Evolution 3

What is a species?

Human populations

- How different are humans from each other?
- What makes us different?
- Are all humans the same species?

What makes a species?

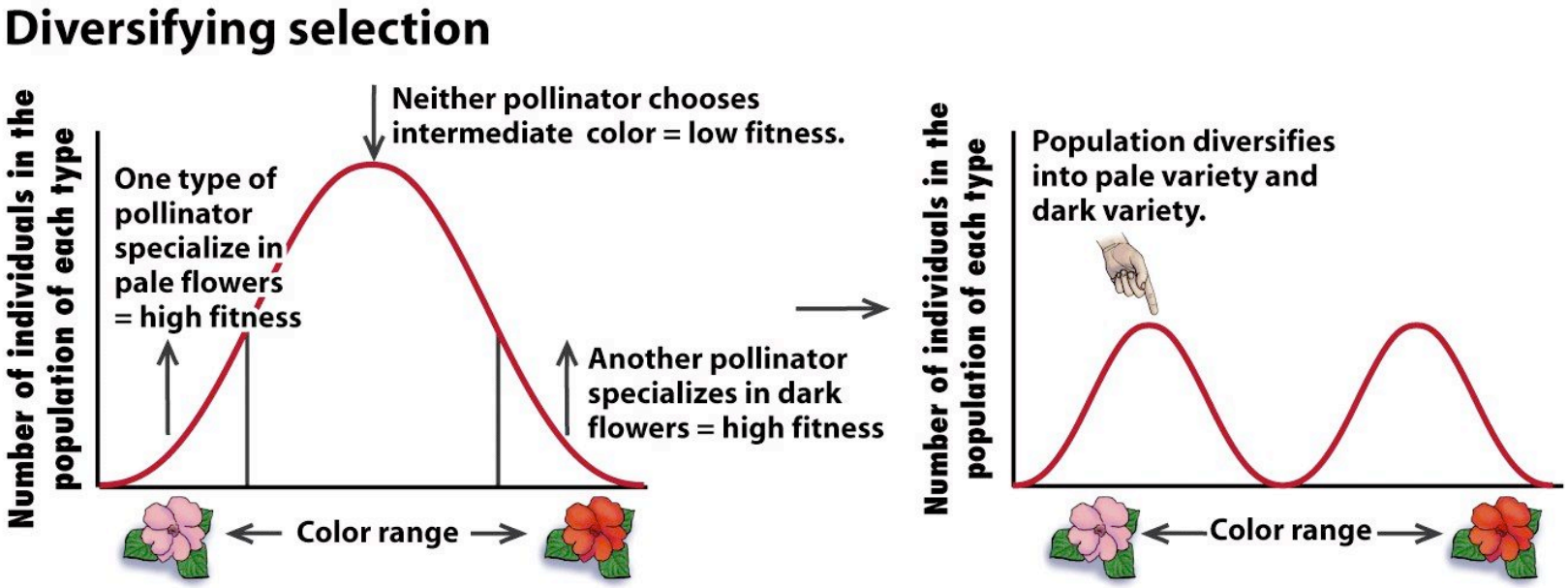


Figure 10-14c Biology: Science for Life, 2/e

What produces traits?

- **Genes**
  - Parts of a strand of DNA that are responsible for the production of some traits
  - Passed down from parent to offspring
    - Version of a gene that are passed down from one parent to offspring = **allele**
    - 2 alleles (one from each parent) for each gene

What produces traits?

- Individual with high fitness
  - Passes down more of its alleles than an individual with low fitness
  - Over time, those alleles become more common in a population
    - Evolution by natural selection
- Different species have different sets of traits as a result of different sets of alleles
  - How did they end up with different sets of alleles?
  - What makes species different from each other?

What is a species?

- Biological Species Concept
  - Species are groups of actually or potentially reproducing organisms that are reproductively isolated from other groups.
    - You're the same species as another if you can mate and produce viable and fertile offspring

What does that mean?

