reaction for the brilliant green lactose bile medium is between pH 7.1 and 7.4.

It cannot be stated definitely that the characteristics of the strains employed in this study might not have been changed if the experiment had been carried on for a considerably longer time, or if greater concentrations of bile had been employed. However, in spite of these factors, it seems that the results of the experiments here reported should argue in favor of the stability of the culture reactions of pure established cultures of *Aërobacter aërogenes*, so far as the influence of bile or bile salts alone is concerned.

9915 P

Radioactive Iodine as an Indicator in the Study of Thyroid Physiology.*

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The known facts of thyroid physiology indicate that iodine is selectively taken up by the thyroid gland, and that in some measure that gland's function is regulated by its iodine content. Artificial radioactivity may be induced in a variety of elements by means of neutron bombardment. It seemed that the possibility of using "tagged" (radioactive) iodine as a physiologic indicator was one which demanded investigation.

Ethyl iodide (600-1000 cc) was irradiated in a paraffin-surrounded bottle by immersing in it a neutron source consisting of 110 mg of radium mixed with beryllium in a sealed tube. The radioactive iodine thus obtained was concentrated by a method which has been described elsewhere.[1] This method gave a precipitate of radioactive silver iodide, which was dissolved in a solution of 0.5-1.0 g of sodium thiosulphate, and then diluted to 10-15 cc for intravenous injection. In a series of 48 rabbits, no toxic effects from the acute administration of such quantities were experienced. Aliquot portions of the solution of radioactive iodine used for injection were withheld for measurement of radioactivity.

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[1] Roberts and Irvine, *Phys. Rev.*, 1938, **53**, 609.

A Geiger-Müller counter connected to a suitable vacuum tube amplifier and register to record the individual disintegrations of the radioactive atoms was used for detection of the radioactive iodine in various tissues. This apparatus is standardized and has been fully described elsewhere.[2-4] Since no gamma rays could be observed from radioactive iodine,[1] determinations had to be made from the beta radiations. The half-period of radioactive iodine is 26 minutes, so that accurate measurements could not be extended beyond about 40 minutes after injection, with the activities available to date.

Because of the low penetrating power of beta radiation it was necessary to sacrifice the animals to obtain the various tissues for measurement. The tissues were finely minced and spread on a flat surface and placed in direct contact with the Geiger-Müller counter.

The following tissues and body fluids, in addition to the thyroid, were examined: muscle, spleen, liver, pituitary, adrenals, frontal lobe of the brain, hypothalamus, salivary glands, ovaries, blood, urine, and cerebro-spinal fluid. The results in a typical case may be given as follows:

Rabbit No. 224: Thyroid previously rendered hyperplastic by the injection of anterior pituitary extract. 10 mg of I injected. 15 minutes elapsed between injection and killing of the rabbit.

TABLE I.

Organ	Radioactivity in arbitrary units (counts per min)	
Thyroid	38.5 ± 5	
Spleen (quantity equal to thyroid)	2 ± 5	
Liver (quantity equal to thyroid)	4 ± 5	
Pituitary	0	(5 units correspond to .008 mg of I)
Urine (residue after evaporation)	48 ± 5	(In other exp. 5 units may correspond to as little as .0007 mg of I)
Muscle (quantity equal to thyroid)	0	

In none of the tissues or fluids examined were quantities of iodine found which compared with that taken up by the thyroid, with the exception of the entire bladder urine residue after complete evaporation, and the blood, into which the radioactive iodine was directly injected. Quantities less than 0.05% of the injected iodine could not be detected in these samples. It must be stressed at this point that this method gives information only with regard to the injected

[2] Langer and Whitaker, *Phys. Rev.*, 1937, **51**, 713.

[3] Giarratana, *Rev. Sci. Instr.*, 1937, **8**, 390.

[4] Gingrich, *Rev. Sci. Instr.*, 1936, **7**, 207.

iodine, and disregards any iodine previously present within the tissues.

Other measurements of the collection of iodine by the thyroid were performed, varying the dosage of iodine, the time elapsing between injection and sacrifices of the animals, and the functional state of the thyroid under conditions of thyrotropic stimulation, pregnancy, and spontaneous goiter. The results to date of these experiments are given in the accompanying graphs. They are being extended by further experiment.

