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A respiration calorimeter of the Atwater-Rosa-Benedict type designed for use with dogs and children; with demonstration.

By **H. B. WILLIAMS.**

[*From the Physiological Laboratory, Cornell Medical College, New York City.*]

The apparatus demonstrated is in many respects a miniature of the calorimeters of this type which have been constructed at the Nutrition Laboratory in Boston. The writer wishes to acknowledge his great indebtedness to Dr. Francis G. Benedict, director of that laboratory, for his invaluable assistance in working out the problem of a small calorimeter.

In order to measure with a satisfactory degree of precision the gaseous and energy metabolism of infants and small animals, it has been necessary to introduce some special modifications. As a detailed description of these modifications with a report of the control tests of the apparatus will be communicated within a short time, particular mention need not be made at present.

35 (560)

The chemical and energy transformations in the dog after the ingestion of different quantities of meat.

By **H. B. WILLIAMS, J. A. RICHE** and **GRAHAM LUSK.**

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A dog weighing about 13.8 kilograms was given on different days, 700 grams of meat and 1,200 grams of meat at the noon hour. In the morning the metabolism was determined for an hour, while the dog slept quietly in the respiration calorimeter. The minimum or basal metabolism thus determined was found to be about 25 calories per hour. After the ingestion of meat at noon, the animal was again placed in the respiration calorimeter, and the hourly metabolism determined. The results are given in the following table.

HEAT PRODUCTION AFTER MEAT INGESTION.

700 grams meat at noon.

	A. M. 9.45–10.45	P. M. 12.45–1.45	1.45–2.45	2.45–3.45	3.45–4.45	4.45–5.45	5.45–6.45	6.45–7.45
Calories found	25.06	30.78	35.07	33.98	34.09	33.87	33.51	33.49
Calories calculated	26.32	31.33	35.16	33.62	32.41	32.49	31.88	33.45
Grams urinary N.....	0.234	0.591	0.812	0.974	1.52	1.55	1.54	1.25
No. of experiments	(3)	(2)	(1)	(2)	(1)	(1)	(1)	(1)

1,200 grams meat at noon.

Calories found.....	25.06	33.28	33.96	41.52	39.59	38.16	43.43*
Calories calculated	26.32	38.87	40.30	42.53	40.47	40.64	44.15
Grams urinary N.....	0.272	0.865	1.724	1.80	1.88	1.99	1.93
No. of experiments....	(3)	(4)	(2)	(2)	(2)	(1)	(1)

* Dog awake part of the time.

It will be noticed that the metabolism rises from 25 calories in starvation, to 34 calories after the ingestion of 700 grams of meat, and from 25 calories to 40 calories, after the ingestion of 1,200 grams of meat. In general, the figures agree with Rubner's conception, that about 30 per cent. of the total energy of metabolized protein is wasted as free heat, within the organism. One new point stands out prominently in the above table, and that is, that for the first time, the direct and the indirect calorimetry in hourly periods have been found approximately to agree.

An exception to this occurs during the first two hours after the ingestion of 1,200 grams of meat. Here, the calories found are much smaller than the calories calculated by the Zuntz method of indirect calorimetry, that is from the carbonic acid excretion, the oxygen absorption and the nitrogen elimination. This indicates that the method of indirect calorimetry is not an accurate measure for the heat production during the early hours after the ingestion of meat in large quantity.

Two causes may here be active. Either (1) there is oxygen storage within the organism and carbonic acid elimination from the blood, or (2) there are oxidative processes which require oxygen and cause the liberation of carbon dioxide as the result of the production of early cleavage-products of protein metabolism, products which yield carbonic acid and require oxygen, but which do not liberate heat in the same quantities as it is liberated when the protein molecule is oxidized in its entirety.