similarity to the hybrid substance described by Irwin which occurs in doves (*7*), and, more particularly, to the extensive observations of Cohen on some of the red cell antigens in the rabbit in which genetic interaction has been amply demonstrated (*8*). These results may also be relevant to the problem of heterotic vigor and illustrate how this phenomenon might on occasion be due to the presence, in the heterozygote, of a substance not possessed by either homozygote (*9, 10*).

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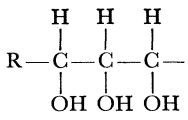
31 March 1958

Isotope Effect in Oxidation of D-Mannitol-2-C^{14} by Acetobacter suboxydans

Previous reports from this laboratory have described the preparation of D-mannitol-1-C^{14}, its oxidation by *Acetabacter suboxydans*, and the carbon-14 assay of the resulting D-fructose-1,6-C^{14} (*1–3*). Because the two halves of the mannitol molecule are stereomerically identical, oxidation by *A. suboxydans* can take place at either carbon 2 or carbon 5. It was pointed out that "if oxidation took place without either an isotope effect or breakdown of the D-mannitol and resynthesis of the fragments, the derived D-fructose would be labeled equally and exclusively at carbons 1 and 6" (*3*). The early work showed that, within the error of measurement, D-fructose-1,6-C^{14} was, indeed, labeled equally and exclusively at carbons 1 and 6.

Oxidation of glycitols by *A. suboxydans* is specific for the group



where R is either H or certain other substituents. Presumably, the enzyme responsible for the oxidation forms an intermediate complex that involves the three carbon atoms indicated. The presence or absence of an isotope effect in the oxidation of a labeled D-mannitol should provide information concerning the rate-determining step, and hence, the mechanism of reaction.

In a more extensive study of a possible isotope effect, both 1-C^{14}- and 2-C^{14}-D-mannitol have been oxidized by *A. suboxydans*. The distribution of carbon-14 in the resulting D-fructose-1,6-C^{14} and D-fructose-2,5-C^{14} has been determined by several chemical methods, selected to avoid isotope effects in the analysis.

The results, summarized in Table 1, confirm the earlier radioactivity analysis of D-fructose-1,6-C^{14}; no isotope effect was detected. However, a small disproportionation in the distribution of carbon-14 was found for D-fructose-2,5-C^{14}. This indicates that, in the oxidation of D-mannitol-2-C^{14} by *A. suboxydans*, there is a small isotope effect, and oxidation is slightly less rapid at carbon 2 (C^{14}) than at carbon 5 (C^{12}).

Because of the extensive use of C^{14}-labeled products in biochemical studies, the demonstration of an isotope effect in a biological oxidation is particularly significant. Although the effect is small, it shows the need for caution in the use of biological oxidations for determining the distribution of carbon-14 in carbohydrates.

All of the compounds listed in Table 1 were recrystallized to constant radioactivity, and samples were assayed in solution (*4*).

Table 1. Radioactivity analysis of D-fructose-1,6-C^{14} and D-fructose-2,5-C^{14}.

Compound assayed	Carbon atoms of original D-fructose	Radioactivity after successive recrystallizations (μc/mmole)	Av. % of original radioactivity
Analysis of D-fructose-1,6-C^{14}			
D-Fructose-1,6-C^{14}	1, 2, 3, 4, 5, 6	2.62*	100
Potassium D-arabonate	2, 3, 4, 5, 6	1.32*	50.4
"D-Glucose" phenylosotriazole†	1, 2, 3, 4, 5, 6	4.35, 4.33, 4.34	100
4-Formyl-2-phenylosotriazole‡	1, 2, 3	2.15, 2.17, 2.16	49.8
Dimedon-formaldehyde compound§	6	2.17, 2.18	50.1
Analysis of D-fructose-2,5-C^{14}			
D-Fructose 2,5-C^{14}	1, 2, 3, 4, 5, 6	1.93, 1.96, 1.93	100
"D-Glucose" phenylosotriazole†	1, 2, 3, 4, 5, 6	1.94, 1.90, 1.91	
4-Formyl-2-phenylosotriazole‡	1, 2, 3	0.93, 0.94, 0.93	48.4
Erythritol	3, 4, 5, 6	0.97, 0.98, 0.99	51.4
Erythritol tetrabenzoate	3, 4, 5, 6	1.01, 1.00, 0.99	
Dimedon-formaldehyde compound§	6	none	

* Value taken from Frush and Isbell (*3*). ‡ D-*arabino-Hexose* phenylosotriazole. ‡ Phenyl-2*H*-1,2,3-triazole-4-carboxaldehyde. § 2,2′-Methylenebis(5,5-dimethyl-1,3-cyclohexanedione).

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7 April 1958

Iodine-131 Fallout in Bovine Fetus

Iodine-131 from radioactive fallout is concentrated in thyroid glands of grazing animals (*1, 2*) and the distribution suggests that I^{131} spreads over the hemisphere in which it is released (*2*). A study of the fallout of I^{131} in the thyroids of fetal animals will serve two purposes: (i) It will be helpful in evaluating the maximum biological accumulation of radioactive fallout; and (ii) it might give useful information regarding iodine distribution during pregnancy.

Gorbman *et al.* (*3*) injected I^{131} into two cows during the ninth month of pregnancy, sacrificed them 24 hours later, and studied the I^{131} distribution. They found that the I^{131} concentrations in the thyroid of the fetuses were 6 to 7 times those of the dams. Autoradiographs showed uniform distribution of radioactivity in fetal glands but nonuniform concentrations in the adult thyroids. Wolff *et al.* (*4*) showed that bovine fetuses began to concentrate iodine at 53 days of gestation and that the amount of iodine increased rapidly after the fifth month.

Barnes *et al.* (*5*) have studied I^{131} distribution in pregnant sheep which were chronically fed the radioisotope. They showed that the near-term fetal thyroid I^{131} concentration was 1 to 2 times that of the dam.

Part of one lobe of the thyroid gland from each of 40 pregnant cows was removed along with the laryngothyroid