Biology in a darkened room

of two.] ... It is uncertain just what is meant by surface area. Does the 'true' surface area of an animal include the skin area between the legs that is not exposed to the outside? Does it include the ears, and if so, both sides?

I would argue that rather than seeking a single reason for nature's apparent preference for a 3/4 rather than a 2/3 power law, we should pause to think whether we have allowed our mathematical enthusiasm to carry us a little too far. Here are my reasons.

Closeness of exponents An elephant weighs about 10^5 times the weight of a mouse. The ratio $R_{3/4}$ of the metabolic rates for the two predicted by the 3/4 rule is given by

$$R_{3/4} = \left(\frac{\text{mass of elephant}}{\text{mass of mouse}} \right)^{3/4}$$

and ratio $R_{2/3}$ of the metabolic rates for the two predicted by the 2/3 rule is given by

$$R_{2/3} = \left(\frac{\text{mass of elephant}}{\text{mass of mouse}} \right)^{2/3}.$$
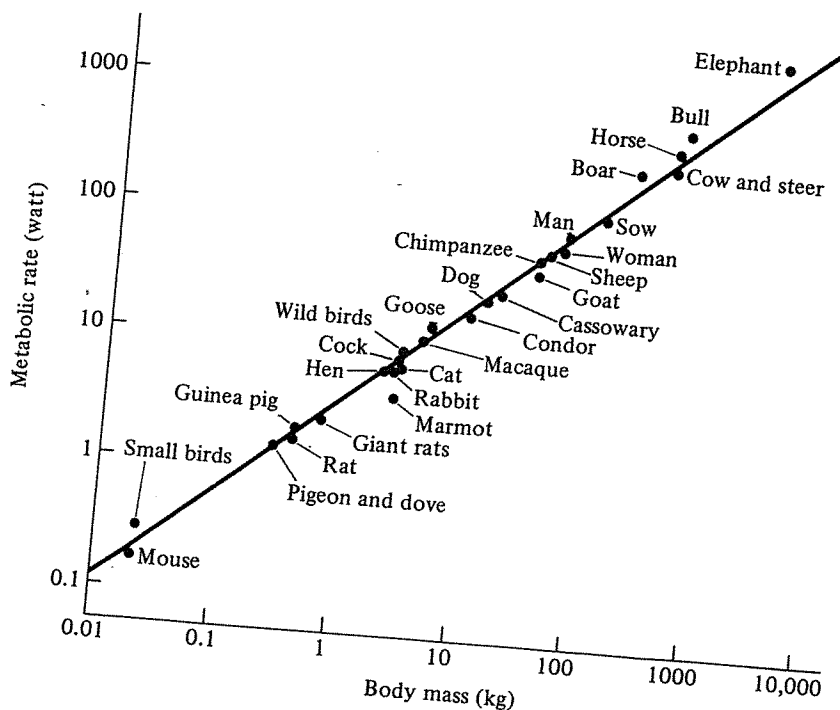

Figure 5.1: Metabolic rates for mammals and birds.