acids impart fruity flavors to milk which also are suggestive of deteriorated milk fat.

Prevention of the coconut-like off-flavor in both anhydrous milk fat and dry whole milk has been investigated at this laboratory. Antioxygenic measures such as vacuum or inert gas packing and the addition of various antioxidants have proven ineffectual in preventing this off-flavor. The only satisfactory preventive noted thus far is low temperature storage (0° C or lower) of the product. Products stored in this manner for several months rapidly develop the off-flavor when they are warmed and held at 100° C for a few hours.

These results are of a preliminary nature and the problem is currently under intensive investigation. Most approaches to problems involving fat deterioration have embraced oxidative mechanisms as a basis. The present findings do not rule out the possibility that minute quantities of oxygen are required in production of the coconut-like off-flavor of milk fat. However, they also suggest a nonoxidative rearrangement of unsaturated fatty acids to lactones as the mechanism of this flavor deterioration.

References

1. KEENEY, M., and DOAN, F. J. *J. Dairy Sci.* **34**, 728 (1951).
2. MUSSETT, A. T., PATTON, S., and DAHLE, C. D. *Ibid.* **33**, 299 (1950).
3. BOSWORTH, A. W., and BROWN, J. B. *J. Biol. Chem.* **103**, 115 (1933).
4. GRÜN, A., and WIRTH, T. *Ber.* **55**, 2197 (1922).
5. HILDITCH, T. P. *The Chemical Constitution of Natural Fats*, 2nd ed., p. 113. New York: Wiley, 1947.
6. KURTZ, G. W., and PATTON, S. To be published.

Received December 30, 1953.

Communications

Uptake of Radiozinc by Normal and Diabetic Rat Pancreas

INCREASING interest is being directed upon the possible importance of zinc in tissue metabolism and upon a role it may play in the etiology of diabetes. Scott and Fisher (*1*) found upon autopsy a difference amounting to one-half in the zinc content of diabetic pancreas as compared to the normal. This finding is in some conflict with that of Eisenbrand and his group who reported, on a fat-free basis, differences of some 17 percent (*2*) and later (*3*) reported no statistically significant difference. A Japanese group directed by K. Okamoto has for some time put forward the view that zinc is rather directly concerned in the production and course of diabetes. Recent papers (*4, 5*) discuss their findings based upon histochemical grounds. Considerable evidence is presented in support of their view that diabetes is reflected in a deranged apportionment of available zinc in the animal body. In their view, agents such as alloxan, oxine, and dithizone are diabetogenic because of their "specific affinity" for zinc. Root and Chen (*6*) report that 8-hydroxyquinoline possessed diabetogenic activity but discuss this action on grounds other than zinc metabolism. That zinc is present in relatively large quantities in normal pancreatic tissue has been confirmed, employing radiozinc, by Chaikoff and co-workers (*7, 8*) and by Heath and Liquier-Milward (*9*).

We felt it would be interesting to scrutinize the distribution of radiozinc in a series of normal and alloxan-induced diabetic rats. Blood sugar levels were employed to follow the course of diabetes. Accordingly, 2.0 ml of an isotonic saline solution of Zn^{65} chloride were injected intraperitoneally into each of 4 alloxan-induced diabetic rats. Twenty-four hr elapsed before the animals were sacrificed. Tissues were removed, ashed, and assayed for radioactivity, employing conventional radiochemical procedures. A wide variety of tissues were retained for counting and some whose behavior appears interesting are reported in Table 1. There appears to be considerably less Zn^{65} concentrated in the diabetic pancreas as compared with the normal. This finding would seem to offer sup-

TABLE 1. Distribution of Zn^{65}, percentage of administered dose found after 24 hr in various tissues.