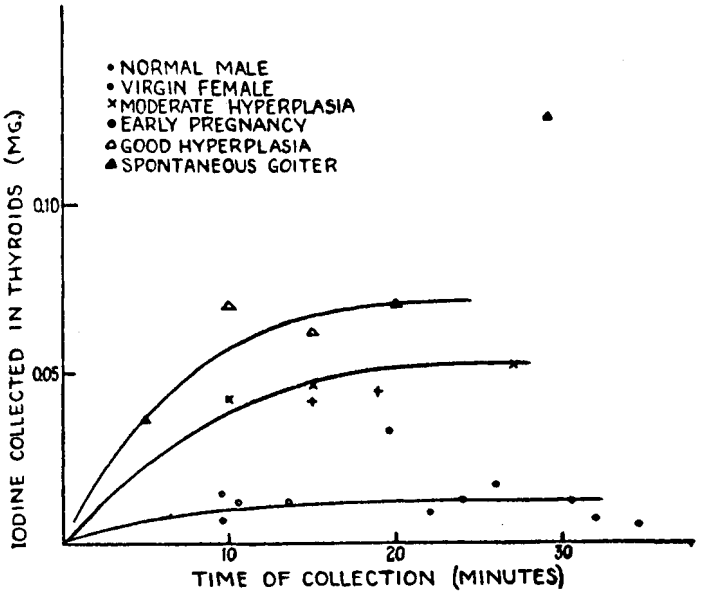

FIG. 1.

Comparison of the quantities of iodine collected by different types of rabbit thyroid glands when the time elapsing between injection and sacrifice is varied.

That the concentration of iodine in the thyroids is a biologically selective process is further attested by the uniformly negative results obtained when radioactive bromine was used, with a similar technic, in place of iodine.

The methods outlined above are established as giving useful information with regard to iodine distribution in the organism. Their accuracy can be expected to increase as sources of stronger radioactive iodine become available. The artificially radioactive material with which these experiments were performed is considered very weak, in comparison with that produced by means of the Van de Graaff electrostatic generator and the cyclotron. The data presented, however, do indicate that radioactive iodine is selectively

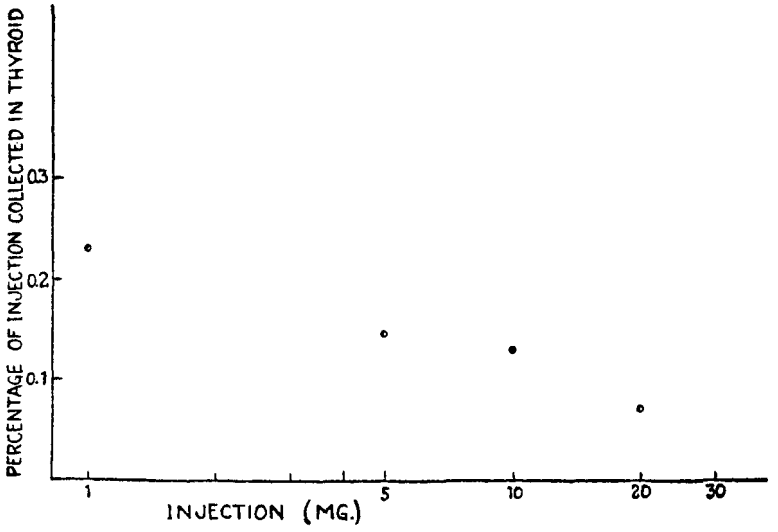

FIG. 2.
Comparison of the quantities of iodine collected by normal rabbit thyroid glands in the same time (15 minutes) when the amount injected is varied.

taken up by the thyroid under normal conditions in a definitely measurable amount. They further tend to show that under conditions of thyroid stimulation (hyperplasia), the collection in the same time is increased severalfold. It is therefore logical to suppose that when strongly active materials are available the concentrating power of the hyperplastic and neoplastic thyroid for radioactive iodine may be of clinical or therapeutic significance.

Recently the discovery of a new radioactive isotope of iodine has been announced.[5] This isotope has a half-period of 13 days. It is obvious that it will have many advantages over the 26-minute isotope for both indicator and therapeutic work. Such experiments as the above may now be extended over much longer time intervals following injection.

We are indebted to Professor J. H. Means of the Harvard Medical School for his stimulating interest in this work.

[5] Tape and Cork, *Phys. Rev.*, 1938, **53**, 676 A.