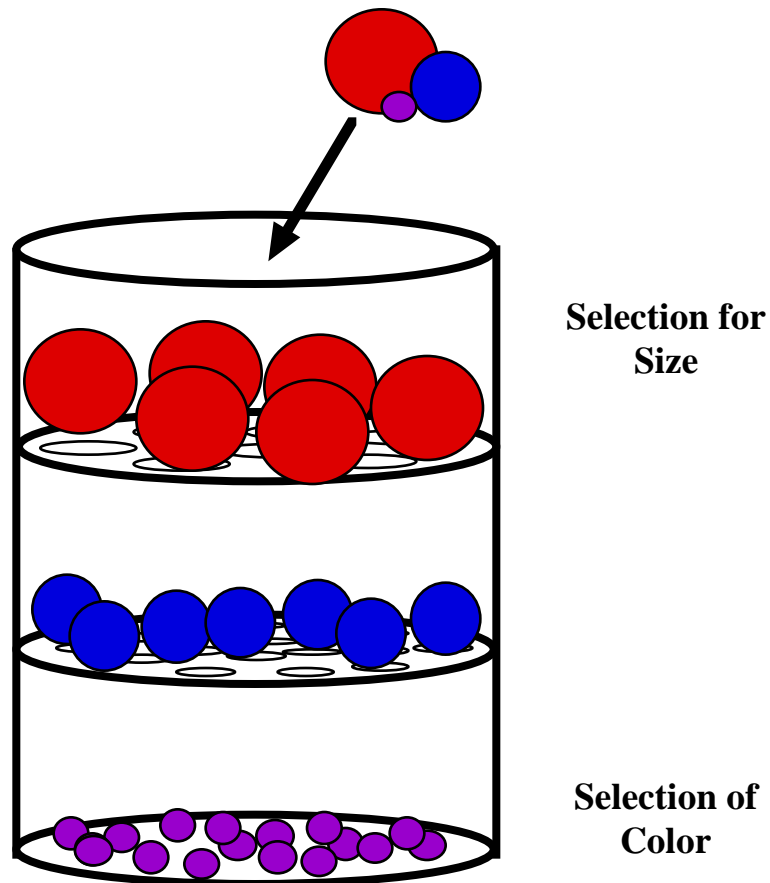


Chapter 8

Studying Adaptation

I) Recognizing Adaptations

A) Selection for versus selection of



B) What adaptations are:

- 1) individual organisms phenotypic adjustments to the environment (not lizard color)
- 2) phenotypic variant that results in the highest fitness relative to a specific set of variants in a given environment
- 3) a derived character that evolved in response to a specific selection pressure

C) What are not adaptations (non-adaptive not maladaptive):

- 1) necessary consequences of physics or chemistry (i.e., red blood)

- 2) neutral characters
- 3) linked changes (small antlers on small deer)
- 4) phylogenetic constraints

D) How to identify adaptations – assume everything is NOT an adaptation until proven otherwise.

- 1) Complexity – complexity usually does not evolve without natural selection
- 2) Design – biological function and engineering models often are parallel.
- 3) Experimentation
- 4) Comparative method – when comparing across species traits can co-vary across traits and/or environments.

II) What natural selection and adaptations are NOT

- A) Necessary – organisms do not have to adapt to changing selection pressure (i.e., no variation no evolution or adaptation)
- B) Perfection – natural selection produces adaptations that are sufficient.
- C) Progress – one adaptation is not more advanced over another
- D) Harmony and the balance of nature – organisms do effect each other but apparent coordination is a secondary consequence of conflicting pressure and not a result
- E) Moral or Immoral

IV) Tradeoffs and Constraints – organism as wholes evolve not characters

A) Allometric constraints – co-variation in the size among characters

1) Allometric relationships: $y = bx^a$ where y is the size of one character, x is the size of another, b is a constant, and a is how they are related

a) Isometric growth is when $a = 1$ as one character increases so does the other and to the same extent

2) Allometric constraints are often a result of natural selection

B) Principle of Tradeoffs – some resource is always limiting

Selection on one character often is opposed by selection on another. Organismal form and function is a compromise among conflicting selection pressures

1) Growth and reproduction – organisms generally have a limited amount of energy. They can allocate into either growth or reproduction, but there are tradeoffs.

e.g., large animals generally have more offspring

increased allocation to growth means that there is less energy for reproduction and lower fitness this year but more offspring next year

increased allocation to reproduction means increased fitness this year but slower growth.

2) Structures without use should be reduced

a) costly to maintain

b) disadvantageous (i.e., legs in marine mammals)

c) negatively correlated with other structures

d) neutral