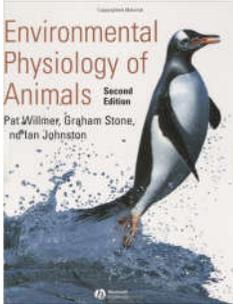


Environmental Physiology – BSC 442/542

- Syllabus
- Office hours
- Structure of the course
 - Grade based on two exams and a cumulative final
 - Graduate students – pick a research topic, write review paper, 15 minute presentation



Environmental Physiology

- How animals cope with the environment
- Comparative physiology vs. environmental physiology
- Environmental physiology=ecophysiology=physiological ecology
- **Evolutionary physiology**



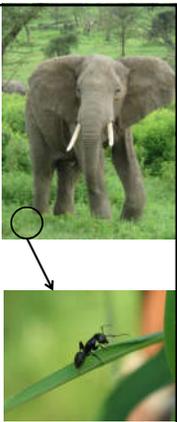
Evolution – review and basic concepts

“How animals cope with the environment”

- **Fitness**
- **Genotype**
- **Phenotype**

What is “the environment”

- Anything that affects phenotypes
- **Biotic** and **abiotic** components
- Importance of **scale**
 - Biome, habitat, microhabitat
 - Coarseness
 - Spatial and temporal variability

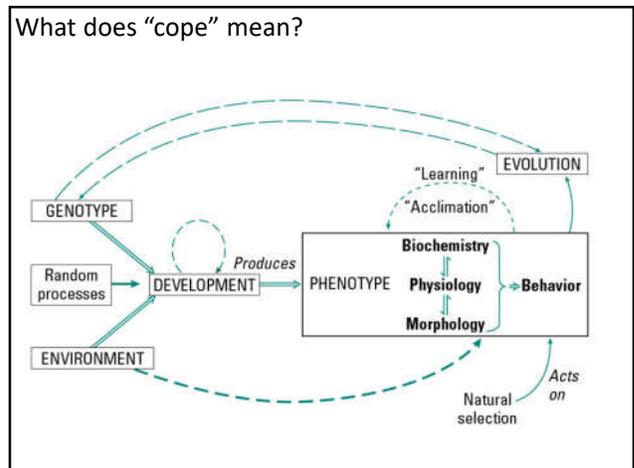
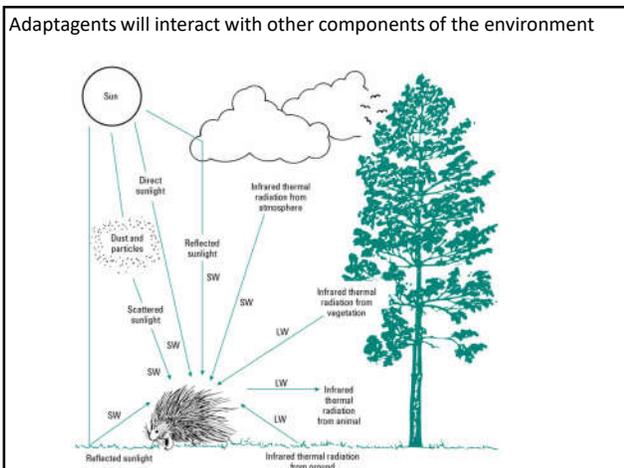


Adaptagens – something in the environment that interacts with phenotypes.

- Adaptagens are not constants
- Spatial (space) and temporal (time) variability in adaptagens:
 - Intensity
 - Frequency
 - Variability
 - Duration

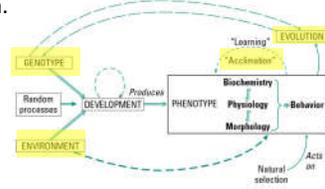
Environmental Gradients

- Adaptagens are often described as changing gradually over space or time. These are **ecological gradients**.



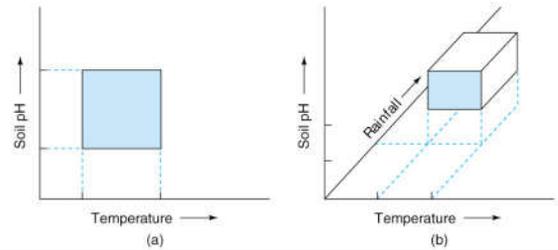
Key Concepts

- Phenotypes are a product of the genotype and environment.
- **Acclimation** – change in a phenotype due to environmental input.
- **Adaptation** – change in population genotype over time due to selection.
- Individuals “cope” through acclimation, populations “cope” through adaptation.

