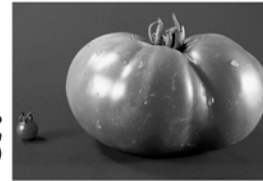


What's the process?

- We've laid out the evidence for evolution, but how does it happen?
- Darwin based his idea on what he knew about artificial selection, mostly in pigeons
- So what's artificial selection?

Wild tomato
(*Solanum
pimpinellifolium*)



Domestic tomato
(*Solanum
lycopersicum*)

Figure 3-1 Evolutionary Analysis, 4/e
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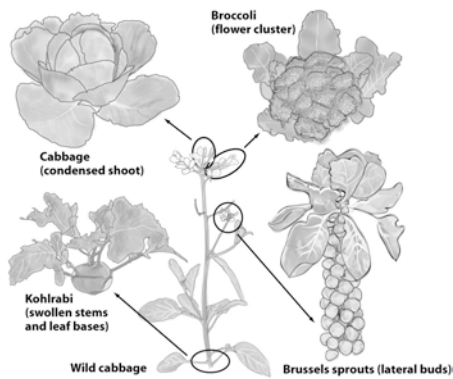


Figure 3-2 Evolutionary Analysis, 4/e
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Darwin's Four Postulates

1. Individuals within populations are variable
2. Variations are heritable
3. Some individuals are more successful at surviving and reproducing than others
4. Survival/reproduction is not random: those with favorable traits do better

If the postulates are true:

--the characteristics and composition of the population changes slightly with each generation.

This is Darwinian Evolution: gradual change in populations over time

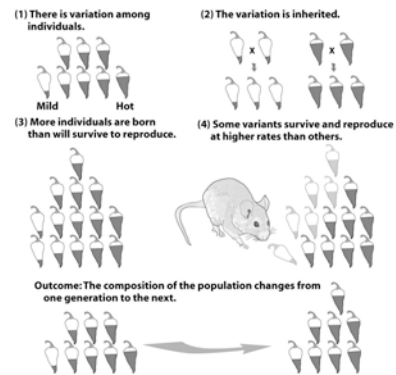


Figure 3-4 Evolutionary Analysis, 4/e
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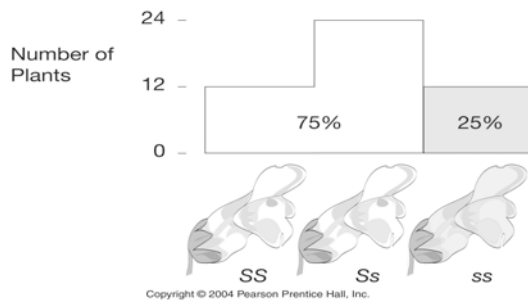
Darwinian Fitness

- The ability of an individual to survive and reproduce in its environment. Their offspring make up a higher percentage of the population in the next generation.
- The trait or characteristic that makes an individual more fit is called an **adaptation**

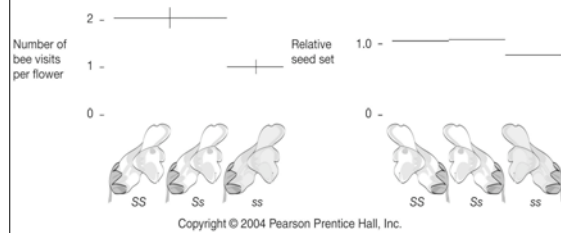
The Snapdragon Experiments

- The goal was to test each postulate and then determine whether evolution did occur as a result of the postulates being true.

