

Evolution of populations

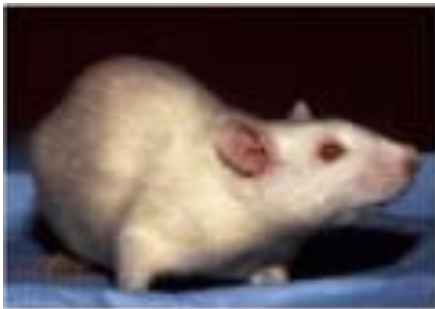
Sections from ch 15 and ch 16

15-1 The puzzle of life's diversity

- Evolutionary theory is a collection of scientific facts, observations, and hypotheses.
- Evolution is change over time. In a biological context, evolution includes how ancient organisms have become modern organisms changes over time.
- A scientific theory is a well-supported testable explanation of phenomena that have occurred in the natural world.

15-1 The puzzle of life's diversity

- **Organisms: individual living things (plant/animal)**



Rat
(*Rattus norvegicus*)



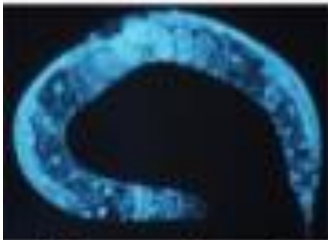
Mouse
(*Mus musculus*)



Fruitfly
(*Drosophila melanogaster*)



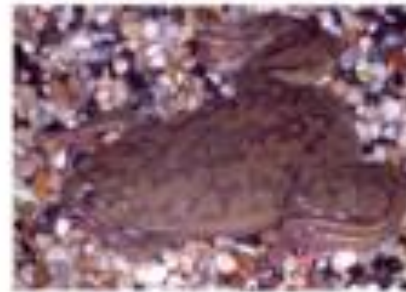
Plant
(*Arabidopsis thaliana*)



Nematode
(*Caenorhabditis elegans*)



Sea Urchin
(*Strongylocentrotus purpuratus*)



Frog
(*Xenopus laevis*)

