

fibrous configuration than are at present available as protein fibers in which the molecules are not so oriented.

Studies on the fixing and tanning of fibers formed in the fashion described are also in progress.

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AN INTERMEDIATE IN THE ALCOHOLIC FERMENTATION OF CARBOHYDRATES BY FUSARIUM LINI BOLLEY (FIB.)¹

Sir:

Among the few microorganisms which degrade carbohydrates to give rise to carbon dioxide and ethyl alcohol in a ratio comparable to that obtained in fermentations with ordinary yeasts are the *Fusaria*. They have been designated as "...the alcohol former par excellence" of the lower fungi.² In spite of accumulated data on enzymic effects of *Fusaria*,³ the most important transitory stage in the phase sequence between carbohydrate and alcohol has been so far unknown.

We have been successful in isolating pyruvic acid which accumulates transiently during the course of fermentations of glucose, fructose, mannose, galactose, and xylose effected by FIB. The synthetic nutrient media consisted of the usual inorganic salts and carbohydrate (pH 4.5). That this accumulation is not a characteristic of our strain alone, as used in corresponding work,⁴ was shown by the following. Another culture of FIB, obtained through the courtesy of the North Dakota Agricultural Experiment Station, and cultures of *Fusarium oxysporum*, *Fusarium graminearum* Schwabe, and *Fusarium lycopersici*, all yielded the self-same result since pyruvic acid accumulated as an intermediate during the fer-

mentations. It was identified in every case as its 2,4-dinitrophenylhydrazone in the usual way.

TABLE I

Day of experiment	Glucose fermented, g. (per 100 cc.)	Pyruvic acid found, mg. (per 100 cc.)
0	0.00	0
4	1.73	158
6	3.47	171
8	4.09	155

TABLE II

Day of experiment	Xylose fermented, g. (per 100 cc.)	Pyruvic acid found, mg. (per 100 cc.)
0	0	0
5	1.60	15
6	2.51	24

This accumulation of pyruvic acid, which occurred in complete absence of any interceptor, in transformations caused by an alcoholic fermenting system, could be very likely attributed to a deficiency, with respect to some components, of the decarboxylating system. That this consideration is correct was shown by experiments in which vitamin B₁ was added to the nutrient medium.⁵ Under these conditions, the ratio between the pyruvic acid found in the vitamin containing media (24 mg./100 cc.) and pyruvic acid accumulating in the control (171 mg./100 cc.) was about one to seven, at the time when the absolute amounts of pyruvic acid were at a maximum in both cases.

In view of numerous findings in the sphere of enzymic carbohydrate degradations, these experiments lend additional support to the view³ that conclusions drawn from a comparison of living systems may prove more justifiable in the study of the mechanism of the enzymic conversion of a given compound than those arrived at from the application of artificial or disorganized enzyme preparations.

Details of the experiments, with hexoses as well as with pentoses, and a discussion of their significance, will be presented later.

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(2) J. H. Birkinshaw, *Biol. Rev.*, **12**, 369 (1937).

(3) F. F. Nord, *Chem. Rev.*, **26**, 423 (1940).

(4) George J. Goepfert, *J. Biol. Chem.*, **140**, 525 (1941).

(5) E. Dammann, O. T. Rotini and F. F. Nord, *Biochem. Z.*, **297**, 184 (1938).