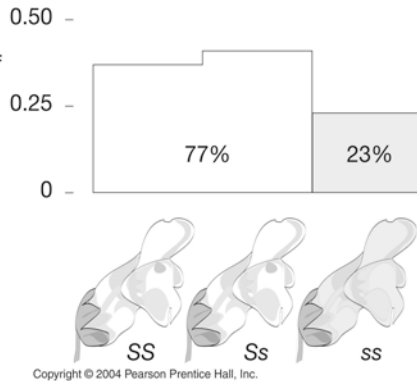
(a) Composition of parental population



(b) Differences in reproductive success through male function (left) and female function (right)

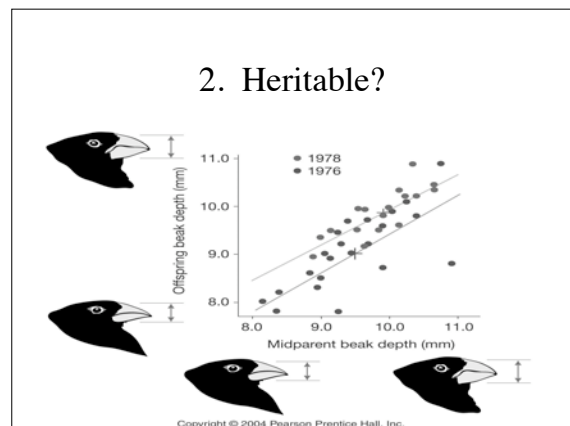
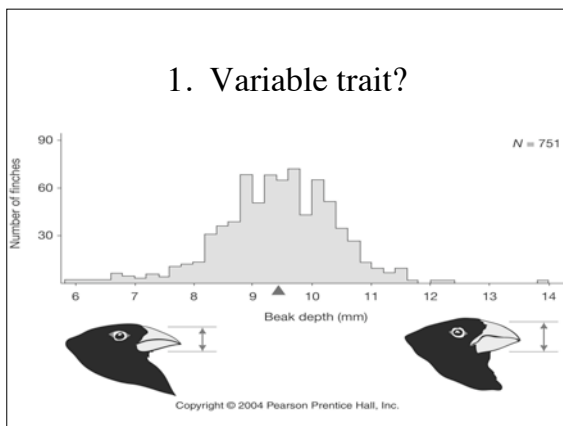
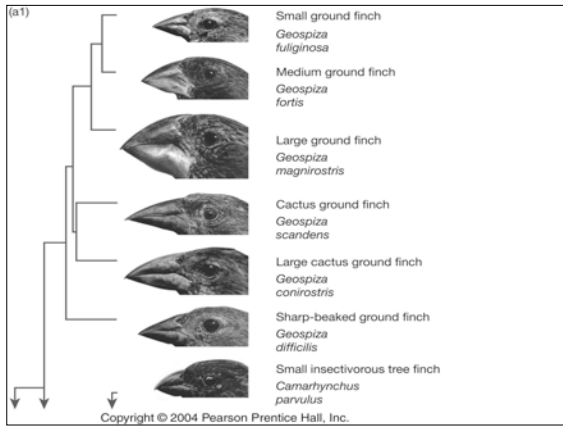


