Summary only

AN AIRFLOW CALORIMETER FOR THE MEASUREMENT OF THE SENSIBLE HEAT LOSS OF ANIMALS

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THE GENERAL PRINCIPLE of an airflow calorimeter was described and is shown in Fig. 1. If the airflow is constant, then heat output is proportional to the temperature difference between the ingoing and outgoing air for a calorimeter of known constant cross-section. The constant term will depend on the specific heat of the airstream. The temperature difference was measured directly as the potential difference between banks of thermocouples. A sufficient number of couples were connected in series to enable readings to be made on a potentiometric recorder.

Airflow calorimeters for sheep and mice, respectively, were described. Direct calibration with a known heat source was considered preferable to theoretical calibrations because of difficulties of exact airflow measurement and also the possible variations in the specific heat of air with humidity and temperature. While further detailed calibration tests have yet to be made, initial calibration showed reasonable agreement with theoretical expectation.

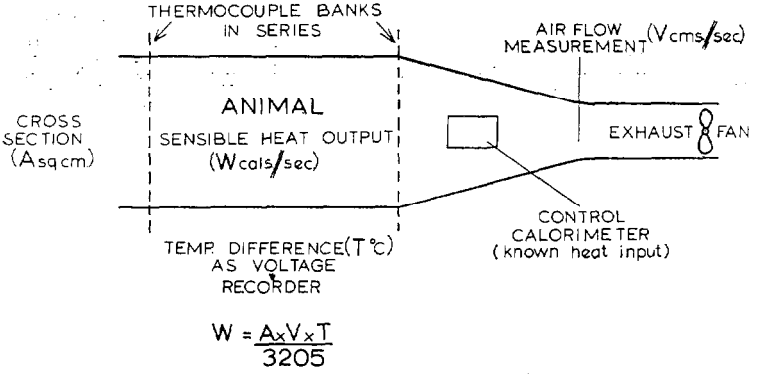

Fig. 1: General principle of air-flow calorimeter.

Repeatability trials with a mouse calorimeter showed that differences of heat loss could be detected between two strains of each of five mice. Allowing by regression for bodyweight differences, the standard deviation within strains and repeat measurements was 0.017 cal/sec (16 d.f.) or 7% of the general mean. This would include some residual variation between the mice as well as that from the calorimeter.

Initial repeatability trials with the sheep calorimeter (2 sheep, each measured 6 times for about 1 hour, data from summation of recorded readings, at 4 per minute, for 3 periods of 4 minutes) showed that sheep differences could be detected. Sheep means were 12.2 ± 0.30 and 10.3 ± 0.38 cal/sec ($P < 0.001$ by t test). Individual recorder readings over 4 minutes had an average standard deviation of 0.62 cal/sec. The overall mean had a standard error of 0.25 cal/sec (32 d.f. within sheep) or 2.2% of the mean. It was suggested that the use of an integrating recorder and suitable planned experiments over longer periods would make this a maximum estimate of error.

Possible extensions of the calorimeter in order to measure heat losses from water vapour and methane were discussed.

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