which was kept for five days after deglycogenization 0.069 gram of glycogen was found per 100 grams of muscle.

These experiments prove that fasting diabetic dogs, even after they have been completely deglycogenized, possess the power of glycogen formation. Glucogenetic substances therefore can well be administered to animals without giving rise to extra glucose in the urine.

CONCLUSION.

I. Diabetic dogs contain glycogen in their muscles to the extent of 0.150 per cent. even after seven days of fasting and diabetes; residual glycogen.

II. This glycogen can be completely driven out by means of adrenalin.

III. Deglycogenized diabetic animals even during a period of prolonged fasting and diabetes are capable of reforming their lost residual glycogen.

IV. Failure on the part of an animal to show extra glucose elimination during the period of deglycogenization does not mean that the substance is not glucogenetic.

V. The conclusions of Sansum and Woodyatt that acetaldehyde is not glucogenetic nor antiketogenetic are objected to as invalid.

50 (1797)

Concerning antiketogenesis.

By A. I. RINGER.

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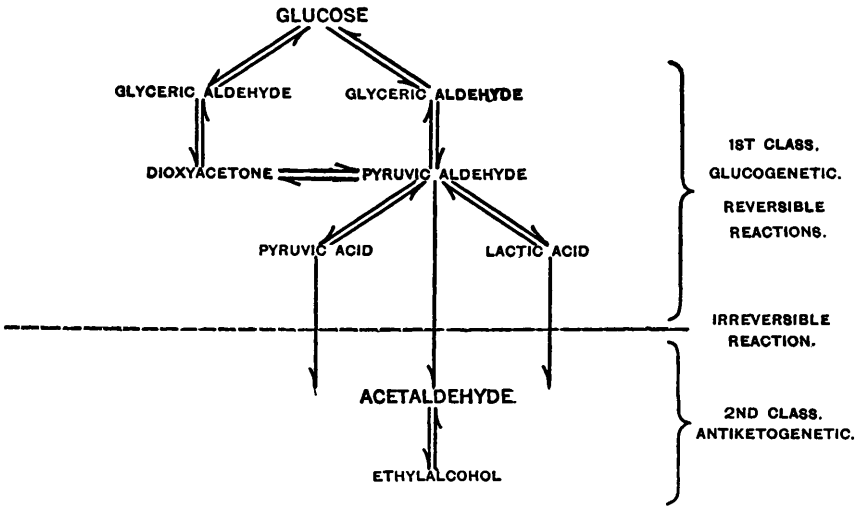
It is a well-known fact that the withdrawal of carbohydrates from the diet of normal individuals is followed by the appearance of ketone bodies in the urine. Individuals that have interference with their power to utilize carbohydrates, as diabetics, develop degrees of ketonuria that are proportional to the severity of the disturbances in their carbohydrate metabolism. It is also established definitely that these ketone bodies are formed normally in the intermediary metabolism of fat and of certain amino acids, and that with the oxidation of carbohydrates the ketone bodies suffer oxidation. The carbohydrates therefore are known as antiketogenetic.

For a number of years we have been engaged in trying to solve the problem how the carbohydrates exercise their anti-ketogenetic powers, and to find a chemical explanation for it. We fed to diabetic animals every known chemical compound that may play a rôle in the intermediary metabolism of carbohydrates, and we found that they may be divided into two classes.



The first consisting of those substances like glyceric aldehyde, dioxyacetone, pyruvic aldehyde, pyruvic acid and lactic acid, which when given to diabetic animals are completely and directly converted into glucose. They all possess the power of reversible reaction in the body, *i.e.*, they all can be converted from one into the other, and possess but slight antiketogenetic properties because when given to diabetics the main force of the reaction is upwards towards the glucose stage, and as such they become excreted in the urine. Practically none of these are burnt in the body of the diabetic animal.

The second consisting of substances like acetaldehyde and perhaps also ethylalcohol. The reaction towards these from glucose and its intermediary products is irreversible, when given to diabetics, they possess marked antiketogenetic powers. For acetaldehyde this was established by Ringer and Frankel and for alcohol by Neubauer and by Benedict and Török.

In diabetes the intermediary metabolites of glucose seem to

have lost the power to break through the trapdoor which leads to the acetaldehyde stage in which they are capable of exercising antiketogenetic effects. Apparently the only way the carbohydrates affect ketogenesis is when they have come down to the acetaldehyde stage.

The modus operandi of the action of acetaldehyde on the ketone bodies has already been discussed by Ringer and Frankel. They suggested the possibility of acetaldehyde combining with β-hydroxybutyric acid or acetoacetic acid giving rise to a substance which is not ketogenetic.

51 (1798)

Botulism.[1] A method for determining the thermal death time of the spores of Bacillus botulinus.

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In the course of a series of experiments dealing with the determination of the thermal death point of spores of *Bacillus botulinus* in which the method of procedure recommended by Bigelow and Estey[2] was followed with minor modifications, it was found that in the daily transplanting of several hundred specimens to the tubes in which the heated material was to be incubated, it was inevitable that a certain small percentage of the tubes became contaminated. The number of proved contaminations was not large, less than 1 per cent. in a test of approximately 2,000 tubes, but because of the fact that one could not be absolutely certain that any particular tube was free from contamination, it was impossible to draw accurate conclusions in any instance where an unusual survival time was indicated. It was therefore imperative that a method be devised in which the necessary number of tubes per day could be handled with rapidity, and, at

[1] These experiments are a part of an investigation of Botulism which is being made in California by the U. S. Public Health Service, Leland Stanford Junior University and the University of California under a grant from the National Canners' Association, the Canners' League of California and the California Olive Association.

[2] Bigelow and Estey, *Jour. Infect. Dis.*, 1920, xxvii, 602.