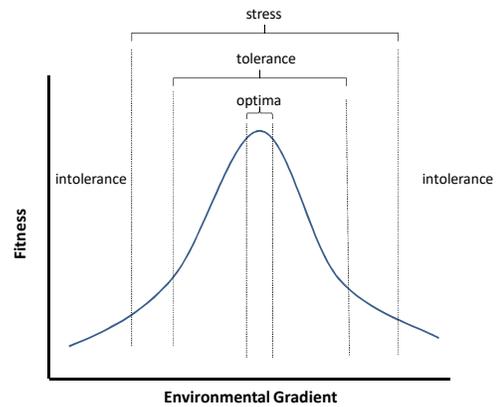
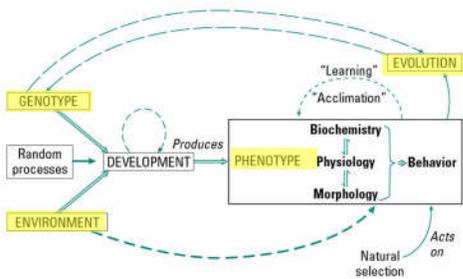


Niche – review and basic concept

- Environments are complex, viewed as multiple overlapping gradients.
- N-dimensional hyperspace
- Each dimension = gradient of one adaptagent
- Where do you expect organism fitness to be maximized?

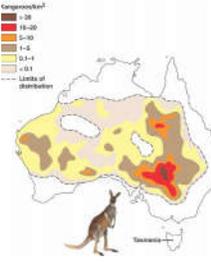
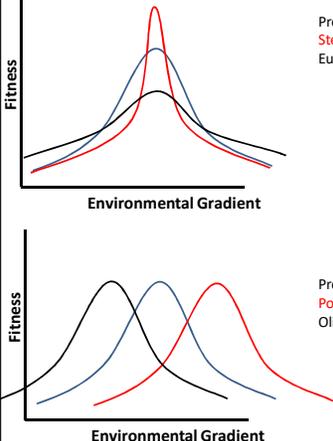


Evolution should alter **genotypes** to maximize **phenotype** fitness in the occupied **environment**.



Shelford's Law

- “absence or failure of an organism can be controlled by the qualitative or quantitative deficiency or excess with respect to any one of several factors which may approach the limits of tolerance for that organism”
- Generalist vs. specialist
 - E.g. R vs K selection
 - How are the optima different for R vs. K species?

Prefix:
Steno---
Eury---

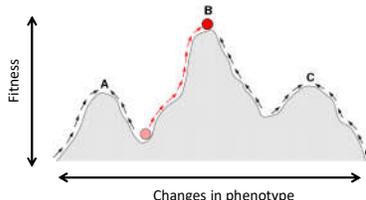
Suffix:
---thermal (temperature)
---haline (salinity)
---phagic (food)

So... what is a eurythermic species?
Polyphagic species?