- Same species IF they WOULD interbreed when you put them together.
  - Isolation isn't enough to make them separate species

Plethodon jordani

Plethodon jordani complex

- Separated by valleys between mountains

P. montanus

P. cheoh

P. shermani

P. metcalfi

Gene flow can prevent speciation

- Movements of individuals between populations can prevent divergence

- If there is no gene flow between populations, may get speciation

Speciation

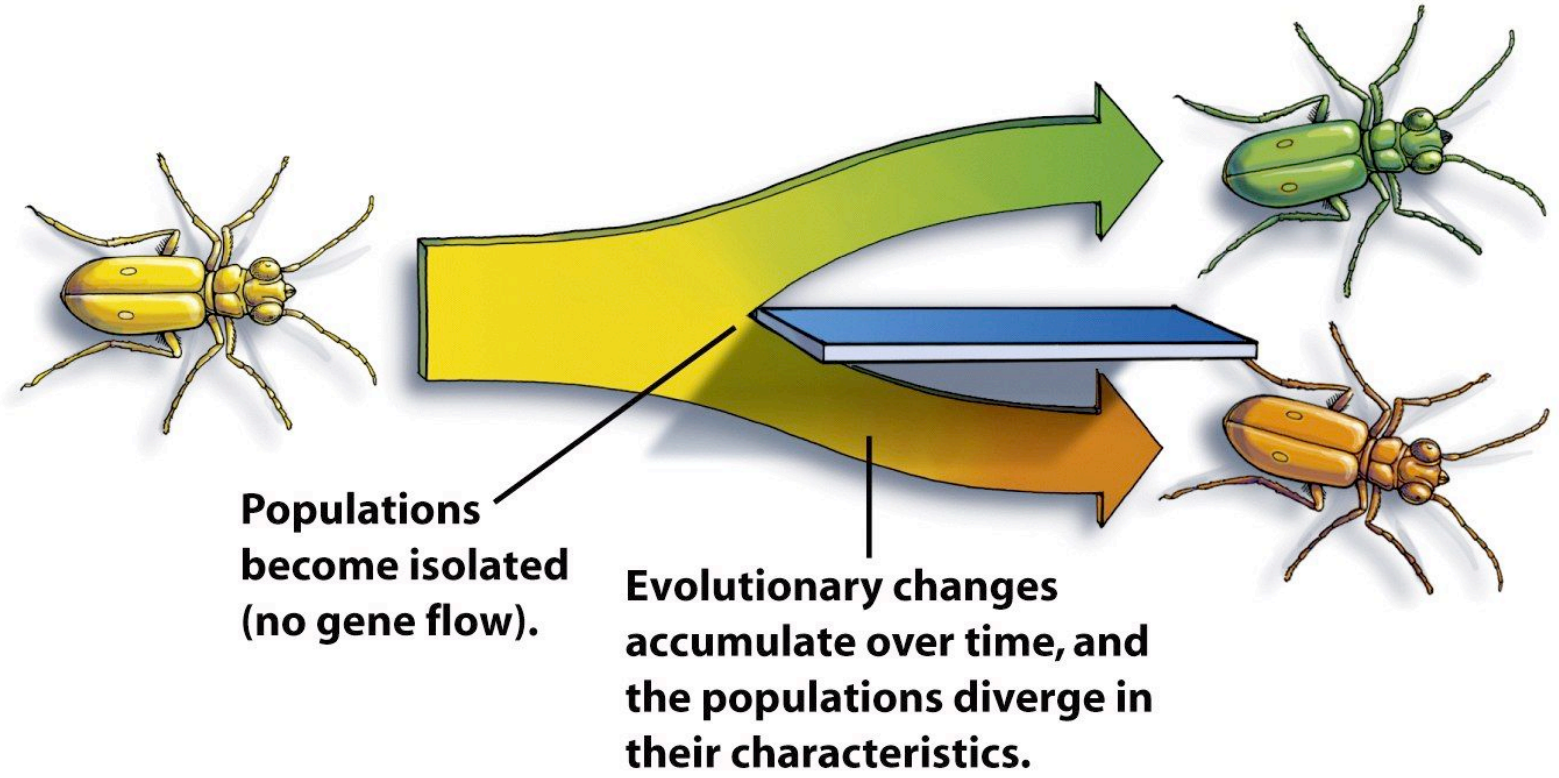


Figure 11-4 Biology: Science for Life, 2/e

Speciation

- Isolation MAY result in speciation
  - The formation of one or more new species as a result of changes in allele frequencies or trait frequencies in populations