15-1 The puzzle of life's diversity

- **A species: group of organisms that can produce fertile offspring**



jaguar



cheetah

www.visualdictionaryonline.com



lion



leopard

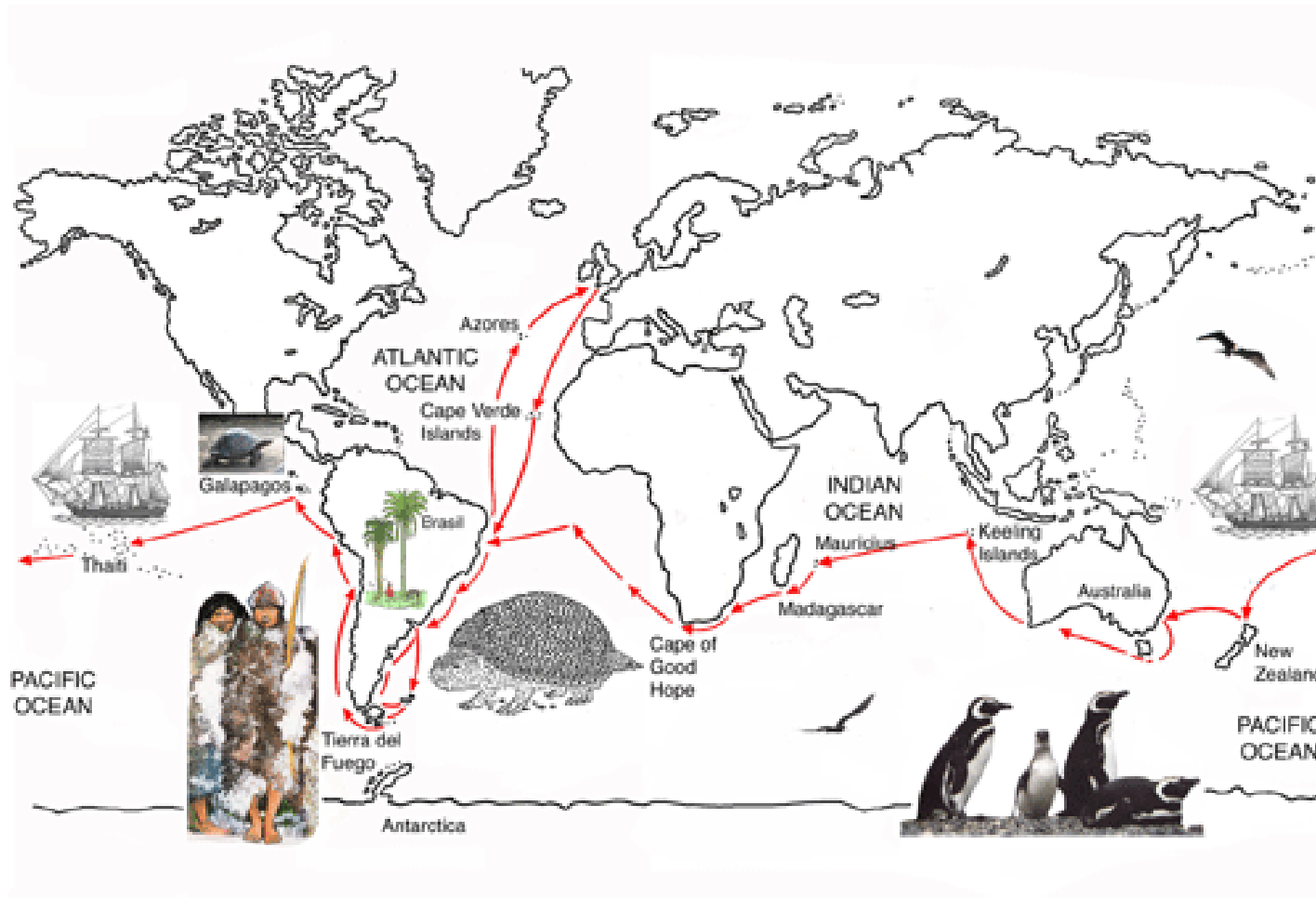
15-1 The puzzle of life's diversity

- **A population: all the organisms in a species that live in a particular area**

