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A Device for Holding Rats for Thyroid Uptake Determinations

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INTRODUCTION

The equipment used in radioisotope units is not only very costly but sometimes is not entirely suited for nonclinical uses. Hence, special adaptations of equipment may need to be devised in the laboratory. We found this to be true when we wished to do *in vivo* radioiodine thyroid uptake studies on rats. Whole-body counters were not satisfactory because they counted not only radiation coming from the thyroid, but also radiation coming from the liver and other areas of the body which had also accumulated the radioiodine. This report describes the apparatus used for holding rats which can be made out of items usually found in a laboratory.

MATERIAL AND METHODS

The device used for positioning the rats is shown in Figure 1. The platform (B) is made from one-fourth inch thick plastic or enamelled plywood and is approximately 23 cm long and 14 cm wide. A 24 by 28 mm hole is cut about 4 cm from one end and equal distances from the sides. The two L shaped pieces (A) are made of plastic and are used to hold the neck of the rats over the hole. They are adjustable so they can be used for different sizes of rats. Item (C) is a one-fourth inch thick lead plate used mainly to help make the platform more stable but does offer some shielding. The platform and lead plates are fastened to a lead ring one-inch thick (D) that fits around the scintillation crystal (E). It is wise to cover the crystal with a thin sheet of plastic or cellophan to prevent contamination.

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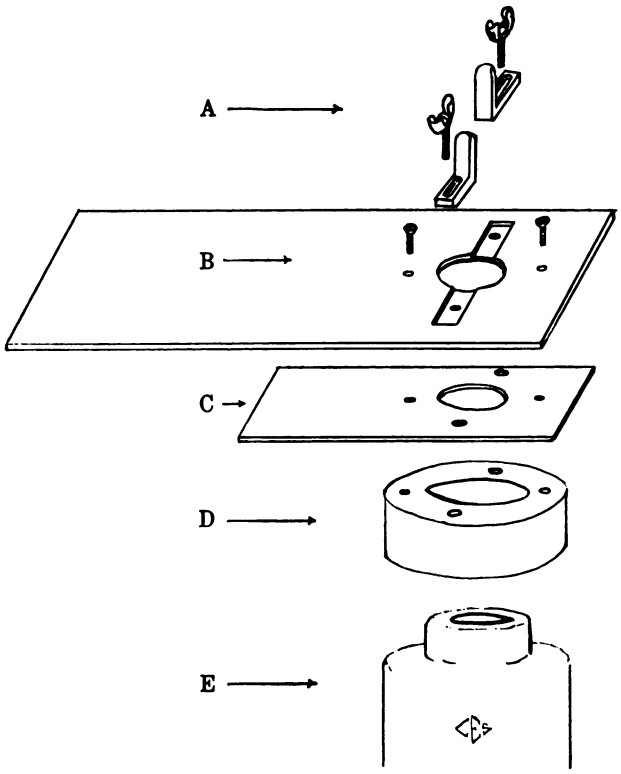

Fig. 1. Detailed drawing of the apparatus for holding rats for thyroid uptake determinations. (A) are adjustable clamps for holding the neck in position over the hole; (B) platform on which the rat is placed; (E) lead sheet; (D) lead ring which fits around the scintillation crystal; (E) scintillation crystal and housing for crystal and photomultiplier tube.

The radioiodine is usually administered intraperitoneally in the dose of ¼ μC for rats weighing up to 200 g and ½ μC for larger rats. A standard is prepared by putting a proportion of the dose in a suitable plastic container and placing it in the center of the hole at a height corresponding to the depth of the thyroid in the neck of the rat. A scaler (Nuclear-Chicago, Model 183) with a one-inch scintillation detector (DS5) was used for the uptake determination.

To prevent the rats from struggling too much while holding them in position on the platform, they were anesthestized lightly with pentobarbital (2 to 3 mg/100 g body weight).

RESULTS

The thyroid uptake determinations using this apparatus for holding the rats was compared with *in vitro* determinations in Table I. Radioiodine-125 gave similar results by both methods. When ^{131}I was used, the *in vivo* method gave higher results than *in vitro*. This was especially true of the six-hour determinations and was most likely due to strong gamma radiation from the blood, liver, kidneys, etc., that was not shielded adequately from the crystal. This is also reflected in the ratio of the *in vivo* and *in vitro* values.

TABLE I

IN VIVO AND IN VITRO RADIOIODINE THYROID UPTAKE OF NORMAL RATS USING ^{125}I AND ^{131}I.

Isotope	*6 Hours Uptake*		*In Vivo / In Vitro*	*24 Hours Uptake*		*In Vivo / In Vitro*
	In Vivo	In Vitro	—	In Vivo	In Vitro	—
^{125}I	7.1%	6.3%	1.13	9.6%	12.0%	0.80
^{125}I	7.1%	6.4%	1.11	9.0%	9.0%	1.0
^{125}I	7.3%	6.5%	1.12	8.0%	8.2%	0.97
^{125}I	5.4%	5.7%	0.95	5.5%	6.5%	0.84
^{125}I	7.5%	6.7%	1.12	6.8%	7.0%	0.97
Average	6.9%	6.3%	1.09	7.7%	8.5%	0.90
^{131}I	12.2%	7.1%	1.72	13.7%	12.5%	1.11
^{131}I	12.5%	8.0%	1.56	13.4%	13.2%	1.02
^{131}I	13.1%	6.5%	2.02	12.9%	12.8%	1.01
^{131}I	13.5%	8.5%	1.59	13.4%	13.1%	1.02
^{131}I	12.6%	6.6%	1.91	13.3%	13.3%	1.00
Average	12.8%	7.3%	1.76	13.3%	13.0%	1.08

There is one important precaution that has to be observed. The thyroid must be exactly over the center of the hole in the platform. If it is not, the geometry will vary and the counts lower. A quick survey of the results will tell when an animal has a low count, and this determination can be easily repeated. With reasonable caution it is possible to obtain repeatedly almost identical counts on the same rat.

DISCUSSION

The apparatus described here has proven to be more satisfactory than any other instrument we have used to do thyroid uptakes on rats. Counting apparatus for use with small animals has been described before (1,2,3). Geiger-Muller detectors were used, however, which required more elaborate equipment than that described in this report.

The radioisotope ^{125}I is more satisfactory than ^{131}I for performing thyroid uptakes especially the six hour uptake, because its weak gamma radiation is easily shielded by a collimated detector. Thus, the only radiation counted comes from the thyroid region. This is not true of ^{131}I because its strong gamma radia-

tion is difficult to shield, and the radioisotope located in the blood, liver and other organs is counted as well as that in the thyroid.

The chief difficulty is holding the rat so that the thyroid gland is exactly in the center of the hole in the platform. However, with a little experience this is not difficult. Unanesthesized small rats can be satisfactorily held on the platform but larger rats should be lightly anesthesized as they can not be held firmly enough, even when wrapped in a towel to prevent slight movements that change the geometry and, therefore, the counting rate. We prefer to use pentobarbital as the anesthetic rather than diethyl ether, because of the hazard of an explosion when the latter is used around electrical equipment.

Larger scintillation detectors and more elaborate scalers such as those with pulse-height analyzer were also used. However, except for slight increase in sensitivity in the six hour uptake, the results are not improved.

SUMMARY

An inexpensive apparatus is described for positioning rats and other small laboratory animals over a scintillation crystal for doing thyroid uptakes. The material necessary to build it is usually found in the laboratory. The radioisotope ^{125}I is more satisfactory than ^{131}I for doing the early uptakes as its gamma radiation is easier to shield, and it gives a value corresponding more closely to the *in vitro* value.

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