- How do we get isolation?
  - 2 ways
    - Pre-fertilization (Pre-zygotic)
    - Post-fertilization (Post-zygotic)

Speciation

- Pre-fertilization isolating mechanisms
  - 1. Behavioral
    - Mate choice

Courting dance

Figure 11-1a Biology: Science for Life, 2/e

Speciation

- Pre-fertilization isolating mechanisms
  - 2. Spatial isolation
    - Salamanders on mountains
  - 3. Temporal isolation
    - Hawthorn and apple flies mate at different times of year

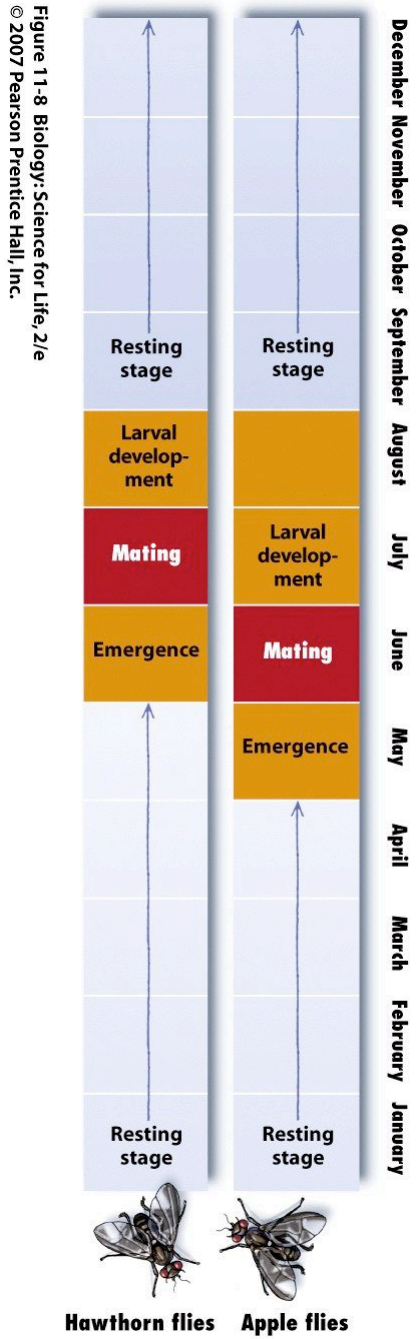
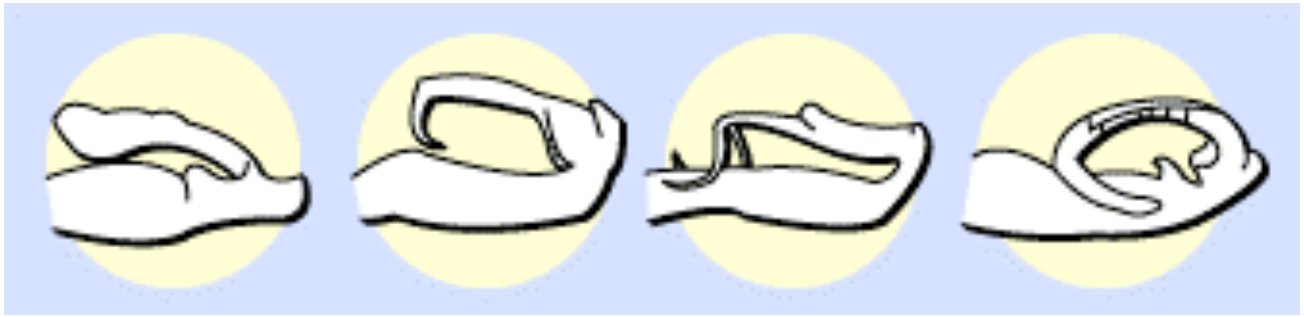


Figure 11-8 Biology: Science for Life, 2/e

Speciation

- Pre-fertilization isolating mechanisms
  - 4. Gamete incompatibility
  - 5. Mechanical isolation



Damselfly penises adapted from Eberhard, W.G. 1985. Sexual Selection and Animal Genitalia. Harvard University Press.