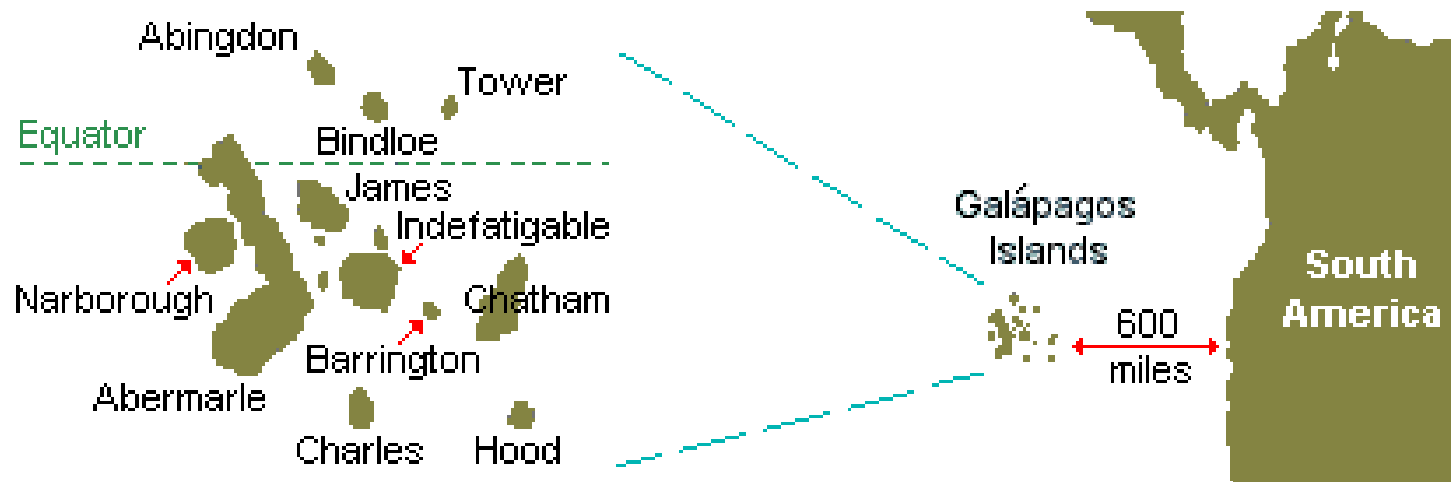


Darwin

- Voyage of the Beagle

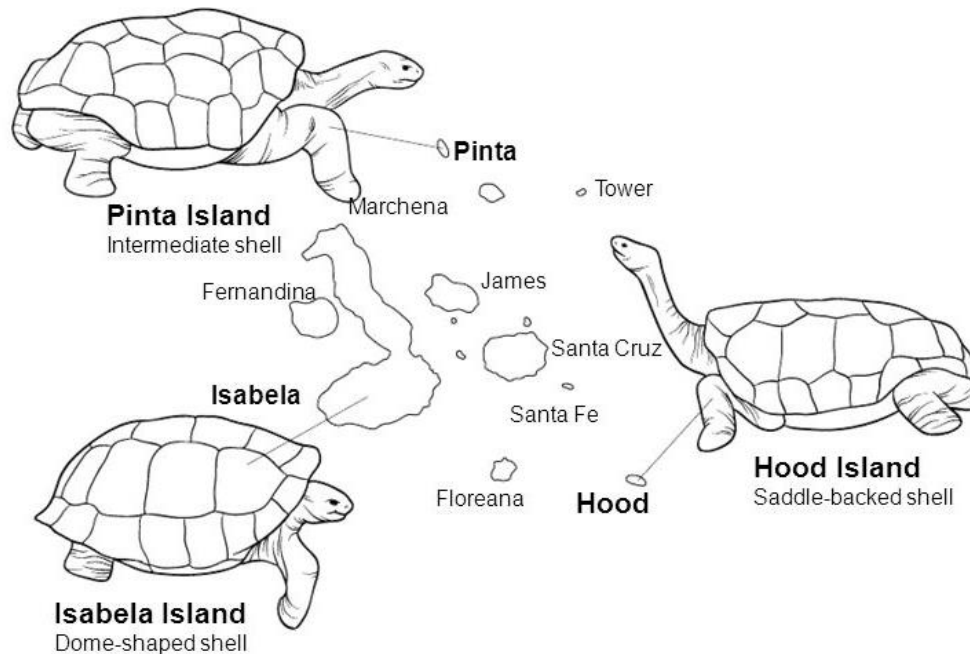


- Voyage of the Beagle



- Voyage of the Beagle

Giant Tortoises of the Galápagos Islands



- Voyage of the Beagle



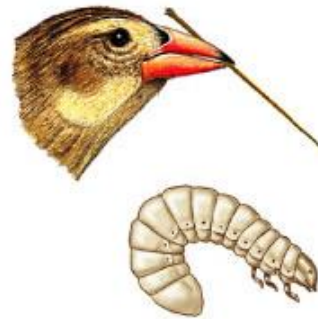
Large ground finch (seeds)



