23.5

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EFFECTS OF TEMPERATURE ON METABOLIC RATES OF PACIFIC BLUEFIN TUNA, *THUNNUS ORIENTALIS*

Tunas are remarkable among teleosts for systemic endothermy, high metabolic rates and exceptional cardiac performance. Among tunas, the 3 bluefin species attain the largest body sizes, inhabit the broadest thermal niches, and maintain the highest body temperatures. We measured oxygen consumption of 7 to 10 kg Pacific bluefin tuna as the animals swam in an 870 L swim tunnel respirometer for up to 6 days at temperatures of 6 to 25 C. Routine metabolic rates of bluefin at 20 C (222 ± 24 mgO2/kg/hr) were higher than those of yellowfin tuna in this study (162 ± 19 mgO2/kg/hr). VO2 was minimized at higher speeds in bluefin than in yellowfin. At a given speed, bluefin swam with higher tailbeat frequencies and shorter stride lengths than yellowfin tuna. This difference may be related to interspecific differences in internal temperature. VO2 of bluefin swimming at 1 BL/s was minimized at temperatures of 15 to 20 C and increased at ambient temperatures of 8 to 10 C and at 25 C. Yellowfin tuna showed a similar pattern, but were unable to tolerate temperatures below 10 C. Archival tag data indicate that visceral thermal excess remained constant as ambient temperature in the swim tunnel changed. The cold-induced increase in VO2 may be related to endothermy, muscle mechanics, or behavior. Interspecific differences in metabolic rate and thermal tolerance correspond to differences in cardiac performance and biochemistry. Funded by NSF and Monterey Bay Aquarium.

15.8

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A TEST OF REPRODUCTIVE POWER IN SNAKES

Reproductive power is a contentious concept among ecologists and the model has been heavily criticized on theoretical and empirical grounds. Despite these criticisms, this model has successfully predicted the modal (optimal) size in three large taxonomic groups and shape of the body size distribution in two of these three groups. Here, we test the reproductive power model on a group that differs from the endothermic groups (upon which the model was derived) in both physiology and shape of the body size distribution. We derived snake-specific constants for the model using allometric relationships of energy in clutches or litters and relative population productivity. The relationships used to derive these constants were surprisingly similar between snakes and endotherms. Using snake-specific constants, the model accurately predicted the modal size in the snake size distribution; maximum reproductive power is achieved for a snake that is 408 g. However the model predicted a right-skew rather the log-normal shape of the empirical size distribution for snakes. If the model is correct, then snake diversity is limited especially in the largest size classes. Possible explanations for this limitation include biomechanics of locomotion and energetic constraints on foraging for the large prey. We briefly discuss how the relationships used to derive constants could limit the predictive power of the model.

38.3

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ACTIVITY OF STEROIDOGENIC ENZYMES IN PLACENTA AND IN LUNG, FAT AND SKIN OF THE STELLER SEA LION PUP (*EUMETOPIAS JUBATUS*)

Steroidogenic enzymes that regulate levels of estrogens and androgens in mammalian tissues may be targets for endocrine disruptors. As a basis for assessing their role in regulating hormone levels and their potential as biomarkers of endocrine disruption in the Steller sea lion, 17β-hydroxysteroid dehydrogenase (17β-HSD), 3β-hydroxysteroid dehydrogenase/5-ene-3-ketosteroid isomerase (3β-HSD) and 3αa-hydroxysteroid dehydrogenase (3α-HSD) were assayed in homogenates of placenta (n=13) as well as lung, subcutaneous fat and skin from one female and five male pups (1-4 weeks). 17β-HSD activity with estradiol (E2) and testosterone (T) was detected in the placenta samples as was 3α-HSD activity with 5α-DHT. 3β-HSD activity with DHEA was not detected. With regard to 17β-HSD activity in pup tissues, lung samples had the lowest activity and skin the highest. The ratio of 17β-HSD activity with E2 and T varied from 0.1 to 1.1 for skin and 0.1 to 2.3 for fat. For male pup skin samples, the 17β-HSD/3α-HSD activity ratio varied from 0.27 to 7.2. For subcutaneous fat the range was 0.16-5.1. No 3α-HSD activity was detected in the female pup skin sample. The marked variations in activity levels and ratios are consistent with the presence of multiple isoforms of 17β-HSD. They are also suggestive of differential regulation of 17β-HSD, 3α-HSD and 3β-HSD in skin and fat, tissues in which the levels of these enzymes are known to be regulated in other species by gonadal steroids. Although the basis for the marked differences between samples remains to be clarified, our findings suggest activity patterns and ratios may be sensitive markers of endocrine status and endocrine disruption in sea lion pups.

14.3

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COMPARATIVE TIME-LAPSE STUDIES OF TWO DIFFERENT SPONGE DESIGNS

Most time-lapse microscopy studies on sponges have been done on those with leuconoid canal architecture (seen in a majority of sponges). This present study has initiated time-lapse examinations of live asconoid sponges. It was hoped that recording asconoid sponges, with their simpler architecture, would provide valuable insight into motile phenomena seen in more complex sponges. Time-lapse videos of intact asconoid sponges (*Leucosolenia* sp.) show motile behaviors, such as locomotion and contractile waves, that are similar (in appearance and speed) to those seen in leuconoid sponges (e.g.: *Aplysilla longispina*). In asconoids, contractile waves propagated at speeds of 30- 50 μm/minute, and they involved systemic constriction then dilation of the slender canal-body tubes. Apparent locomotion of the asconoid tubes was an outward movement away from the central conglomeration, this movement was always accompanied by spicule rearrangements. Time-lapse videos of the margins of the leuconoid sponges confirmed earlier reports of several features: such as crawling amoeboid cells at the leading edge, and contractile waves in both canals and in cortical tissues. Further comparisons between the two sponge designs will be discussed.