The wire retaining ligature was removed two days after operation. Hypertension did not develop and at autopsy the left kidney was within normal limits.

Vascular changes in the right unoperated kidney were observed in the animals with hypertension of several weeks' duration. This was usually less in degree from that observed in the infected kidney, but was easily demonstrable. In only one animal was it marked (rat 1).

Discussion. There were 3 findings of interest in these experiments. First, hypertension of some degree invariably accompanied chronic unilateral pyelonephritis in the rats surviving the infection. Hypertension has been induced by unilateral hydronephrosis alone(5) when the kidney was not totally destroyed, but unfortunately superimposed infection was not ruled out. Secondly, in some instances contracted, fibrotic, pyelonephritic kidneys showing no hydronephrosis resulted from partial ureteral obstruction and infection. Thirdly, only the kidney in which there was ureteral or pelvic stasis became infected, a circumstance which might have been predicted(3). In addition, vascular changes in the opposite kidney were seen in those animals which developed hypertension, also a predictable finding(7).

The method used was simple and readily applied. Further studies on prevention or treatment of the pyelonephritis so induced should be rewarding.

Summary. Unilateral renal diseases resembling hydronephrosis, pyonephrosis, or pyelonephritis were induced in rats by partial ureteral constriction and intravenous injection of *E. coli*. Arterial hypertension developed when chronic unilateral renal infection was produced.

7. Schroeder, H. A., and Neumann, C., *J. Exp. Med.*, 1942, v75, 527.

Received May 25, 1951. P.S.E.B.M., 1951, v77.

A Technic for Measurement of Radioactive Iodine (I-131) Uptake by the Human Thyroid Gland. (18920)

JOHN U. HIDALGO, SAMUEL B. NADLER, TED BLOCH, AND ROBERT T. NIESET.

From the Department of Biophysics, Department of Medicine, Tulane University School of Medicine, and Touro Infirmary, New Orleans.

In the study of the uptake of iodine (I-127) by the thyroid, the most practical tracer is the radioactive isotope of iodine (I-131). This isotope has a half life of 8 days and emits 2 types of radiation, beta particles and gamma rays. The maximum energy of the emitted betas is of the order of 600 Kev, while the gammas are emitted with a maximum energy of 723 Kev(1). The conventional Geiger-Muller tube is 90% efficient in measuring beta radiation and only 2% efficient for the gamma radiation. This means that of the incident radiation, 90% of the beta radiation and 2% of the gamma radiation will be recorded. The tube used in our work is a bismuth cathode, Geiger-Muller tube, Radiation Counter Laboratories, Mark 1, Model 12, used axially like an end window counter. The tube has a high gamma efficiency and a low beta efficiency. In an actual comparative experiment using I-131 the bismuth cathode tube showed a count rate of about 7.5 times greater than the conventional end window tube over the same sample. To attain the same counting geometry, the end window tube must be recessed about 1 inch into the lead shield. With this change in tube distance, the bismuth tube count rate is 11 times greater. With the beta radiation filtered out by appropriate aluminum absorbers, the ratio of count rates increases to approximately 16 times. Since most of the beta radiation is

1. Cork, J. M., Rutledge, W. C., Stoddard, A. E., Branyan, C. E., and Childs, W. J., *Physical Rev.*, 1951, v81, 482.

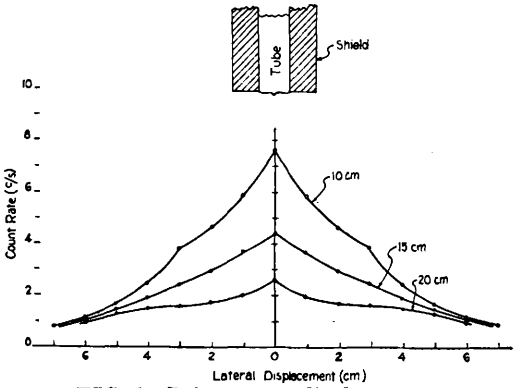

FIG. 1. Point source displacement.

absorbed by the intervening tissue in the *in vivo* measurement of iodine uptake by the thyroid, the latter case is the closest approximation to actual conditions.

Because of the predominance of gamma type radiation in ambient cosmic rays, an increase in the background count rate for the bismuth tube is twice that of the mica window tube. Even with this increase in background there is a 10 to 12 times increase in sensitivity of the tube.

To determine the optimum tube-to-patient counting distance, the directional characteristics of the shielded bismuth tube and the decrease in counting rate with distance were studied. Using a point source of radiation, it was found that at a distance of 15 cm and a lateral displacement of 4.3 cm from the axis of the tube, the counting rate dropped to 50% of the axial value (Fig. 1). That is to say, if all of the radioactivity were concentrated at a point 4.3 cm from the axis, only 50% of the radiation measured at the axis would be recorded. The point source is of course, the worst possible distribution. On the basis of these dimensions we can see that 15 cm is the minimum distance that will give adequate coverage for the "average gland".

Experiments with 2 vials containing equal quantities of I-131 showed that the decrease with this lateral displacement was more of the order of 20%, or, 80% of the radiation was recorded. In this experiment the vials were spread and counted at various distances, symmetrical to the axis of the tube. This is much more nearly the case for the distribution of radioactive iodine in an actual gland (Fig. 2).

