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A Simple Apparatus for Metabolic Measurements on Small Animals.*

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In view of the highly complicated apparatus which is usually described as being necessary to measure the oxygen consumption of the smaller laboratory animals, it appears worthwhile to point out that equally valuable and accurate results may be obtained with an extremely simple device. The apparatus described herein seems so obvious a method of measuring metabolism by the use of oxygen consumption that there is hardly anything original in its design.

In essence the apparatus consists of a thin-walled copper tank, inside of which (K) an animal such as a frog, rat, mouse or guinea pig may be placed. The animal sits on a floor (L) of coarse wire gauze (3 mesh) supported on legs above the surface of a fine wire gauze basket (M) which contains 12 mesh soda-lime. This raised floor permits the feces to drop out of the way so the animals do not soil themselves and spend time cleaning their fur. A second basket for soda lime (G) is suspended in the top of the tank. This basket is made double so the animals cannot get their noses against the soda-lime and sniff the irritating dust up their nostrils. A perfect seal is easily obtained by having a flat top (D) with a downward projecting rim (E) which extends into a moat (F) containing oil or water. This gives a perfectly tight liquid seal without the necessity of having the usual ground joints or clamps, etc. Through the top projects the tube (C) of an ordinary float volume recorder (B). Changes in volume are recorded from the level of the volume recorder on the scale (A). By having the scale drawn or pasted on a mirror, parallax in the readings is avoided; a thermometer (P) also projects through the top. Oxygen is admitted to the tank through a copper tube (O) in the bottom, the flow being controlled by a stopcock. A weight (N) is fastened to the bottom to prevent the tank floating when immersed in a water bath (J). A hole is cut in the side of the tank over which is sealed with sealing wax, a glass plate (I) which serves as a window for observing the activity of the animal.

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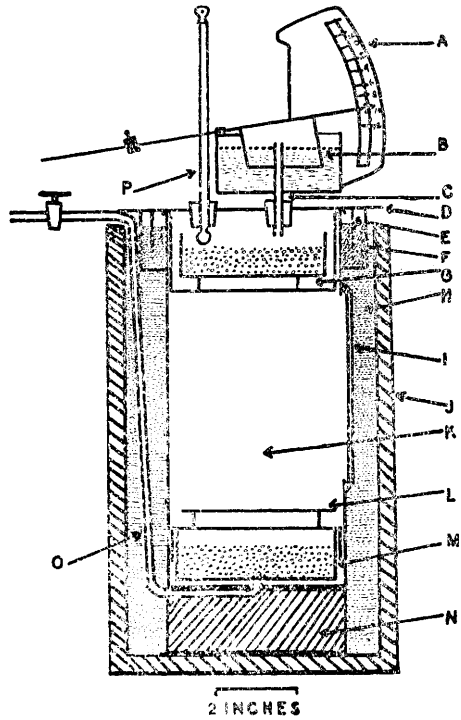

FIG. 1.

The apparatus (Fig. 1) is large enough for rats or guinea pigs of at least 600 gm. in weight. The reason for the accuracy of this apparatus is that it has a negligible excess of air space. This minimizes the change in absolute volume of the gas inside if any slight fluctuations occur in the temperature. The heat capacity of the water jacket (H) is sufficient to hold the temperature very constant, even when the animal has metabolic rates several hundred per cent above the normal, as during dinitrophenol poisoning. Under conditions of prolonged observations or extreme atmospheric conditions, the apparatus can be placed in a constant temperature bath, or water from such a bath may be allowed to run through the glass jar.

In actual practise the animal is put into the tank and permitted to relax for 10 or more minutes, until there are no movements over a reasonable period of time. Meanwhile oxygen slowly runs into the tank from an ordinary gas cylinder at a rate slightly faster than the utilization, the excess bubbling out the top by upward displacement of the float recorder (B). When a measurement is to be made, the oxygen inflow is stopped by turning the stop-cock, and

the float recorder drops down across the scale as the oxygen is used up. The time required to use from 2 to 8 cc. of oxygen is measured with a stopwatch. A series of readings are taken while the animal is quiet. The readings are accepted if there is no progressive drift in a series of 5 or more consecutive readings taken over a period of 5 to 10 minutes. These values should check each other within a maximum range of not more than 10%.

The experience of several years' steady use of this apparatus shows that no difficulty is encountered in obtaining values in good accord with those of more complicated instruments. Reference to the recently published papers on the metabolic stimulation caused by dinitrophenol will show the type of data that has been obtained with this apparatus.[1] The apparatus may be made smaller for animals below 150 gm. The one illustrated in this paper, and one about half the size, has served all needs for animals between the weights of 30 and 600 gm.

Summary. A simple apparatus is described for measuring the metabolic rates of smaller laboratory animals. It requires no unusual materials and can be made in a few hours by anyone able to solder. Its accuracy and simplicity are derived from the fact that by keeping the size down to a minimum, the contained gas volume is very small and the necessity for rigorous temperature control and circulation of the air is thereby eliminated. The values reported in the literature, with more complicated apparatus and groups of animals measured over longer intervals of time, are reproducible in this simple apparatus using single animals and observation-periods of relatively few minutes.

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Conventional Bacteriologic Technics in "Hormone" and "Vitamine" Research.*

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A fairly uniform bacteriologic technic is in current use for the demonstration of "hormones," "vitamines" and "accessory growth-

[1] Tainter, M. L., *J. Pharm. Exp. Therap.*, 1934, **51**, 45.

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