1. Thermal Physiology (Ch 8)

http://eebweb.arizona.edu/eeb_course_websites.htm

Thermal Physiology

Microhabitat

Thermoregulation

Cardiovascular control of heating and cooling

- Cardiac Shunts
- Peripheral Vasodilation
Heat Windows

Rabbit Ears

Guanaco

Hot Body, Cool Brain

Keep brain cool during prolonged increased organismal activity:

- Countercurrent
- Carotid Rete

Pyrogens

Fever

Dipsosaurus dorsalis

Temperature Set Point
(season, reproductive state, infection)

Hypothalamus functions as thermostat

Neuronal Control of Thermoregulation

Endotherms in the COLD...

Countercurrent Heat Exchange
Thermogenesis

Endotherms in the COLD...

Shivering (or locomotion)
- antagonistic muscle contractions
- heat byproduct

Non-shivering
- fats metabolized, but produce heat instead of ATP
- brown fat specialized

sympathetic stimulation:
1. ATP hydrolysis used to pump ions needlessly
2. Proton leakage in mitochondria, rather than production of ATP in presence of thermogenin

Ectotherms in the COLD

Freeze Tolerance vs. Supercooling/Antifreeze

Freeze Resistance
- supercool
- prevent ice crystals

Freezing - ice crystal formation
- alter osmolality
- physical destruction

Thermoregulation

Freezing - ice crystal formation
- alter osmolality
- physical destruction

Critical Temperature

Within TNZ:
- Vasomotor
- Posture
- Insulation
  - fluff fur/feathers

Below TNZ:
- Increase metabolism above basal

Above TNZ:
- Cool via evaporation
Would you rather be an ectotherm or an endotherm?

COST/BENEFIT ANALYSIS

1. Ectotherms
   - lower metabolic rate
   - require less water
   - require less food (foraging time)
   - greater proportion energy into growth and repro
   - small body size works (different shapes)
   - reliant on environmental heat sources
   - seasonal and daily limits on activity
   - low aerobic capacities

2. Endotherms with 'opposite' costs and benefits