Speciation

- Post-fertilization isolating mechanisms
  - 1. Hybrid death
  - 2. Hybrid infertility

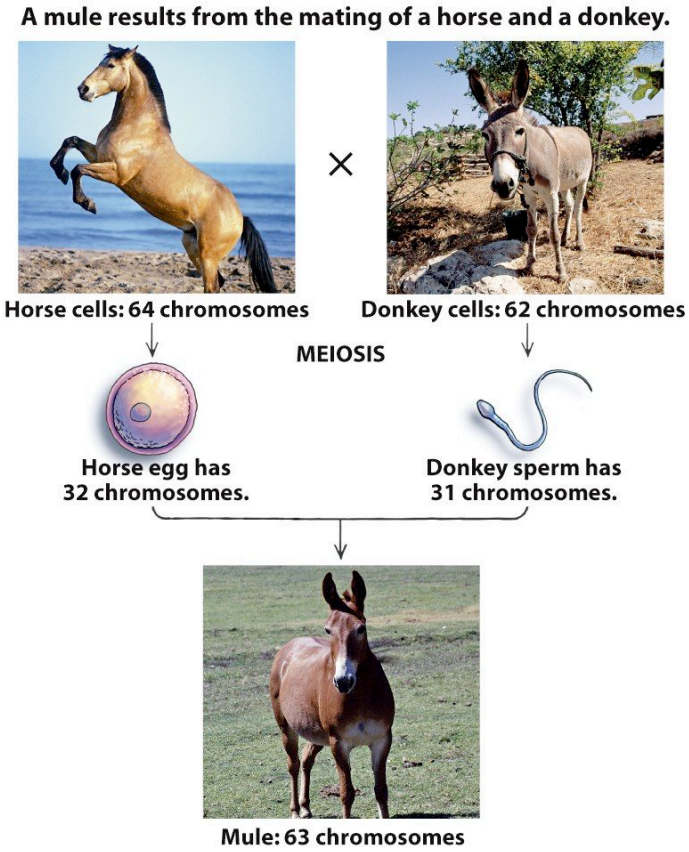


Figure 11-3a Biology: Science for Life, 2/e

Speciation

- How can we determine if two organisms are the same species if they:
  - Are extinct?
  - Don’t have sexual reproduction?

Speciation

- Morphological species concept
  - Species are groups of organisms that have some sets of physical features that are different from those found in other groups

Speciation

- Genealogical species concept
  - The smallest group of reproductively compatible organisms that contains all the descendants of a single, common ancestor

Figure 11-12 Biology: Science for Life, 2/e

Speciation

Species concept	Definition	Pros	Cons
Biological	Species consist of organisms that can interbreed and produce fertile offspring and are reproductively isolated from other species.	Useful in identifying boundaries between populations of similar organisms. Relatively easy to evaluate for sexually reproducing species.	Cannot be applied to organisms that reproduce asexually or to fossil organisms. May not be meaningful when two populations of the same species are separated by large geographical distances.
Genealogical	Species consist of organisms that can interbreed and are all descendants of a common ancestor and represent independent evolutionary lineages.	Most evolutionary meaningful because each species has its own unique evolutionary history. Can be used with asexually reproducing species.	Difficult to apply in practice. Requires detailed knowledge of gene pools of populations within a biological species. Cannot be applied to fossil organisms.
Morphological	Species consist of organisms that share a set of unique physical characteristics that is not found in other groups of organisms.	Easy to use in practice on both living and fossil organisms. Only a few key features are needed for identification.	Does not necessarily reflect evolutionary independence from other groups.

Table 11-1 Biology: Science for Life, 2/e