Table 1. Neuraminic acid values (in micrograms) for different zones of paper electropherograms.
(80 μlit serum)

Serums	Albumin	Globulins				Starting point
		alpha-1	alpha-2	beta	gamma	
Single case	0.6	7.8	12.0	2.4	2.0	1.0
10 patients (pooled)	.7	9.6	16.8	4.8	0.8	0.8
40 normal adult males (pooled)	.9	7.5	14.5	7.0	3.0	1.3

heated for 30 min in a boiling water bath and then reprecipitated with 8 vol of ethanol, neuraminic acid was released and could be detected in the alcoholic supernatant about 80 percent of total originally present). Since this procedure is unlikely to result in hydrolysis of a polysaccharide or glycolipid, it appears unlikely that neuraminic acid is a constituent of an independent polymer that happens to have the same mobility as alpha-2 globulins; rather it indicates that neuraminic acid is either bound to alpha-2 globulins or is present as a constituent of the polysaccharide or glycolipid moieties of alpha-2 globulins. The relationship of neuraminic acid levels to alpha-2 globulin levels in various disease states is under investigation.

References and Notes

* Captain, MC, AUS.
1. E. Klenk, *Hoppe-Seyler's Z. physiol. Chem.* **235**, 24 (1935); **267**, 128 (1940); **268**, 50 (1941); **273**, 76 (1942).
2. ———, *ibid.* **282**, 84 (1947).
3. E. Klenk and H. Langerbeins, *ibid.* **270**, 185 (1941).
4. J. Folch, S. Arsove, and J. A. Meath, *J. Biol. Chem.* **191**, 819 (1951); L. L. Uzman, *Arch. Path.* **55**, 181 (1953).
5. E. Klenk and F. Rennkamp, *Hoppe-Seyler's Z. physiol. Chem.* **273**, 253 (1942); E. Klenk and K. Lauenstein, *ibid.* **295**, 164 (1953).
6. P. Bohm, St. Dauber, and L. Baumeister, *Klin. Wochschr.* **32**, 19 (1954).

7. We are indebted to Stanley M. Levenson for his interest and advice and to E. Durrum, MC, for helpful suggestions concerning paper electrophoresis.

10 September 1954.

Fractional Total-Body Irradiation and Thyroid Function in the Burro

Joseph C. Schoolar,† John J. Lane, Robert A. Monroe, John H. Rust,*† Bernard F. Trum*

University of Tennessee–Atomic Energy Commission Agricultural Research Program, Oak Ridge

Thyroids of burros exposed to acute or fractional total-body irradiation have shown histological evidence of extreme stimulation by hyperplasia of the epithelial cells and marked colloid depletion.

Increased uptake of iodine-131 in thyroids of irradiated animals has been reported by Monroe *et al.* (*1*), Evans *et al.* (*2*), and Hursh *et al.* (*3*). Botkin *et al.* (*4*), however, noted that total-body irradiated rats had a decrease that followed a small initial rise. In the present study (*5*) burros were exposed to total-body cobalt-60 gamma irradiation, 25 r/day, until death and the thyroid uptake of intraperitoneally administered iodine-131 (*6*) followed.

Of 13 healthy burros (*Equus asinus asinus*), ten were simultaneously exposed, and three served as controls for stable iodine determinations (*7*). Exposures were made on a large exposure field previously described (*8*). Burros were allowed orchard grass hay, water, and noniodized salt *ad libitum* throughout the study. Each animal was its own control, by comparison with preirradiation rate of uptake. To increase the number of observations, the group was divided and, at staggered intervals, each group of five received intraperitoneal injections of 10 μc of carrier free iodine-131. Thyroid activity was measured by external counting with a scintillation counter (NaI crystal). The iodine-131 that accumulated in the thyroid 8 hr after injection was chosen for purposes of comparison. The fractionation and determination of total stable iodine and stable thyroxin iodine were done by the method of Taurog and Chaikoff (*9*).

After 600 to 800 r some animals began to concentrate iodine-131 (Fig. 1*b*) to a marked degree; others

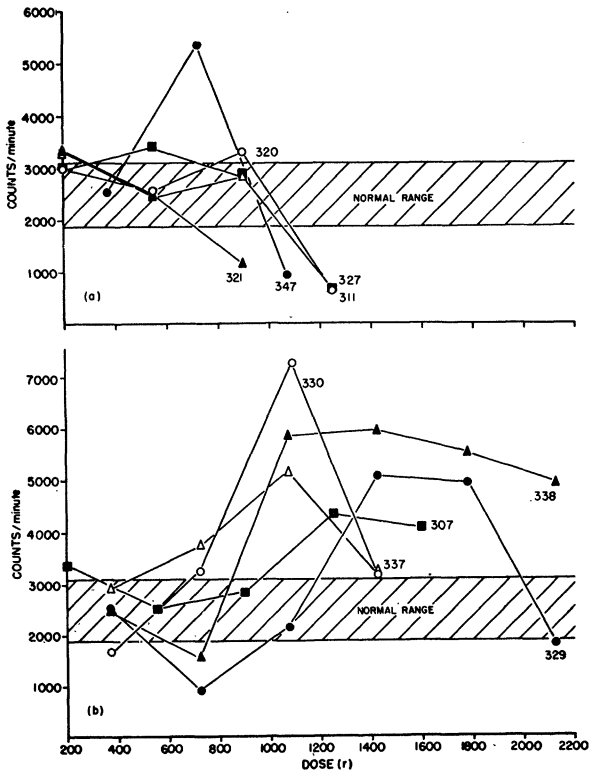

Fig. 1. Counts per minute over the thyroid at various accumulated dose levels. The plots are separated for ease in reading.

