

Life in a Shell: A Physiologist's View of a Turtle

By Donald C. Jackson. 2011. Harvard University Press. 79 Garden Street, Cambridge, Massachusetts 02138 USA. 178 pages. \$29.95 USD.

Instantly recognizable because of their distinctive shells, turtles are nonetheless taken for granted. People rarely consider the questions inherent in living inside a bony shell. How can turtles breathe since they can't expand their ribcage? And how can they survive an entire winter under water without breathing?

Such questions have fascinated Donald Jackson for many years. Jackson, now a professor emeritus at Brown University, has studied the physiology of turtles since the late 1960s. Unlike many turtle biologists, Jackson did not begin with a passion for turtles. He began his research career studying temperature regulation in exercising dogs. An interest in anaerobic metabolism led to an experiment using turtles to measure total metabolic rate and so began Jackson's ongoing studies in turtle physiology.

Jackson's book is divided into eight chapters, each focusing on a different topic: a general introduction to turtles, buoyancy, breathing, studies on sea turtles at Tortuguero in Costa Rica, overwintering without breathing, surviving without oxygen, the heart, and metabolic rate. Although this is a slender volume, Jackson tackles some very technical issues. The explanations are general clear, with plenty of examples and comparisons to humans. And the book is filled with fascinating insights. For example, turtles breathe differently than mammals. Turtles do not breathe contin-

uously, like we do, but intermittently. A turtle takes a few breaths, holds its breath and then repeats the cycle. This pattern holds true even when turtles are on land. Turtles, of course, are renowned for holding their breaths long periods of time. Most humans can hold their breath for a minute or two, but according to Jackson, the world record is an amazing 11 minutes, 35 seconds. Of course, even 11 minutes is trivial compared with the six months a turtle may spend under water during hibernation. Turtles are "cold blooded" so in winter, resting on the bottom of a wetland, their body temperature is just slightly above freezing. This can reduce their heart rate to as little as one beat every 10 minutes, however, even at this reduced rate oxygen would be all consumed in less than a day. So how do turtles survive the winter? Either through oxygen uptake from the water, or, in some species, anaerobic metabolism.

This is certainly a book about physiology, more than turtles. With an emphasis on partial pressures of oxygen, regulation of blood pH, metabolic depression, and lactate sequestration this book is not for the reader just casually interested in turtles. It will be of primary interest to physiologists and dedicated turtle biologists.

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