
Topic: The Origin of Species

Reading: Chapter 16

Main concepts:

- The concept of “species” is difficult. While in general, species are considered groups of interbreeding populations, the lines between species can be fuzzy. Defining “species” among one-celled organisms is especially difficult. Even among animals, populations of the same species at opposite extremes of the species’ range may not interbreed if brought together. Biologists often prefer to work with populations rather than species.
- Reproductive isolation is an important mechanism in speciation. Premating isolation prevents two groups from interbreeding. Postmating isolation reduces hybrid formation.
- Two patterns of speciation described in the book are:
 - Allopatric speciation: Two populations are geographically separated from one another, and experience different selective pressures in their different localities.
 - Sympatric speciation: Reproductive isolation occurs without geographical isolation. For example, overpopulation may drive some groups to the far extremes of a species’ range, where they are exposed to different selection pressures than the main group.
- Extinction is the ultimate fate of species, and is a normal evolutionary process. Specialization can give species an advantage in a stable environment by reducing competition with other species, but leave the species vulnerable to extinction during periods of dramatic climate change.
- “Sudden speciation” is rare but possible among plants. Mis-match of chromosomes from parent plants of two different species may prevent a hybrid from being fertile. If the chromosomes in the offspring spontaneously double, the offspring is now polyploid. If the plant is self-fertile (its ovules can be fertilized by its own pollen), it can produce fertile offspring.

Common misconceptions:

- Most people have a “barnyard taxonomy” sense of what a species is: a horse is a horse, a cow is a cow. However, defining “species” is seldom that simple in nature. Furthermore, we have to remember that all taxonomic categories, including “species,” are artificial categories that we humans impose on nature even though we base the categories on our observations of the natural world.
- “Species go extinct because they are weak.” Woolly mammoths are hardly anyone’s definition of “weak,” yet they went extinct. The reasons for extinctions are often complex. One thing that we do know for certain is that we are in the middle of a major extinction event on earth — and we humans are the cause of it.
- “New species happen when two individuals of different species mate.” Except for rare cases of sudden speciation in plants, hybridizing is not what leads to speciation. Selection pressures on isolated groups may lead to genetic divergence, that leads to a collection of differences, that leads to the development of two different but related species.
- “Natural selection is how organisms learn to adapt (or try to adapt) to their environment.” Selection is not a deliberate process on the part of individuals. They do not “try” to or “learn” to develop new anatomical features. Selection can only act on traits that already exist in the population.

Reading notes:

- List several reasons why it is difficult to define what a species is in nature.
 - List and explain the mechanisms of premating isolation that are described in the text.
 - List and explain the mechanisms of postmating isolation that are described in the text.
 - Summarize the process of allopatric speciation.
 - Summarize the process of sympatric speciation.
 - Compare sympatric and allopatric speciation. How are they alike, and how are they different?
 - Define “adaptive radiation” and under what conditions it may occur.
 - Describe the causes of extinction listed in the book. Why is hybridization a problem to endangered species (see the Earth Watch essay).
 - Describe how polyploidy can lead to new species of plants. Why is this limited to plants?
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Notes

Biology 101, Fall 2007

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Useful websites:

- “[Understanding Evolution](http://evolution.berkeley.edu/evolibrary/home.php)” (<http://evolution.berkeley.edu/evolibrary/home.php>) is a huge site that is full of information about evolution and the mechanisms of evolutionary change.
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