Energy metabolism in animals and man

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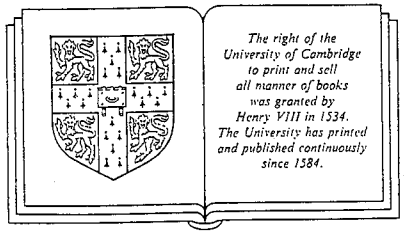

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Table 5.1. *The composition of the fat-free body of different species*

Species	Body weight (kg)	Water (%)	Protein (N × 6.25) (%)	Ash (%)
Rat	0.35	73.7	22.1	4.2
Hen	2.5	71.9	22.0	3.9
Rabbit	2.6	72.8	23.2	4.0
Cat	4	74.4	21.0	4.6
Man	65	72.8	19.4	7.8
Sheep	80	71.1	21.9	4.2
Pig	125	75.6	19.6	4.7
Ox	500	71.4	22.1	6.0
Horse	650	73.0	20.5	5.8

predict the enthalpy of combustion if crude protein is an index of fat-free mass. This approach has long been used as an alternative to the direct determination of enthalpy of combustion of the whole body by bomb calorimetry by applying specific enthalpy factors to the determined crude composition. For example, in sheep the enthalpy of combustion of the ether extracted (crude) fat is 39.1 kJ/g and of fat-free organic matter 23.2 kJ/g. For cattle the corresponding values are 39.5 kJ/g and 23.0 kJ/g, respectively (Agricultural Research Council 1980). The enthalpy of combustion of the fat-free organic matter in these two species is very close to that of crude protein (N × 6.25) which is 23.6 kJ/g. In these two species application of the respective factors to chemical analytical data predicts enthalpy of combustion extremely well. Factors differ little from species-to-species and there are many examples of their validation in laboratory species.

5.1.2 *The composition of the fat-free body*

Table 5.1 gives data on the composition of the fat-free body of different species, which reflects the broad constancy referred to above. It will be noted that there is no entry for carbohydrate. Glycogen is found in the liver where its concentration ranges from considerably less than 1% to over 5%, and in muscle where its concentration ranges from less than 1% to about 4%. For the body as a whole, the mean concentration of glycogen is usually less than 1%. In a normally-fed man, not undergoing severe exercise, the total amount of glycogen in the body is 300–500 g, or 0.4–0.7% of body weight. Liver and muscle glycogen are both depleted in starvation and by severe sustained exercise. Glycogen is stored in association with 3–4 times its weight of water (Olsson & Saltin 1970). By measuring energy retention and change in body weight twice daily for 10 d, Garrow (1978)