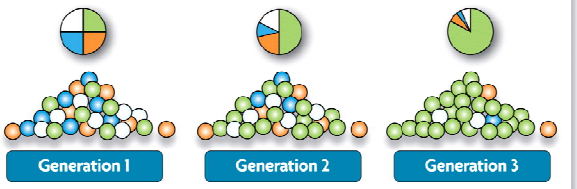
11.6 Patterns in Evolution

- **Evolution through natural selection is not random.**
  - Natural selection can have direction.
  - The effects of natural selection add up over time.

FIGURE 11.14 PATTERNS IN NATURAL SELECTION

In this hypothetical population, green body color is favored by natural selection. With each generation, alleles associated with green body color increase in frequency. Over time, more and more individuals in the population will have the advantageous phenotype.



11.6 Patterns in Evolution

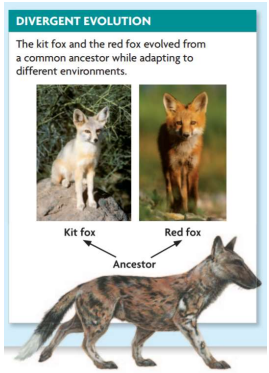
- **Evolution through natural selection is not random.**
  - **Convergent evolution** describes evolution toward similar traits in unrelated species.

- **Defined**: different species evolve similar traits due to similar habitats
- Survival advantages to particular environments
- Ex: Tuna (fish) and dolphins (mammals)
  - Unrelated species with a similar environment (ocean)

tail fins

11.6 Patterns in Evolution

- **Evolution through natural selection is not random.**
  - **Divergent evolution** describes evolution toward different traits in closely related species.



11.6 Patterns in Evolution

- **Species can shape each other over time.**
  - Two or more species can evolve together through **coevolution**.
    - evolutionary paths become connected
    - species evolve in response to changes in each other

11.6 Patterns in Evolution

- **Species can shape each other over time.**
  - **Coevolution** can occur in **beneficial** relationships.

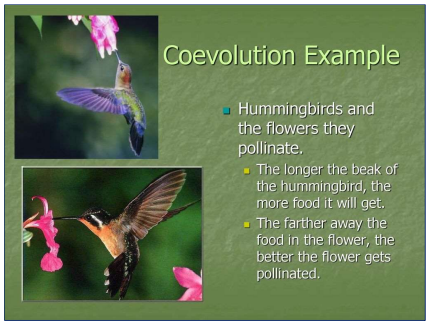
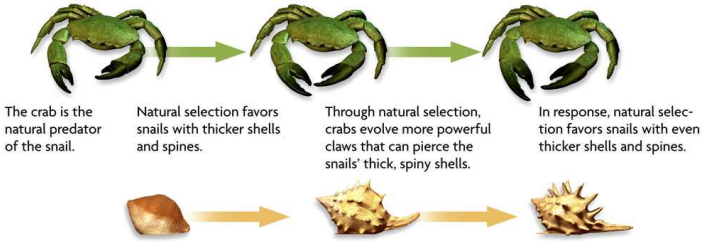


FIGURE 6.3 The relationship between this ant and the acacia plant has developed through coevolution. The ant lives inside the hollow thorn and protects the acacia by stinging any potential predators.

11.6 Patterns in Evolution

- **Species can shape each other over time.**
  - **Coevolution** can occur in **competitive** relationships, sometimes called **evolutionary.**



11.6 Patterns in Evolution

- **Species can become extinct.**
  - **Extinction** is the elimination of a species from Earth.
  - **Background extinctions** occur continuously at a very low rate.
    - occur at roughly the same rate as speciation
    - usually affects a few species in a small area
    - caused by local changes in environment

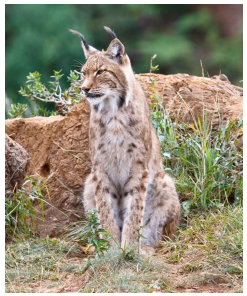
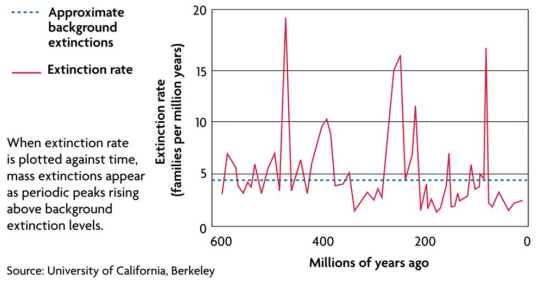


FIGURE 6.4 Native to Portugal and Spain, the Iberian lynx is the world's most endangered feline. The World Wildlife Federation estimates that there are only 84 to 143 adult individuals remaining in the wild.

11.6 Patterns in Evolution

- **Species can become extinct.**
  - **Mass extinctions** are rare but much more intense.
    - destroy many species at global level
    - thought to be caused by catastrophic events
    - at least five mass extinctions in last 600 million years



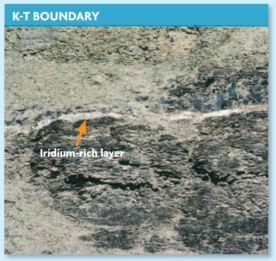
Source: University of California, Berkeley

11.6 Patterns in Evolution

- **Species can become extinct.**
  - **Mass extinctions** are rare but much more intense.

FIGURE 6.8 The K-T Boundary

The K-T boundary layer is marked clearly in rock layers in many places around the world. It is linked to the collision of an asteroid with Earth around 65 million years ago. The layer contains high concentrations of the element Iridium. Iridium is very rare on Earth, but is found in much greater abundance in objects from space.



– The extinction of the dinosaurs about 65 million years ago left environments full of open niches for other types of animals. In the first 10 million years of the Tertiary period following the mass extinction event, more than 4000 mammal species had evolved, including the ancestors of modern whales, bats, rodents, and primates. Evidence of this mass extinction, known as the Cretaceous-Tertiary (K-T) boundary, can be seen in FIGURE 6.8.

11.6 Patterns in Evolution

- **Speciation often occurs in patterns.**
  - A pattern of **punctuated equilibrium** exists in the fossil record.
    - bursts of evolutionary activity (speciation) are followed by long periods of stability (little evolutionary change)
    - theory proposed by Eldredge and Gould in 1972
    - revised Darwin's idea that species arose through gradual transformations

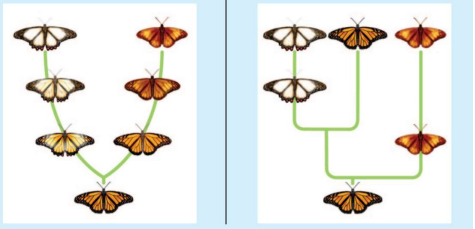
11.6 Patterns in Evolution

- **Speciation often occurs in patterns.**
  - A pattern of **evolutionary gradualism** exists in the fossil record.
    - evolutionary changes are thought to occur over long periods of time

FIGURE 6.6 Evolutionary Gradualism and Punctuated Equilibrium

The concept that species evolve slowly, over long periods of time, is known as evolutionary gradualism.

Punctuated equilibrium proposes that species show little evolutionary change for millions of years, followed by periods of rapid speciation.



11.6 Patterns in Evolution

- **Speciation often occurs in patterns.**
  - Many species evolve from one species during **adaptive radiation.**
    - ancestral species diversifies into many descendent species
    - descendent species usually adapted to wide range of environments