



The Cold Blooded News

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How Do Lizards Breathe?

by Donald L. Blanchard
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Can lizards breath while they are running? It is an old and often argued question. Most lizards run in short, rapid bursts, then appear to breath heavily afterwards, as if making up for an oxygen deficit. It has been suggested that lizards use the same rib muscles to hold their bodies erect and to undulate from side to side when running that they use in breathing, making it unlikely that lizards can breathe normally and get as much oxygen while running as they are consuming. Most lizards are also what is known as sit-and-wait predators, who spend most of their waking hours motionless, waiting for food to come by.

Some lizards, such as Whiptails (*Cnemidophorus*) and Monitors (*Varanus*) adopt a more active lifestyle, as wide ranging foragers. As reported in a Research News article in Science magazine, Elizabeth Brainerd and her colleagues at the University of Massachusetts, Amherst, have suggested that Monitor lizards are fully capable of normal respiration while running. She noticed from an x-ray video of a Monitor on a treadmill that the gular region of the lizard's throat seemed to be expanding and contracting. It had previously been noted that Monitors seem to inhale in a series of small breaths, and exhale all at once. Brainerd was able to determine

that the small breaths feed air into the gular pouch, which acts as a pump, pumping air into the lungs.

There was a strong correlation between the frequency of the breaths and the amount of activity; the faster the lizard ran, the more frequent the breaths. Even while running, blood oxygen levels remained high, indicating that the lizards are in fact fully capable of breathing while running. When the Monitor's mouth was propped open, preventing the gular pump from operating effectively, oxygen intake dropped 22% when running on the treadmill at 1 kilometers per hour, and 37% at 2 kilometers per hour.

Mammals, of course, solve the breathing problem quite differently, having evolved a diaphragm, rather than relying on chest muscles, to pump air. Birds breathe with the aid of their enlarged flight muscles, which pump air into their lungs, through the hollows in their skeleton, and back out to the throat, in a one-way flow. This increase in oxygen intake efficiency allows them to metabolize rapidly enough to sustain powered flight.

Author's note: *I strongly suspect that the gular pump arrangement is operable in many, if not all, lizards, at least to some degree. Rapid throat/gular flap motions can be observed after even short range sprinters come to rest. In Whiptails, I suspect that it operates at the same efficiency as in Monitors, or very close to it. I have personally pursued the same Six Lined Racerunner (*Cnemidophorus sexlineatus*) for a full hour, during which time it only paused long enough to ingest three grasshoppers.*

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