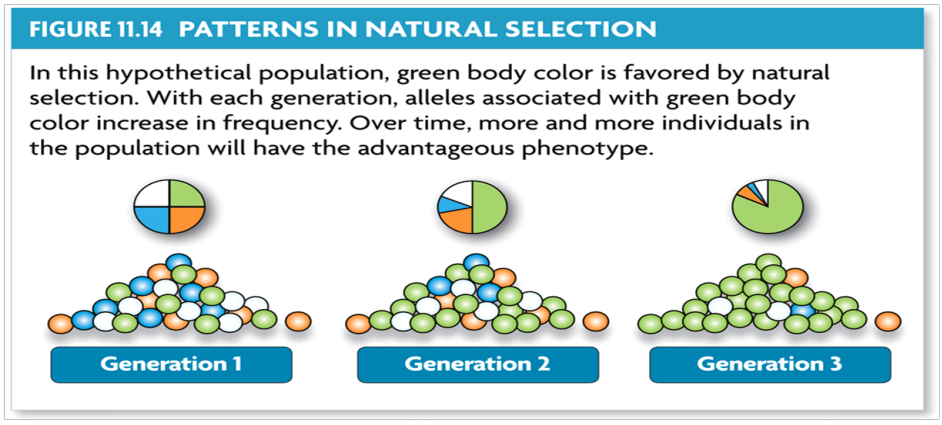
Section 11.6 Patterns in Evolution

Evolution occurs in patterns.

I. Evolution through natural selection is not random.

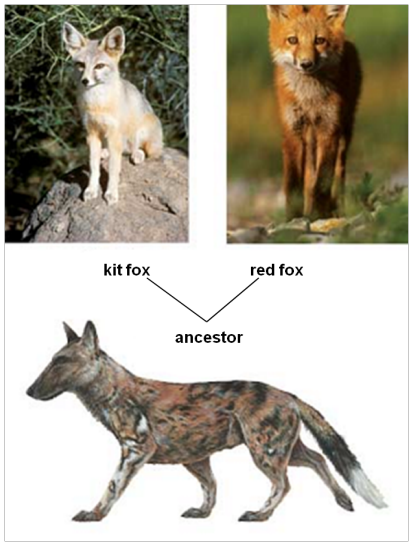
-***Natural*** selection can have direction.

-The effects of natural selection***add up over time***.



-***Convergent evolution*** describes evolution toward similar traits in unrelated species. A pattern of evolution in which distantly related organisms evolve ***similar traits***.

-***Divergent evolution*** describes evolution toward ***different traits*** in closely related species.



How do convergent and divergent evolution illustrate the directional nature of natural selection?

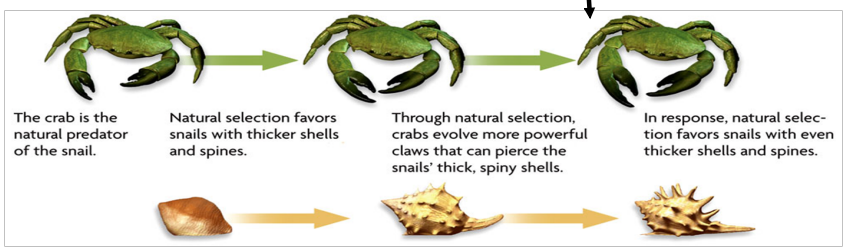
II. Species can shape each other over time.

Two or more species can evolve together through *coevolution.*

1. Evolutionary paths become ***connected***
2. Species evolve in response to changes in each other

a. Coevolution can occur in ***beneficial*** relationships.
Ex: Ant & acacia tree

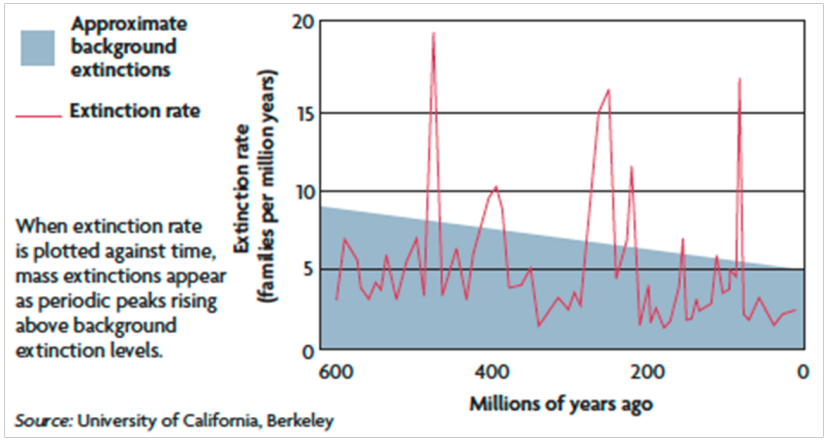
b. Coevolution can occur in ***competitive*** relationships.
Ex: crab & snail



III. Species can become extinct.

1. **Extinction** is the ***elimination*** of a species from Earth.
2. **Background** ***extinctions*** occur continuously at a very low rate.
   a. occurs at roughly the ***same rate*** as speciation
   b. usually affects a ***few species*** in a small area
   c. caused by local **changes in environment**

3. **Mass extinctions** are rare but much ***more intense***.
   a. destroy many species at ***global level***
   b. thought to be caused by ***catastrophic events***
   c. at least **five mass extinctions** in last 600 million years



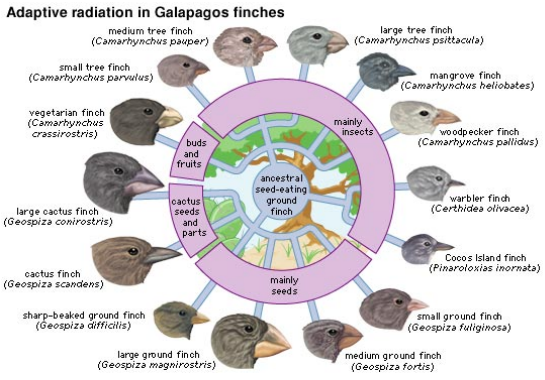
IV. Speciation often occurs in patterns.