With a normal uptake from a 50 uC tracer dose, the counting rate at 20 cm is only 6 to 8 times greater than the background rate. For a counting interval of 6400 counts the statistical error of the Geiger-Muller tube will be of the order of 1%, based on the premise that the counting rate is 10 times greater than the background rate.

Thus, the boundaries are presented. The minimum counting distance, 15 cm, is determined by the directional characteristics of the tube and the maximum counting distance, less than 20 cm, is determined by the limitations of statistical accuracy. Interpolation between these two factors gives an optimum distance of 17 cm, which yields a high enough count rate and an effective counting area at the thyroid of 9.92 cm or about 4 inches in diameter.

It has been stated that the maximum tracer dose of I-131 which will have no deleterious effects on a normal gland is 200 uC per year (2). The minimum efficient tracer dose for the mica-window tube is 100 uC whereas with the bismuth tube, 50 uC is quite efficiently measured.

On this basis, tracer studies are repeatable at intervals of three months as compared with the 6 month interval demanded by the mica-window tubes. Because of the false negatives caused by recent ingestion of such iodine blocking agents as Lugol's solution, propyl-

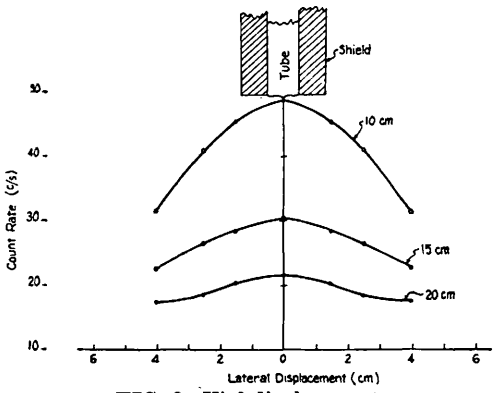

FIG. 2. Vial displacement.

2. Werner, S. C., Quimby, E. H., Schmidt, C., *J. Clin. Endocrinol.*, 1949, v9, 342.

thiouracil, and various other iodine containing preparations, the shorter interval is highly desirable.

The reference sample diluted to constant volume is placed in a small saline bottle and counted at the same distance of 17 cm. The percentage uptake in the gland is represented by:

$$Up \frac{(Cg \times 100)}{(Cs)} F_G.$$

Where Up denotes the percentage uptake, Cg is the count rate over the gland, Cs is the count rate over the standard sample, and F_G is the geometrical factor.

This geometrical factor is a function of the ratio of the solid angles presented by the gland and the reference sample. If the reference sample is standardized, this factor reduces to a function of the variation of the solid angle presented by the gland. Consequently this factor is a function of the variation in gland size. Standardizing on the basis of the "average gland", this F_G will be greater than one for all glands larger than "average" and so on. However, reconsidering the distributive picture of the directional characteristics of the tube, it is readily seen that no serious error will be introduced by assuming this factor equal to one.

Summary. It has been found that with the bismuth cathode tube, a 50 uC dose can be used efficiently, and that a tube-to-patient distance of 17 cm will cover a sufficiently large area to make variations in gland size unimportant to the accuracy of the test.

Received May 28, 1951. P.S.E.B.M., 1951, v77.

Mandelic Acid Antagonism to Phenyllactic Acid Utilization in *L. casei*.* (18921)

DOROTHY E. HUBBARD† AND EMIL G. SCHMIDT.

From the Department of Biological Chemistry, University of Maryland, School of Medicine, Baltimore, Md.

In the course of experiments designed to develop microbiological methods for the determination of specific aromatic acids in urine, *L. casei* was found to utilize phenyllactic acid in an otherwise complete but phenylalanine-free medium. This observation has recently been made also in other laboratories(1,2). The present report concerns the growth inhibitory activity of certain structural analogues of phenyllactic acid on this organism.

Methods. Our microbiological assay procedures, media, cultures, inocula, etc., have been described elsewhere(3). DL-Phenyllactic acid was prepared by the methods of Erlenmeyer and Lipp(4), and Fischer and Zemplén(5). Both products when recrystallized twice from carbon tetrachloride melted at 95°C and gave identical growth curves. Melting points of 95-96 and 96-97(6), 97(7), and 97.5°C(2) have been reported for DL-phenyllactic acid.

The growth stimulating effect of phenyllactic acid, phenylalanine, and the various ana-

* This investigation was supported (in part) by a grant from the Division of Research Grants and Fellowships of the National Institutes of Health, U. S. Public Health Service, and a grant-in-aid from the Bressler Alumni Research Fund.

† John F. B. Weaver Fellow in Biological Chemistry.

1. Prescott, B. A., Borek, E., Brecher, A., and Waelsch, H., *J. Biol. Chem.*, 1949, v181, 273.

2. Eiduson, Samuel, Camien, Merrill N., and Dunn, Max S., *Arch. Biochem.*, 1950, v29, 302.

3. Schmidt, E. G., McElvain, Norma F., and Bowen, J. J., *Am. J. Clin. Path.*, 1950, v20, 253.

4. Erlenmeyer, E., and Lipp, A., *Ber.*, 1880, v13, 303.

5. Fischer, E., and Zemplén, G., *Ber.*, 1909, v42, 4891.

6. Moss, A. R., *J. Biol. Chem.*, 1941, v137, 739.

7. Fourneau, E., and Billeter, R., *Bull. Soc. Chim.*, 1940, v7, 593.