Fraction of plants



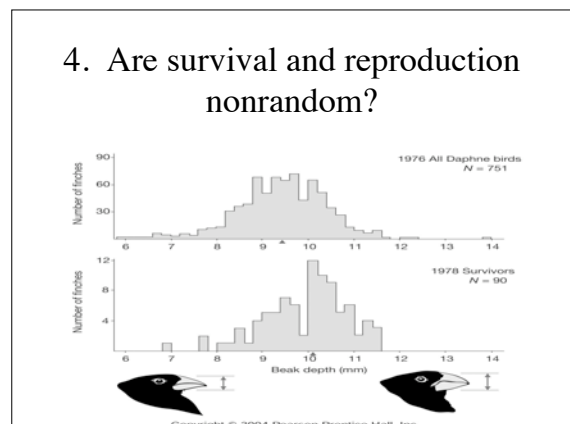
Darwin's Finches

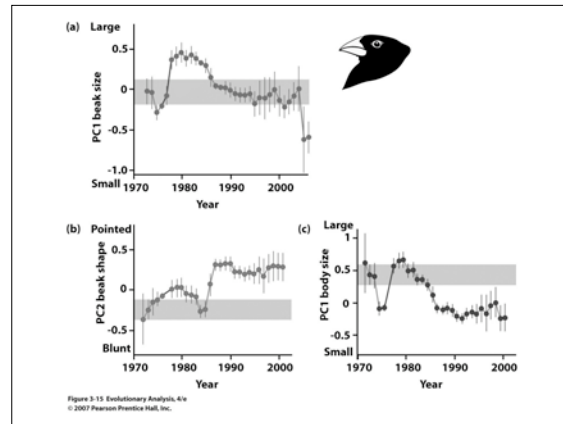
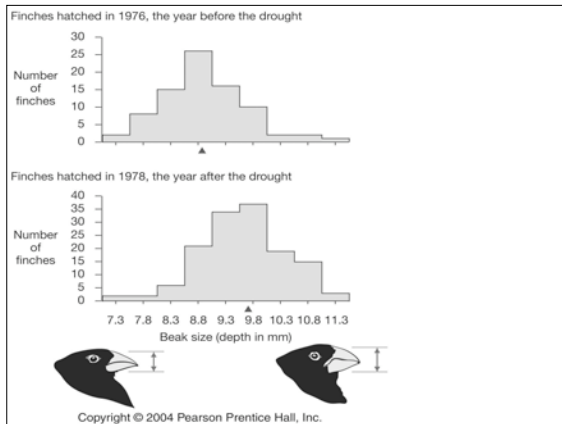
- So Darwin's theory holds under experimental conditions where we know for sure that postulate 1 and 2 hold.
- What about a natural population?
- We'll look at Grant and Grant's long-term study of the medium ground finch on one of the Galapagos Islands



3. Is reproductive success variable?

- This is universally true---more offspring are produced than will survive and reproduce.
- Individual reproductive success is variable.

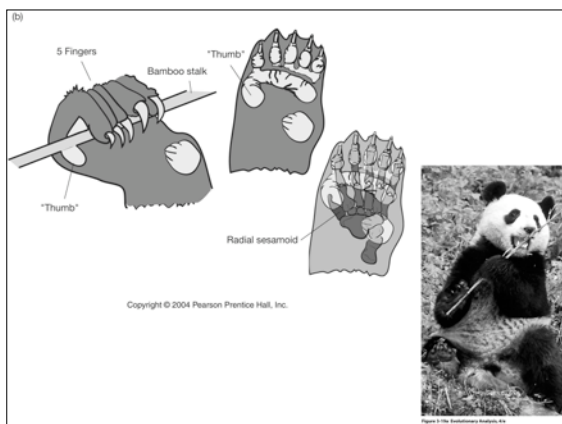




How Natural Selection Works

- 1. Natural selection acts on individuals but its consequences occur in populations
- 2. Natural selection acts on phenotypes but evolution consists of changes in allele frequencies
- 3. Natural selection is not forward looking

- 4. New traits can evolve even though natural selection acts on existing traits
 - Mutations
 - Recombinations as a result of sexual reproduction
 - Preadaptations-traits used in a novel way are elaborated on by selection



- 5. Natural selection is not perfect.
- 6. Natural selection is nonrandom but it is not progressive.
- 7. Fitness is not circular
- 8. Selection acts on individuals, not for the good of the species
 - The issue of altruism

The Evolution of Darwinism

1. Because Darwin knew nothing about mutation, he had no idea how variability was generated in populations
2. Because Darwin knew nothing about genetics, he had no idea how variations were passed to offspring
 1. Blending inheritance and Lamarkism
3. Kelvin's age of the earth

The Modern Synthesis

1. Gradual evolution results from small genetic changes that are acted upon by natural selection.
2. The origin of species and higher taxa, or macroevolution, can be explained in terms of natural selection acting on individuals, or microevolution.