lxi, 149.

[2] Kuriyama, S., *J. Biol. Chem.*, 1918, xxxiv, 269.

[3] Cori, C. F., *J. Biol. Chem.*, 1926, lxx, 577.

[4] Cannon, W. B., McIver, M. A., and Bliss, S. W., *Am. J. Physiol.*, 1924, lxix, 46.

3450

Bacteriologic Studies in Acute Rheumatic Fever with Reference to Soluble Toxin Production.

KONRAD E. BIRKHAUG.

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

An extensive comparative study was made of the production of soluble toxins by hemolytic and non-hemolytic streptococci, isolated from a large series of normal and diseased individuals. The author encountered a strongly toxigenic strain of a non-hemolytic, non-methemoglobin-forming, inulin-fermenting, bile-insoluble, gram-positive streptococcus, isolated on March 24, 1926, from blood-cultures of a 5-year-old girl, ill with acute rheumatic fever, endocarditis, myocarditis, pericarditis, and pleurisy. Post mortem, the identical organism was isolated from the vegetations on the mitral valves, as well as from the heart's blood. In subsequent studies, a similar non-methemoglobin-forming streptococcus was regularly isolated from the tonsillar crypts, abscesses, and irregularly from blood-cultures, heart-vegetations, feces and urine, of persons with rheumatic fever and the allied forms of this protean disease. Culturally, serologically, and toxigenically, this new type of non-methemoglobin-forming streptococci was found to constitute a closely related group of micro-organisms, distinguishable from the *Streptococcus viridans* and *Streptococcus hemolyticus* groups. (Table I.) For toxin production, the tryptic medium employed was the original Douglas'[1] tryptic medium digest, modified by Hartley,[2] Watson and Wallace,[3] and the cultures were incubated at 37°