

Chapter 47

Evolutionary Aside 47.3--Evolution of Basal Metabolic Rate

Basal metabolic rate (BMR) varies among species for a variety of reasons. The two most important factors are body size and whether the animal is an ectotherm or an endotherm. With regard to the latter, as you have seen in chapter 42, ectotherms either have a body temperature that is the same as their surroundings, or they regulate their body temperature by behavioral means. By contrast, endotherms generate their own heat internally. This is reflected in the basal metabolic rate, which must be much higher in endotherms to generate the heat; for example, mammals have a BMR seven times that of reptiles of the same size.

Size is the second important factor. In comparisons among species, BMR increases with body size, but not proportionally—the slope of the relationship between mass and BMR is < 1.0 , so that the ratio of BMR/Mass decreases as animals get larger. A likely explanation is that as animals get larger, the ratio of their surface area (i.e., skin) to volume (body mass) gets smaller. Because heat production is related to mass, but heat loss is related to surface area, larger animals need to produce less heat *per unit mass* to compensate for heat lost through the skin, and thus they need a relatively lower BMR.

Other factors also affect BMR. Species, such as anteaters, that eat food that is less nutritious tend to have a low BMR, perhaps because they can't afford to burn calories at a higher rate due to the quality of their food. Burrowing mammals also have lower BMR for reasons that are not entirely clear.