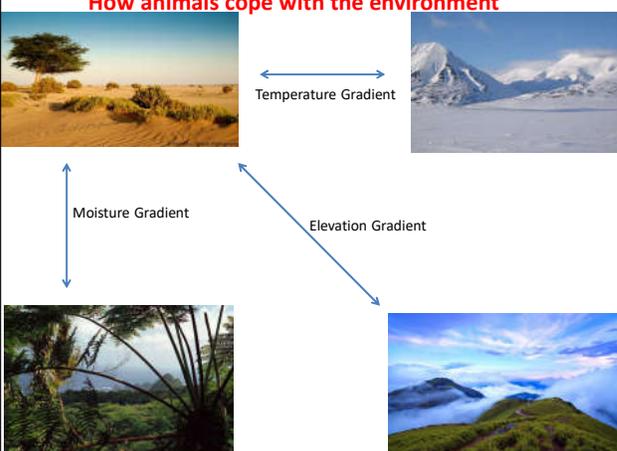
Prefix:
Poly---
Oligo---

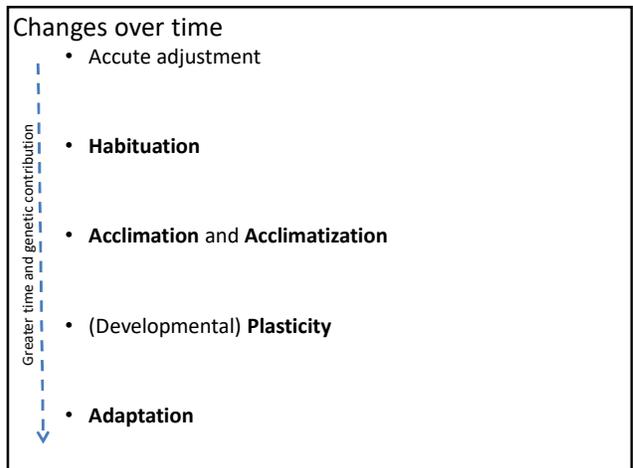
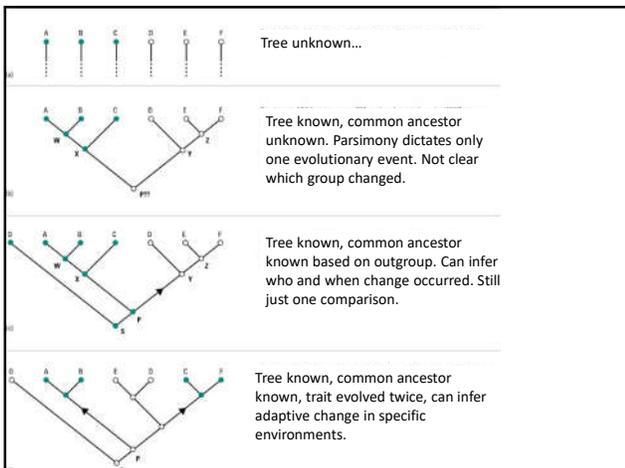
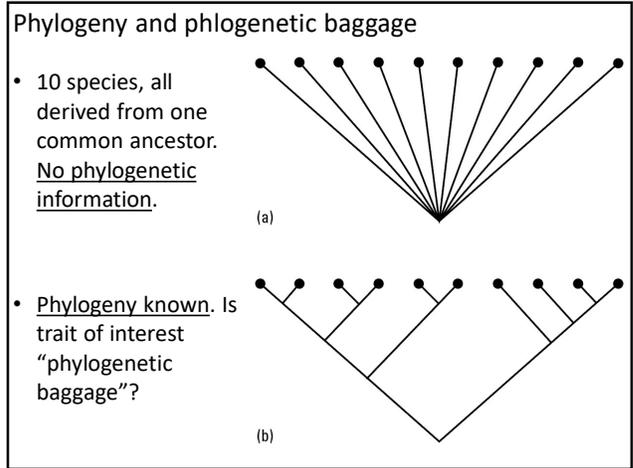
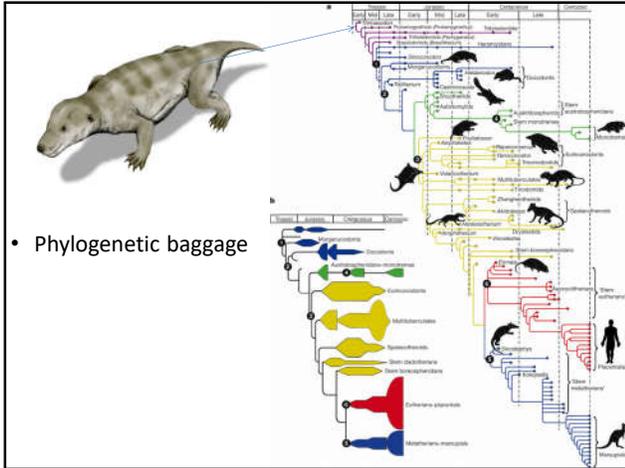
Optima and Tradeoffs

- Optima**
- Changes to optimize for one adaptagent usually lead to reduced optimization for other adaptagents.
- Evolutionary tradeoffs**



“How animals cope with the environment”





Review

- Genotype x environment → phenotypes
- Selection acts on phenotypes, genotypes evolve
- Selection should favor optimization of populations in their niche
- Responses to change in the environment can be
 - fast (acute response, habituation, acclimation, acclimatization, some forms of plasticity) and reversible
 - Slower (some forms of plasticity, adaptation) and irreversible.
- Constraints to evolutionary changes
 - Tradeoffs: Optimization for one trait often means reduced optimization for another
 - Phylogenetic constraints