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THE THERMAL CONSEQUENCES OF RETREAT SITE SELECTION BY GARTER SNAKES. R.B. Huey, C.R. Peterson*, S.J. Arnold, and W.P. Porter. Univ. of Washington, Univ. of Chicago, and Univ. of Wisconsin, Madison.

Studies of behavioral thermoregulation of ectotherms have typically focused on animals active above ground even though temperate-zone ectotherms actually spend more time sequestered in retreats. To explore the thermal consequences of retreat site selection by garter snakes (Thamnophis elegans), we measured potential body temperatures in various retreats in northeastern California during the summer. We combined these data with information on thermal tolerances, preferences, and thermal dependencies of metabolism and digestion to predict which sites would be physiologically optimal. We tested the predictions with data from telemetered snakes. During much of the day, garter snakes had to avoid the open surface, thin rocks, or shallow burrows because temperatures there exceeded their voluntary thermal maximum (36 C). Except for about an hour in the morning, the best sites for maintaining preferred body temperatures (28-32 C) were under medium thickness rocks (25-30 cm thick) and the snakes usually selected these rocks as retreat sites.

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AT WHAT SIZE ARE TUNAS ABLE TO ELEVATE MUSCLE TEMPERATURES SIGNIFICANTLY? K. A. Dickson, Calif. State Univ., Fullerton, CA, and Inter-American Tropical Tuna Commission, La Jolla, CA.

Black skipjack tuna (Euthynnus lineatus) juveniles [10-20 mm fork length (FL)],captured by nightlighting, were raised to larger sizes at the Inter-American Tropical Tuna Commission laboratory in Achotines, Panama. In addition, larger specimens were obtained by trolling feathered jigs from the R/V Roncador. Bailey BAT copper constantan thermocouples inserted into the fish's body were used to measure maximal muscle temperatures (Tm) and ambient water temperature (Ta), and Tx (Tm-Ta) values were calculated. Fish of 15.5-114.7 mm FL had maximal Tx of 0-2.5 $\pm$ 0.5°C (N=14). The largest lab raised fish, FL 279 mm, had a significantly elevated Tm (Tx = 3.8°C). Fish caught at sea (319-543 mm FL; N=10) had maximal Tx = 4.0-7.0°C. Therefore, black skipjack tuna acquire the ability to elevate deep muscle temperatures significantly when they are between 115 and 279 mm FL. These data will be compared with measurements of heat exchanger development and size.

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INSPIRED CO_2 AND THE CONTROL OF BREATHING IN GARTER SNAKES AND GECKO LIZARDS. R.A. Furilla and D. Bartlett, Jr.* Dartmouth Medical School, Hanover, N.H.

This study was undertaken to gain a better understanding of the role of IPCs in the control of breathing. Snakes and lizards were tracheostomized to remove the influence of upper airway receptors. Animals were unidirectionally ventilated or allowed to ventilate normally, but without glottal control of the breath-hold. When a bidirectionally breathing snake was presented with CO_2 at the tracheal tube, inspiratory duration and volume decreased. When CO_2 was removed from the inspired air, inspiratory duration and volume increased. Removing CO_2 from the airstream of a unidirectionally ventilated snake during a breath-hold produced apnea, but removing CO_2 at the beginning of inspiration caused the duration and volume of that inspiration to increase. None of these maneuvers caused a significant change in inspiration in geckos until at least the second breath after the maneuver. Therefore, if IPCs are present in geckos, and IPCs are responsible for the response seen in snakes, then geckos integrate this information differently from snakes.

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DIMENSIONS AND IMPORTANCE OF OXYGEN BOUNDARY LAYERS IN CUTANEOUS GAS EXCHANGE. M.E. Feder and A.W. Pinder. The Univ. of Chicago.

Theoretical considerations and anecdotal observations suggest that oxygen boundary layers surrounding animals in water should pose a significant resistance to cutaneous oxygen exchange, but the magnitude of this resistance has never been determined directly. With oxygen microelectrodes, we measured the oxygen boundary layer surrounding a variety of amphibians submerged in normoxic water. The P_{O_2} at the skin-water interface was usually less than 20 Torr in still water, demonstrating that the boundary layer can offer a profound resistance to cutaneous gas exchange. Both the size of the boundary layer and the severity of hypoxia at the skin-water interface were related to the speed of water flow past the skin. The ventilatory environment of the skin can affect respiratory and other behaviors. In diving frogs (*Xenopus*) obtaining oxygen via cutaneous uptake from water, cessation of cutaneous ventilation (which presumably decreased the P_{O_2} at the skin-water interface) increased air-breathing frequency, decreased dive duration, and increased routine voluntary movement. The data demonstrate that diffusion boundary layers are large and can significantly affect overall gas exchange in skin-breathing vertebrates. Supported by NSF DCB84-16121 and DCB87-18264.