Table 1. Ratios and amounts of total stable iodine and total stable thyroxin iodine in the thyroid glands of burros at death (mg/g). Mean ± standard error.

	Group I*a*	Group I*b*	Control
Survival (days)	49.5 ± 1.23	79.0 ± 4.66	
Total iodine (TI)	6.4 ± 2.8	1.20 ± 0.22	5.56 ± 1.98
Thyroxin (TX) iodine	0.70 ± 0.27	0.24 ± .44	0.66 ± 0.22
TX/TI	.127 ± .021	.212 ± .044	.133 ± .028

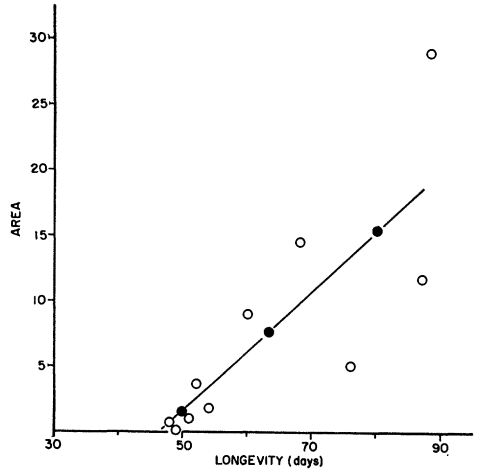

Fig. 2 Planometrically determined areas beneath the curves in Fig. 1*a* and *b*, expressed in arbitrary units, as a function of survival time. The black dots and connecting line represent the regression of area on longevity.

fell to subnormal levels (Fig. 1*a*). Those that accumulated iodine-131 survived significantly longer than did those within the normal range or below.

This relationship was not observed in the stable iodine values of thyroids taken at autopsy. The total stable iodine and the stable thyroxin iodine was least in those surviving the longest. In those surviving the shortest period of time both the stable iodine content and thyroxin iodine content were not significantly different from the normal controls (Table 1).

A significant correlation was apparent between the planometrically determined areas under the accumulation curves (Fig. 1*a* and *b*) and the survival time of the animals (Fig. 2).

The causal relationship between iodine-131 uptake and survival is not understood. It may be a reflection of degree of stress response to ionizing radiation. The early deaths may indicate a body-wide metabolic collapse, whereas later deaths indicate less irreparable damage and partial compensation for injury but eventual deaths from more latent physiologic disturbances.

References and Notes

* Veterinary Corps, U.S. Army.
† Present address: Department of Pharmacology, University of Chicago, Chicago 37, Ill.
1. R. A. Monroe, J. H. Rust, and B. F. Trum, *Science* **119**, 65 (1954).
2. T. C. Evans, G. Clarke, and E. Sobel, *Anat. Record* **99**, 577 (1949).
3. J. B. Hursh, P. A. Van Valkenberg, and J. B. Mohney, *Radiology* **57**, 411 (1951).
4. A. L. Botkin *et al.*, *Endocrinology* **50**, 550 (1952).
5. This report is published with the approval of the director of the Experiment Station, University of Tennessee.
6. The I^{131} was obtained from the Oak Ridge National Laboratory on allocation from the U.S. Atomic Energy Commission.
7. The stable iodine determinations were done by the Chaney Chemical Laboratories, Glendale, Calif.
8. J. L. Wilding, C. S. Simons, and J. H. Rust, *Nucleonics* **10**, 36 (1952).
9. A. Taurog and I. L. Chaikoff, *J. Biol. Chem.* **163**, 323 (1946).

30 August 1954.

Demonstration of an Oligosaccharide Intermediate in the Enzymatic Hydrolysis of Cellulose

John H. Hash and Kendall W. King

Biology Department, Virginia Polytechnic Institute, and Department of Biochemistry and Nutrition, Virginia Agricultural Experiment Station, Blacksburg

Data summarized by Reese *et al.* (*1*), and Tracey (*2*) indicate a random cleavage of the cellulose molecule by cellulase. Such a random cleavage should yield a variety of intermediate dextrins with the eventual formation of cellobiose and glucose. However, the only products that have been found, in spite of concerted efforts, are cellobiose and glucose (*3*). This failure, plus the fact that cellobiose, but not glucose, inhibits the enzymatic hydrolysis of cellulose (*1*), has led Levinson *et al.* (*4*) to conclude that cellobiose is the end-product of cellulase action, in analogy to β-amylase, with glucose arising as the result of a β-glucosidase. This communication is to report the demonstration and tentative identification of an oligosaccharide intermediate in the enzymatic hydrolysis of cellulose.

Successful demonstration of the intermediate has been achieved repeatedly by enhanced dissociation of the oligosaccharide-enzyme complex through dialysis. After incubating cellulase and substrate in a collodion sac, an oligosaccharide, tentatively identified as cellotetraose, was demonstrated in the dialyzate.

The enzyme used in these experiments was obtained by growing *Myrothecium verrucaria* (USDA 1334.2) on the medium of Saunders *et al.* (*5*) for 11 days at room temperature. Two liters of the culture filtrate was concentrated in vacuum to 50 ml and exhaustively dialyzed in a collodion sac against running tap and distilled water. No further purification was attempted. The cellulose substrate (Solka-floc) was swollen in phosphoric acid by the method of Walseth (*6*) and also dialyzed against tap and distilled water.