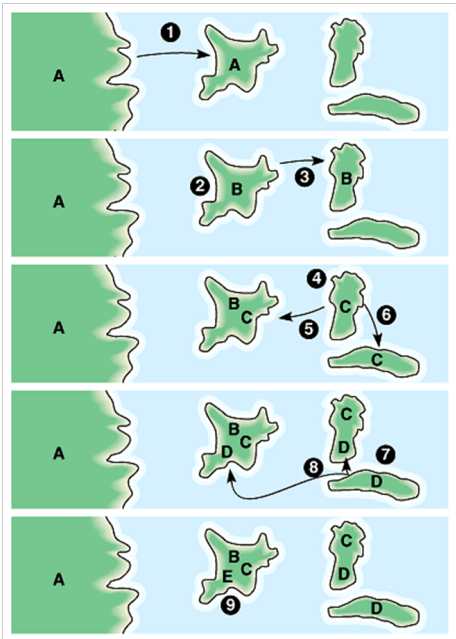
A pattern of punctuated equilibrium exists in the fossil record.

1. episodes of speciation have a ***sudden appearance*** in geologic time
2. **Followed by** long periods of little evolutionary change
3. **revised Darwin's idea** that species arose through gradual transformations
4. Many species evolve from one species during ***adaptive radiation.***
   a. **ancestral species** ***diversifies*** into many descendent species
   b. **descendent species** usually adapted to ***wide range*** of environments

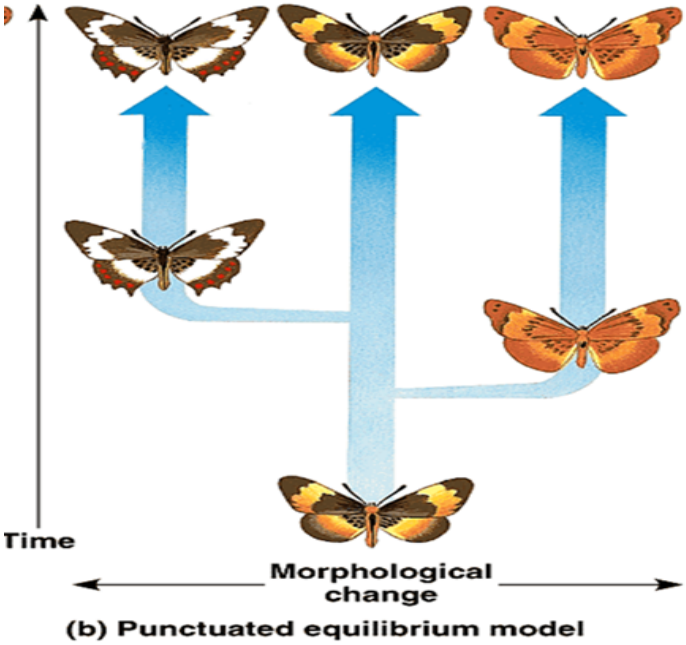
Pattern of Evolution

Adaptive radiation



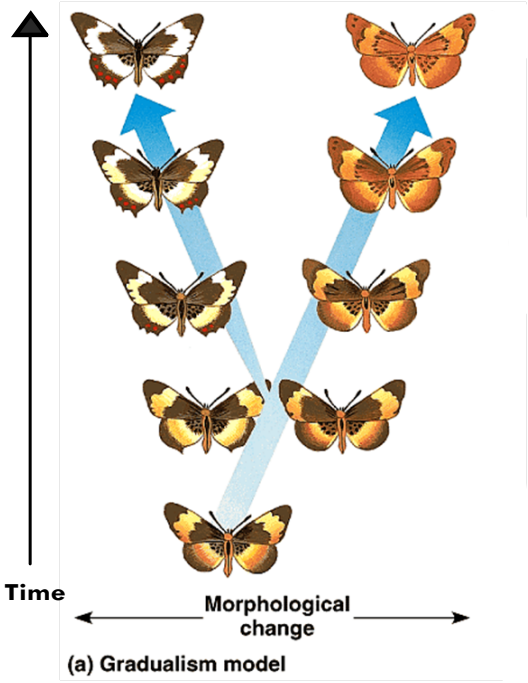


1. Punctuated equilibrium = speciation occurs relatively ***quickly***, with long periods of ***genetic*** equilibrium which can (Ex: higher temperature or competitive species) → lead to rapid changes in a ***small*** gene pool.



(b) Punctuated equilibrium model

2. ***Gradualism*** = species originate through a gradual change of adaptations.



(a) Gradualism model

3. Physiological adaptations can develop rapidly

- Physiological adaptations are changes in an organism's ***metabolic*** processes.
- EX: ***insects*** and ***weeds***..after years of **exposure to** specific ***pesticides***, many species have **become resistant** to those chemicals that are used to kill them

- EX: bacteria become resistant to ***antibiotics***.