

BIOE 370: Review questions for Animal and Plant Physiology sections.

Animal

1. How does an animal's surface to volume ratio relate to body size? How does this relate to heat exchange with the environment?
2. Examine the graph that relates metabolic rate (energy expenditure) and body temperature to ambient temperature for an endothermic thermoregulatory. Understand differences between the thermoneutral zone (between the lower and upper critical temperatures) and the zones of active heat loss and active heat production.
3. What shape does a plot of metabolic rate (Y) on body size (X) have? What shape does a plot of daily water replacement (Y) on body size (X) have? Why are these two plots related? Use these to identify the approximate lower limit on body size for warm-blooded species.
4. What are the heat fluxes that affect body temperature, and what are some of the adaptations that affect these heat fluxes?

Plant

1. Plants unavoidably lose H₂O when they take up CO₂. Why? Consider the concentration gradient and mass of the two molecules.
2. Considering your answer to question 1, explain how CO₂/H₂O trade-offs are related to allocation of plant carbon to roots vs shoots.
3. Examine the graph of gross photosynthetic rate and respiration rate as functions of temperature. Because net photosynthetic rate is gross photosynthesis minus respiration, understand how this graph identifies the minimum, maximum and optimal temperatures for photosynthesis.
4. Considering your answer to question 3, explain plant adaptations to the trade-off between access to light and build-up of heat. That is, how do 'sun leaves' and 'shade leaves' differ? How does leaf design affect the thickness of the boundary layer? How does boundary layer thickness affect CO₂ uptake, H₂O loss and heat loss?
5. Examining a plot of photosynthetic response curves (photosynthetic rate, Y, vs. light level, X), understand the trade-off between maximum (light-saturated) photosynthetic rate and the compensation point.