

Typical Response to Temperature

- Gradual increase in performance to an **optimum temperature**
 - Response here is rate of population growth
- Rapid drop past optimum
- These aphids differ in their response
 - Macrosiphum euphorbiae* (dashed line)
 - Myzus persicae* (solid line)

Data from Barlow 1962 Can. J. Zool. 40:145-156 (from Angilleta, 2009. Thermal Adaptation, Oxford, Pg 36)

Connecting Physiology to Ecology

- Most Enzymes have narrow temperature tolerances
- Trout Experience a broad range of water temperatures
- How can Trout survive the winter?

Temperature and enzyme activity

Figure 4.8

- Trout have two forms of many enzymes
 - One for hot
 - One for cold

Acetylcholinesterase of trout held at 2°C shows highest affinity for its substrate at 2°C.

Acetylcholinesterase of trout held at 17°C shows highest affinity for its substrate at 17°C.

Data from trout held at 17°C.

Data from trout held at 2°C.

4-6 Source: Baldwin and Hochachka 1970

Acclimation

- Short-term physiological adjustments
- Usually reversible
- In these fish:
 - More mitochondria and lipid droplets in the cold
 - More actin and myosin when warm

Striped Bass 5°C

Striped Bass 25°C

Temperature/population growth of antarctic bacteria

Rate of population growth by these antarctic bacteria was highest at approximately 4°C.

Each point represents population size after 80 hours of incubation at a particular temperature.

Figure 5.14

Temperature/ activity of hot spring bacteria

Rate of sulfur oxidation by these bacteria from a 50°C hot spring was highest at approximately 63°C.

Each point is an average of measurements made three replicate bacterial cultures grown at a particular temperature.

Figure 5.15

Matching The Environment

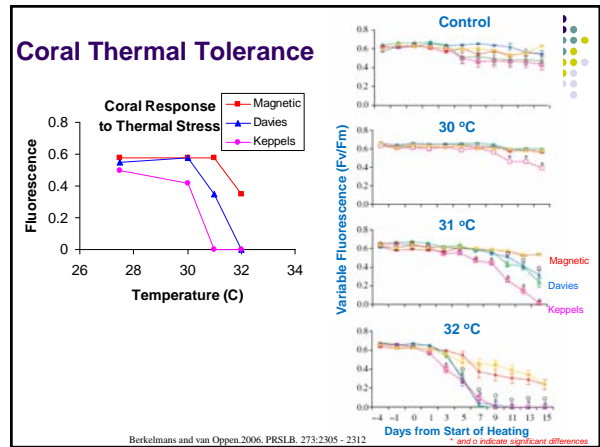
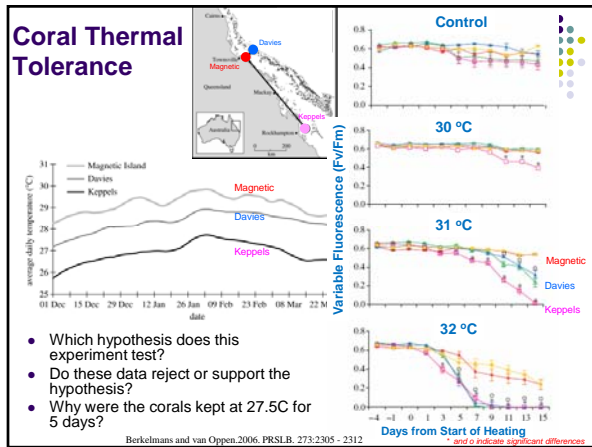
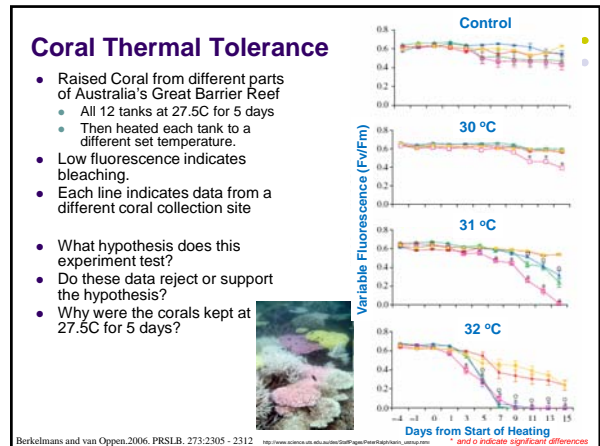
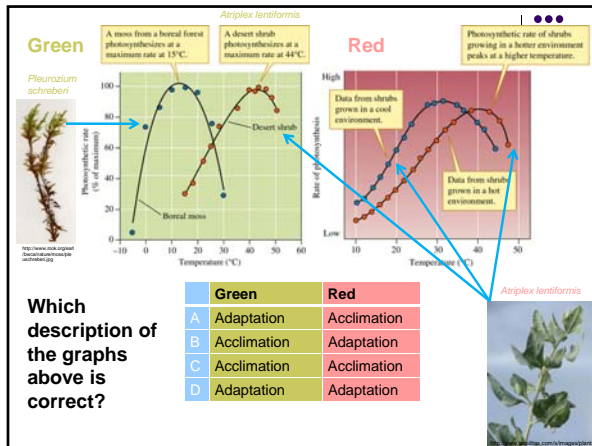
The differences in temperature tolerance between these species of bacteria are **genetically fixed Adaptations**

