

Chapter 48

Evolutionary Aside 48.3--Endurance, Breathing, and Locomotion in Reptiles and Mammals

It has long been known that mammals have greater endurance than reptiles—that is, mammals can exercise at an aerobically sustainable rate for longer periods than reptiles of comparable size. However, physiologists have not understood why this should be, and many theories have been presented.

Recently, research on how the movement of animals affects their breathing has clarified this issue. Most reptiles have a sprawling body posture and move by bending their bodies sideways—think of a lizard climbing a wall or an alligator walking. These movements of the trunk (the part of the body between the front legs and the hindlegs)—shifting it first to the left, then to the right—are controlled in part by the external intercostals muscles, the same ones that are responsible for expanding and contracting the lungs. However, to expand and contract the lungs, the muscles on both sides of the body must work in unison, first expanding then contracting. When moving, the muscles operate in opposition, contracting on one side and expanding on the other. The surprising realization made by scientists is that reptiles cannot breathe while they are running! As a result, they essentially hold their breath as they run, with the result that they quickly deplete their stores of oxygen and then have to stop.

In contrast, most mammals have their legs positioned directly under the body, and as a result, they do not need to shift from side to side while moving, thus allowing movement and breathing to be decoupled, and thus to occur simultaneously. Consequently, mammals can breathe as they run, and thus can keep going for much greater distances, giving them substantially better endurance capability.