A Simple Apparatus for Determining Basal Metabolism of Small Animals in Student Laboratory. (20719)

D. T. WATTS AND D. R. H. GOURLEY.

From the Department of Pharmacology, University of Virginia Medical School, Charlottesville, Va.

Many types of apparatus have been described for determining basal metabolism of small animals(1-4), especially the rat. Haldane's open circuit method(5), in which oxygen consumption and carbon dioxide production are determined simultaneously, has been widely used with various modifications. Most of such equipment has been designed for research purposes and is too complex and expensive for routine use in student laboratory experiments when several sets of the apparatus are required.

The device described in this paper is economical, simple to construct and operate, and quite accurate for equipment of its simplicity. About 30 pieces of this apparatus have been in routine use in our laboratory during the last 3 years with good results.

The apparatus is shown schematically in Fig. 1. A standard wide-mouth, half-gallon Mason jar is secured to a wood base by 2 wire straps. The glass liner is removed from a zinc top* and a 13 mm hole drilled in the center. A 5 ml burette is made by etching lines on an 11 mm o.d. glass tube with 1 mm walls. This burette is sealed in the jar top by slipping a 14 mm o.d. rubber tube over the burette and pushing this gasket into the hole in the zinc top. The animal container is fabricated from 6 mm mesh hardware cloth in the shape of a cylinder closed at one end. The approximate dimensions shown in Fig. 1 are suitable for the adult rat but the size of the animal container can be varied to fit smaller or larger animals.

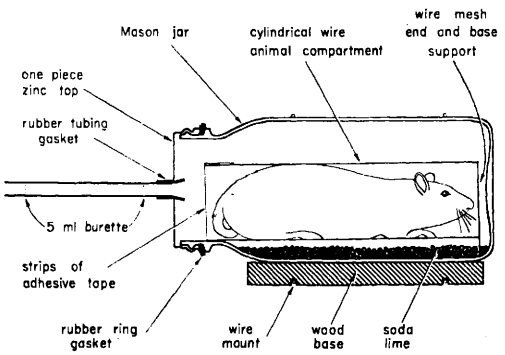

FIG. 1. Diagram of basal metabolism apparatus showing position of rat in animal container.

* If not available locally these can be obtained from Ball Brothers Co., Inc., Muncie, Indiana.

To determine the oxygen consumption of a rat the bottom of the chamber is covered with 8 mesh soda lime. The rat is placed in the animal container and the open end closed with strips of 50 mm adhesive tape. The cage is placed in the respiration chamber exercising care to prevent the animal from coming in contact with the soda lime. The chamber is flushed with oxygen and after wetting the walls of the burette with bubble soap,† the top is screwed on the chamber, using a standard rubber ring as a gasket to insure a tight seal. After waiting about ten minutes for temperature equilibration (the room temperature seldom varies more than 1°C during a laboratory period), a film of the soap is wiped across the end of the burette. As the rat uses oxygen and the carbon dioxide is absorbed by the soda lime, the film moves up the burette and the time taken for it to traverse the 5 ml volume is measured with a stop watch. Five determinations are usually made with the animal resting quietly in the cage and the mean is used for calculations.

Measurements of the rat's oxygen consumption are useful in connection with various exercises in a student laboratory. Typical results obtained in our laboratory are shown in Table I in which are listed the means and standard errors of the means of determinations of the oxygen consumption of adult rats (weighing 200-300 g) by 32 groups of students. The mean oxygen consumption of the control rats was 8.6 liter/m^2/hr which falls within 7% of the average value of collected data given by

† The bubble soap is of the type used by children for blowing bubbles and is usually available locally. Films of this material are more durable than those made from ordinary soap.

TABLE I. Summary of Typical Results Obtained by a Class of Students Using the Simple Basal Metabolism Apparatus. Oxygen consumption values are means for 32 rats corrected to N.T.P.

Treatment	Oxygen consumption, liters/m²/hr	Change from control	t	P
Control	8.6 ± .3			
Pentobarbital sodium (40 mg/kg)	5.6 ± .2	3.0	8.6	<.001
Tapazole (5 mg/kg/day)	7.8 ± .3	.8	2.0	.05

Griffith and Farris(6). After the oxygen consumption of each control animal was determined, the rat was injected intraperitoneally with 40 mg pentobarbital sodium‡ per kg and further determinations made when the animal became comatose. As expected(7), the oxygen consumption of the rat under pentobarbital anesthesia was significantly lower which was determined statistically by using the test for the significance of the difference between means given by Goulden(8).

Another group of 32 rats had been given 5 mg Tapazole§ per kg per day in their drinking water for 3 weeks. The oxygen consumption of these animals was determined by the same students in the same exercise. It is seen in Table I that administration of the antithyroid drug reduced the mean oxygen consumption by a small but statistically significant degree. Thus when used by an average group of students the simple basal metabolism apparatus herein described permits the measurement of even relatively small effects of drug administration.

‡ The pentobarbital sodium was generously provided by Abbott Laboratories.

§ The Tapazole (1-methyl-2-mercaptoimidazole) was generously provided by Eli Lilly and Co.

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Received October 29, 1953. P.S.E.B.M., 1953, v84.

Demonstration of β-Oxidation and Acetoacetate Formation in a Mouse Hepatoma.* (20720)

G. W. BROWN, JR., I. L. CHAIKOFF, AND D. D. CHAPMAN.

From the Department of Physiology of the University of California School of Medicine, Berkeley.

The ability of normal tissues or their enzyme preparations to oxidize fatty acids via C_2 fragments (acetyl-S-CoA) has been demonstrated convincingly by many workers. Until recently, however, fatty acid oxidation by neoplastic tissues received little attention. Weinhouse and coworkers, in a series of papers on the metabolism of neoplastic tissues(1-3), have provided evidence for the occurrence of β-oxidation of fatty acids and the existence of the tricarboxylic acid cycle in such tissues. An interesting aspect of their studies was the search for isotopic acetoacetate which might have accumulated during the oxidation of C^{14}-labeled fatty acids. The amounts of C^{14} recovered in the acetoacetate fraction apparently approached the lower limits of detection. In-

* Supported by Cancer Research Funds of the University of California.