Tissue	Normal rat %			Av.	Diabetic rat %				Av.
	1	2	3		1	2	3	4	
Pancreas	2.3	2.6	2.8	2.6	0.2	0.3	0.4	0.1	0.3
Liver	22.0	13.5	18.1	17.9	18.3	12.5	16.5	14.3	15.4
Stomach	6.4	5.1	5.6	5.7	4.7	3.4	2.0	5.7	4.0
Gastrointestinal tract									
upper	—	4.5	—	4.5	3.6	6.2	5.8	7.9	5.9
middle	3.5	3.8	5.7	4.3	4.3	7.4	5.4	3.4	5.1
lower	3.6	4.0	7.1	4.9	5.3	5.7	5.6	—	5.6
Kidney	2.0	2.0	0.8	1.6	2.6	4.5	3.9	3.7	3.7
Brain	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Heart	0.3	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4
Spleen	—	0.3	1.1	0.5	0.3	0.3	0.2	0.2	0.3
Lung	0.7	0.8	0.7	0.7	0.9	0.8	0.6	0.8	0.8

port for the view that, at least for the case of alloxan, zinc metabolism is disturbed, and the present findings may be compared with those of the Japanese group (*4*). Differences of opinion have been recorded as to the actual location of zinc in pancreatic tissue. Fairly heavy ingestion of zinc is said to lead to deposition in the acinar portion (*10*), while other work implicates the islet tissue (*5*). In the present study the possibility presents itself that diabetic rat kidney takes up more radiozinc than normal kidney. Comment upon this phenomenon must be withheld at the present time.

J. R. LOWRY
R. R. BALDWIN
R. V. HARRINGTON
Central Laboratories, General Foods Corporation
Hoboken, New Jersey

References

1. SCOTT, D. A., and FISHER, A. M. *J. Clin. Invest.* **17**, 727 (1938).
2. EISENBRAND, J., and SEINZ, M. *Z. Physiol. Chem.* **268**, 1 (1941).
3. EISENBRAND, J., SEINZ, M., and WEGEL, F. *Med. u. Chem. Abhandl.* **4**, 250 (1942).
4. OKAMOTO, K. *Acta Schol. Med. Univ.* Kyoto **27**, 43 (1949).
5. ———. *Hyogo J. Med. Sci.* **1**, 77 (1951).
6. ROOT, M. A., and CHEN, K. K. *J. Pharmacol. Exptl. Therap.* **104**, 404 (1952).
7. MONTGOMERY, M. L., SHELINE, G. E., and CHAIKOFF, I. L. *J. Exptl. Med.* **78**, 151 (1943).
8. SHELINE, G. E., *et al. J. Biol. Chem.* **149**, 139 (1943).
9. HEATH, J. C., and LIQUIER-MILWARD, J. *Biochim. Biophys. Acta* **5**, 404 (1950).
10. SCOTT, D. A., and FISHER, A. M. *Am. J. Physiol.* **121**, 253 (1938).

Received November 16, 1953.

Callus and Shoot Formation from Tomato Roots *in Vitro*

IT is known that shoots will arise from some plant callus tissues under certain cultural conditions; the development of plantlets from *Nicotiana* callus (*1–4*) and carrot callus (*4, 5*) has been described. White (*6*) reported that shoots arise from callus formed on isolated dandelion roots in culture. Since 1934, when White (*7*) first was able to subculture tomato roots for indefinite lengths of time, various workers have investigated root cultures of numerous strains of tomato. Through repeated subculturing, some of these lines have been maintained for a number of years. However, there has been no case reported of plants developing from such tomato roots. This paper reports the formation of callus and, subsequently, shoots from roots of a clone of *Lycopersicon peruvianum* (L.) Mill.[1] Root cultures in White's medium (*6*) were kept in the dark. Calluses and shoots were first noted on roots 15 days after subculturing. Most of the roots had a callus on the proximal end, and there were shoots visible on two of these calluses. In cultures originating from a segment of a root, rather than a root tip, there was a callus at one or both cut ends. Callus and shoot formation did not occur in another clone derived at the same time from the same seed sample and kept under the same conditions as the callus-forming clone. In later subcultures of the callus-producing clone, callus formation occurred on most of the roots, and shoot formation was frequent.

[1] The seed, harvested in 1950 from Line 2245, from which this root clone was obtained was furnished by the Ohio Agricultural Experiment Station, Wooster.

FIG. 1. ×5.

FIG. 2.

FIG. 3.