- Traits that increase the ability of a population to live in a particular environment
- Evolutionary** changes that arise over long periods of time (across generations)

The difference in temperature tolerance for the trout is a **reversible Acclimation**

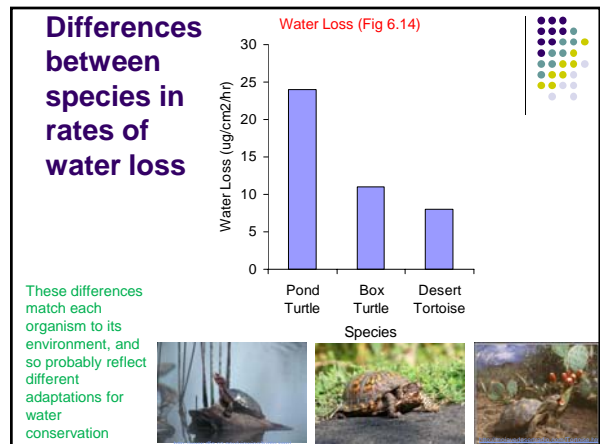
- Short-term adjustments that allow an individual to live in its particular environment.
- Reversible changes that occur within the life of an individual (within generations)

See p 78, 108 in 5th ed (4th ed: pg 89, 185-186)



Muddy Point Assignment. Due Monday (Jan 24) at NOON

- After today's lecture, and after reading Chapter 7, identify one important point that was unclear ("muddy") to you. Write out and send to me a sentence or two that explains which concept is muddy, what is muddy about it, and why this concept is important. DO NOT use questions such as "will this be on the test?" Your muddy points should concern concepts that are important for understanding. You are always welcome to ask questions about exam coverage, but not for credit!
- Send your assignment to me (email: rjm2@uakron.edu, put the words "MUDDIEST POINT" in the subject line; or drop off at my office – ASEC e508; or my mailbox in the biology office).



Water Balance

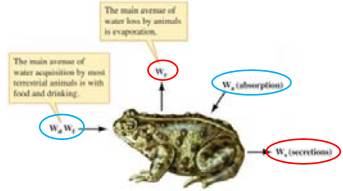
- Water gains must balance water losses
- For many animals:

Avenues for Water Gain

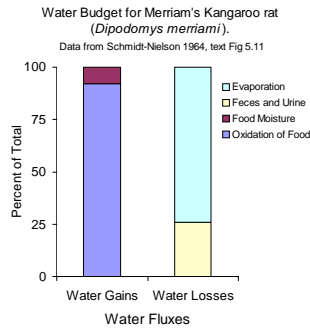
- Drinking
- Water in Food
- Water Absorbed from Air

Avenues for Water Loss

- Evaporation
- Secretion



Kangaroo Rat Water Budget



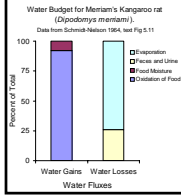
Never need to drink, yet maintain water balance!
(Gains = Losses)



<http://nasa.utep.edu/ichh/theband/animals/mammals/dme.htm>

Comparison of two rodents – the difference is Conservation of Water

Category of Water Gain or Loss	Kangaroo Rats	Laboratory Rats
Gross Metabolic Water Produce	0.54 g/g	0.54 g/g
Obligatory Water Losses		
Respiratory	0.33	0.33
Urinary	0.14	0.24
Fecal	0.00	0.03
Total Obligatory Water Losses	0.47	0.6
Net Gain of Metabolic Water	0.07	-0.06



pg 678 Hill, Wyse, Anderson "Animal Physiology" 2004

Stable Isotope analysis pg 147-148

- New and important tool
- Read and understand this section, including:
 - In general terms, how does stable isotope analysis work? (you do NOT need to know the equation)
 - What sorts of questions can be answered with stable isotope analysis?

