The blood sugar level and the O_2 consumption were higher in the rats injected with active extract than in the controls. The dose of insulin injected produced in both groups of animals only slight changes in carbohydrate oxidation and glycogen storage.

Summary. Rats fasted for 24 hours, when injected intraperitoneally with one cc. of anterior lobe extract shortly before glucose feeding, show a marked decrease in the amount of carbohydrate oxidized and a corresponding increase in the amount of glycogen deposited in liver and muscles, when compared with control rats treated exactly alike and injected with 1 cc. of heat-inactivated extract.

9226 P

Relative Effectiveness of Iodine in Thyroxin, Diiodotyrosine, and Potassium Iodide in Inducing Metamorphosis in Amphibia.*

ALLEN LEIN. (Introduced by Bennet M. Allen.)

From the Department of Zoology, University of California, at Los Angeles.

It has been demonstrated repeatedly by several workers that the tadpole test for thyroid is an extremely sensitive one, and this method has been used extensively in determining the amount of thyroid-like activity in various substances. Using this test, Swingle,[1] in a series of publications, advanced evidence which indicated that iodine appeared to function independently as a hormone without the intermediation of the thyroid gland. This hypothesis received confirmation from the work of several additional experimenters. Among the iodine-containing compounds used in these tests, thyroxin and diiodotyrosine, due to their chemical similarity, were considered to be of particular significance. It was shown that thyroxin and diiodotyrosine produce the same physiological response qualitatively but that the former is much more active than the latter.[2, 3]

The present work was undertaken in order to obtain quantitative data on the relative effectiveness, *per unit of iodine*, of thyroxin,

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1 Swingle, W. W., *Endocrinol.*, 1918, **2**, 283; *J. Exp. Zool.*, 1919, **27**, 397, 417; *Science*, 1922, **56**, 720; PROC. SOC. EXP. BIOL. AND MED., 1926, **24**, 205.

2 Gaddum, J. H., *J. Physiol.*, 1927, **64**, 246.

3 Romeis, B., *Klin. Wochensch.*, 1922, **1**, 1262.

diiodotyrosine, and an inorganic iodine compound, potassium iodide. It was believed that such data would indicate the degree to which the action of iodine is dependent on the remainder of the molecule in which it is a constituent.

The test animals used in this work were 270 *Bufo halophilus* larvae which were selected so that there was a maximum variation of 3 mm. in body length and 5 mm. in total length; posterior limb buds measured 0.3 mm. or less. These animals were divided into 4 general groups: (1) controls, which were immersed in fresh, previously aerated tap water; (2) animals immersed in a thyroxin solution prepared to a concentration of 1 gm. thyroxin to 50,000,000 cc. of water (this solution was used as a standard throughout the experiment); (3) animals immersed in diiodotyrosine solutions prepared to have iodine concentrations ranging from that of the standard thyroxin solution to 400 times that of the standard thyroxin solution; (4) animals immersed in solutions of potassium iodide prepared to have iodine concentrations ranging from that of the standard thyroxin solution to 100 times that of the standard thyroxin solution. Extreme precaution was taken to avoid contamination and to maintain conditions as constant as possible. All solutions were made with previously aerated water; no food was given to the animals during the course of the experiment; and solutions were changed every 2 days throughout the 12-day period during which the animals were exposed to the iodine containing substances. Measurements of body length and total length of each animal were made at the beginning and end of the experiment, and measurements of the posterior limbs were made microscopically with the aid of an eye-piece micrometer.

Measurements indicated that, in accordance with the work of Allen,[4] extremely dilute solutions of thyroxin will induce precocious metamorphosis. The posterior limbs of the animals immersed in the standard thyroxin solution attained a length of 2.34 mm. as compared with 0.43 mm. in the controls. A diiodotyrosine solution having an iodine concentration equal to that of the standard thyroxin preparation had no measurable thyroxin-like activity. The most dilute solution of diiodotyrosine exerting a small but definite stimulus toward metamorphosis in the tadpoles was one having an iodine concentration 20 times greater than that present in the thyroxin used, and this stimulus toward metamorphosis increased with an increase in concentration of diiodotyrosine. Thus, tadpoles immersed in diiodotyrosine solutions having 300 times the amount of iodine

[4] Allen, B. M., *Anat. Rec.*, 1932, **54**, 45.

present in the standard thyroxin solution exhibited marked indications of metamorphosis which were comparable to those produced by the standard thyroxin solution. The posterior limbs of the animals immersed in this solution of diiodotyrosine grew to an average length of 2.04 mm. as compared with 2.34 mm. in the animals treated with thyroxin. Potassium iodide, in the concentrations used, showed no thyroxin-like properties. That this compound lacks this characteristic, however, is not a necessary conclusion for, as Swingle (1919) has indicated, still higher concentrations over greater periods of time may produce the desired effect. Experiments which may yield quantitative data on this question are now being planned in this laboratory. On the basis of the data now on hand, however, it may be said that iodine in diiodotyrosine is probably more than 5 times as active as that in potassium iodide.

Summary. Iodine as it occurs in thyroxin is over 300 times as effective in inducing precocious amphibian metamorphosis as that occurring in diiodotyrosine. The iodine in diiodotyrosine, however, is far more active than that included in potassium iodide.

9227 P

Utilization of Ketone Bodies by the Tissues in Ketosis.

RICHARD H. BARNES AND D. R. DRURY.

From The Scripps Metabolic Clinic, La Jolla, California, and Department of Physiology, University of Southern California School of Medicine.

The work of Chaikoff and Soskin[1] and Mirsky[2] has shown very definitely that the ketone bodies are produced only in the liver. Are the ketone bodies so formed utilized by the tissues in nutritional conditions giving rise to ketosis? This note deals with this question.

A male human was kept on a ketogenic diet for several days. After a definite ketonuria had developed (5 gm. ketone bodies per day), food was withheld during the morning and blood ketone concentrations at 7 A. M. and 11 A. M. were determined (the first blood 12 hours after the previous meal). The 7 A. M. blood contained 26.6 mg. ketones %, the 11 A. M. sample 10.3. The experiment was repeated on 2 other mornings with the following results:

1. Blood ketones 7:20 A. M. 26.4, 11 A. M. 9.5.

1 Chaikoff, I. L., and Soskin, S., *Am. J. Physiol.*, 1928, **87**, 58.

2 Mirsky, A., *Am. J. Physiol.*, 1936, **116**, 110.