Thermo-Regulation in Alligator Mississipiensis

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Many ectothermic animals can tolerate long periods of fasting while maintaining normal functions, in other words they are not estivating or hibernating but remain alert and active during these periods. Endothermic animals eat small but frequent meals. Our study aimed to understand body temperature regulation under fasting and fed (postprandial) conditions in an ectothermic vertebrate, the American alligator (Alligator mississippiensis). Alligators naturally undergo long periods of fasting interspersed with large meals. We hypothesized that during the fast the animals would choose a cool body temperature to reduce metabolic rate and thus save energy. By selecting a warm basking area after feeding, the animals may be able to speed the rate of digestion of these large meals. If preferred body temperature varies in a predictable way in the fasting and in the postprandial state, we will then be able to seek to identify specific regulatory molecules that determine the set point for body temperature (e.g., leptin, growth releasing hormone, vasopressin, intestinal peptide, etc.).

Our hypotheses that ectotherms will choose a warm environment when digesting a meal but a cool environment when fasting was supported by lab data. There are numerous enzymes involved in the processes of digestion and absorption. The activity of enzymes can be extremely sensitive to temperature, over the stable range warmer temperatures can increase the turnover rates of substrate by the enzymes. Furthermore, because the standard metabolic rates of the animals are positively correlated with body temperature, it should be possible for the animals to save energy during a fast by seeking out cooler temperatures. Thus we expected and found that the animals would choose a cooler microclimate when fasting. These results lay the groundwork for future studies aimed at understanding the mechanisms regulating this change in preferred body temperature.

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