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This Week's Citation Classic ®

Brattstrom B H. Body temperatures of reptiles.
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[Department of Biology, California State College, Fullerton, CA]

This study confirmed that reptiles are not "cold-blooded" and that they can maintain their body temperature at high levels by behavior. Yet it also showed that temperate, tropical, alpine, desert, shade-dwelling, and burrowing reptiles have a diversity of thermal requirements and abilities to regulate body temperature. It introduced the notion of physiological control of temperature regulation in some species. [The *SCI*® indicates that this paper has been cited in over 260 publications, making it the most-cited paper for this journal.]

All Reptiles Are Not Alike

Bayard H. Brattstrom
Department of Biological Science
California State University
Fullerton, CA 92634-4080 *

The classical R.B. Cowles and C.M. Bogert[1] paper on body temperature of desert reptiles showed that reptiles were not cold-blooded but behaviorally thermoregulated largely by the absorption of solar radiation so as to fairly precisely maintain their body temperatures above ambient. These studies had been on desert reptiles only, yet they opened the door to what is now referred to as the "grab-em and jab-em" or "noose-em and goose-em" school of body temperature taking. With the diversity of reptiles and the habitats that they occupy, I hypothesized that there must be a diversity of thermal requirements and thermoregulatory mechanisms. In fact, for some tropical, aquatic, or burrowing forms, there might be no requirement for some reptiles to thermoregulate at all! I took body, air, soil, and water temperatures of tens of thousands of reptiles and amphibians from Canada to Panama. In addition, I watched the animals behave, because thermoregulation, if present, is a process that is not necessarily revealed by just taking body temperatures. These data, combined with other people's studies, resulted in the paper cited and one on body temperatures of amphibians.[2] The reptile data showed that some reptiles were thermoconformers, some were thermoselectors, while others were effective thermoregulators. The paper argues that while most previous physiological studies were poorly conducted, there were also some new studies that suggested physiological as well as behavioral control of body temperatures. In subsequent years others have extended these physiological studies or have gone into the biophysical and energetic aspects of reptile thermoregulation.[3,4] Now all workers recognize that reptiles are not all alike, nor all like desert reptiles. The data became the working base for the temperatures reptiles are kept at in captivity and for the thermal limits they can endure in physiological studies. In addition, they showed that, in many reptile communities, there is a thermal partitioning of the environment.

Because of my interest in reptile distribution and fossil reptiles, I wanted to see if the limits of thermal requirements of modern reptiles could indicate past climates. Studies on tortoises and snakes seem to suggest this. Concern that amphibians and reptiles could alter their thermal limits (acclimation), lead to my studies on rates and range of thermal acclimation.[5]

Alas, the truth be out! I love the subtleties by which organisms cope with their environments, but I also want to see the diversity, to see the "big picture"; and there is my built-in excuse to *travel* and *look*!

Besides, it is fun snorkling, thermometer in hand, up to an aquatic turtle basking on a log, but perhaps not so fun being kicked in the face with sand as a female green sea turtle covers her eggs while I take her body temperature (female sea turtles generate about 2° C of heat in the process of egg-laying). It is fun plucking frogs and salamanders from bromeliads or ponds, but perhaps less so when it is night and it is a 4° C Oregon stream. Perhaps it is not fun taking the temperature of a warm rattlesnake at one end while holding the beast down at the other end. But to see new and different species and to see them behave and thermoregulate in diverse ways, there is the fun of it all.

My major concern now is that many of the places to which I traveled in the 1950-1960s are now destroyed or degraded. So, while I continue my studies on temperature, behavior, and ecology, I spend much more time working on habitat conservation and other environmental concerns.[6] We have so little time to save habitats and organisms for the next dozen generations of scientists to study and enjoy!

1. Cowles R B & Bogert C M. A preliminary study of the thermal requirements of desert reptiles. *Bull. Amer. Mus. Nat. Hist.* 83:261-96, 1944. (Cited 135 times since 1945.)
2. Brattstrom B H. A preliminary review of the thermal requirements of amphibians. *Ecology* 44:238-55, 1963. (Cited 110 times.)
3. Gans C & Pough F H, eds. *Biology of reptiles: physiological ecology*. New York: Academic Press, 1982. Vols. 12 & 13.
4. Huey R B, Pianka E R & Schoener T W, eds. *Lizard ecology; studies of a model organism*. Cambridge, MA: Harvard University Press, 1983. 501 p.
5. Brattstrom B H. Thermal acclimation in Australian amphibians. *Comp. Biochem. Physiol.* 35:69-103, 1970. (Cited 30 times.)
6. ————. Habitat destruction in California with special reference to *Clemmys marmorata*: a perspective. (DeLisle H F, Brown P R, Kaufman B & McGurty B M, eds.) *Proceedings of the Conference of California Herpetologists*, 10-11 October 1987. Van Nuys, CA: Southwestern Herpetological Society, 1988. p. 13-24.

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