**Cactus ground finch
(cactus fruits and flowers)**

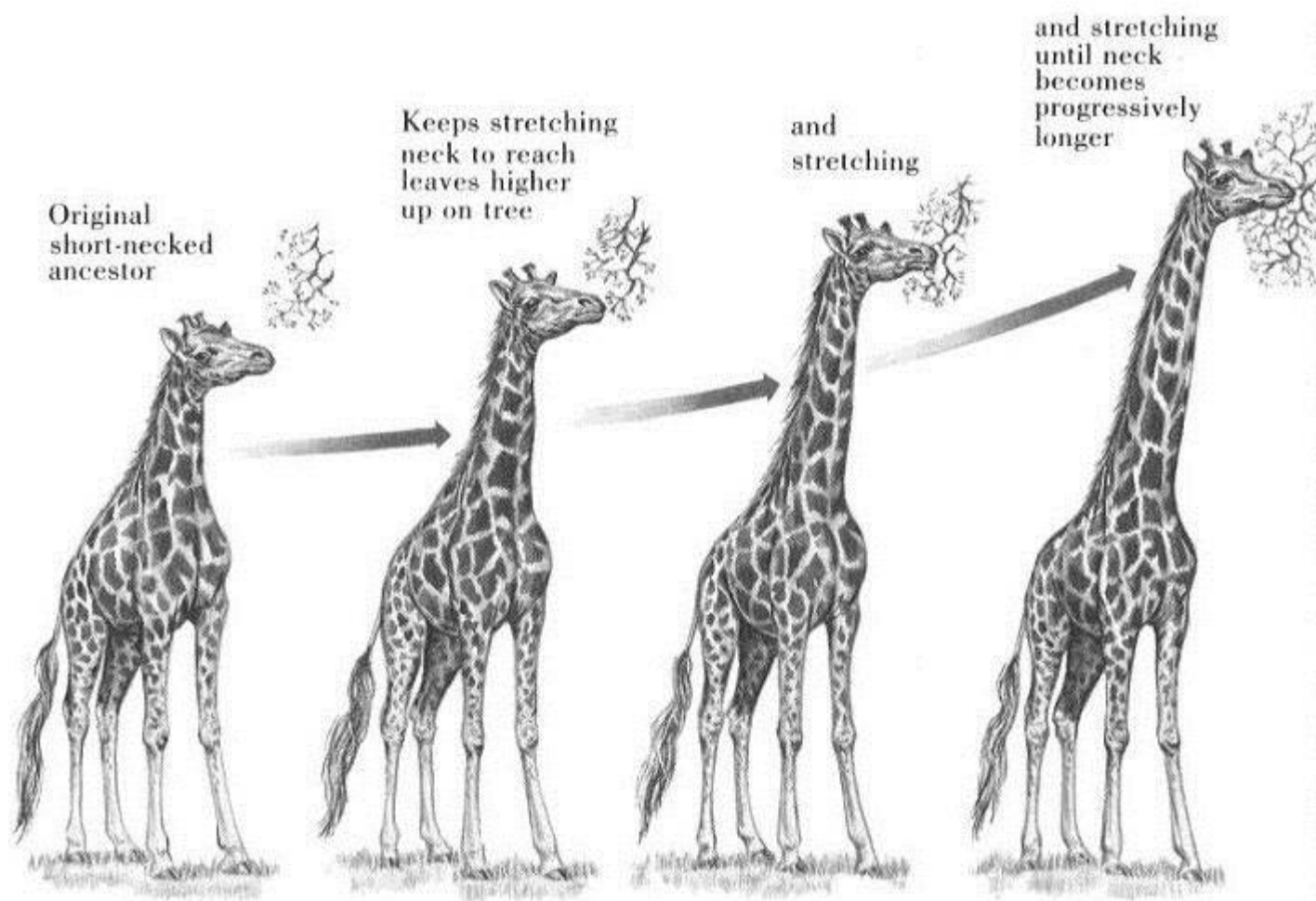


Vegetarian finch (buds)



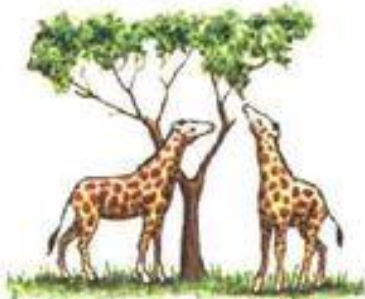
Woodpecker finch (insects)

15-2 Lamarck Evolution Theory



Review Darwin and Lamarck

Lamarck



As girafas ancestrais provavelmente tinham pescoços curtos, que eram submetidos a freqüentes distensões para alcançar a folhagem das árvores.



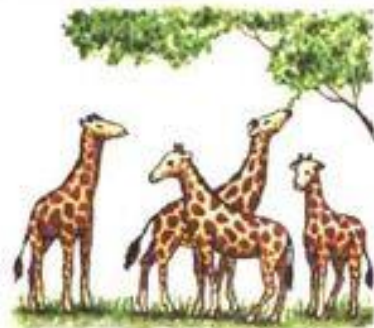
Os descendentes apresentam pescoços mais longos, que são também esticados freqüentemente na procura de alimentos.



Finalmente o contínuo esticamento do pescoço deu origem às modernas girafas, com pescoço longo.

Os fatos conhecidos não sustentam esta teoria.

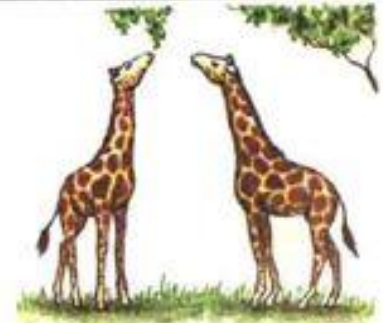
Darwin



As girafas ancestrais provavelmente apresentavam pescoços de comprimentos variáveis. As variações eram hereditárias.



Competição e seleção natural levam à sobrevivência dos descendentes de pescoços longos em detrimento dos de pescoços curtos.



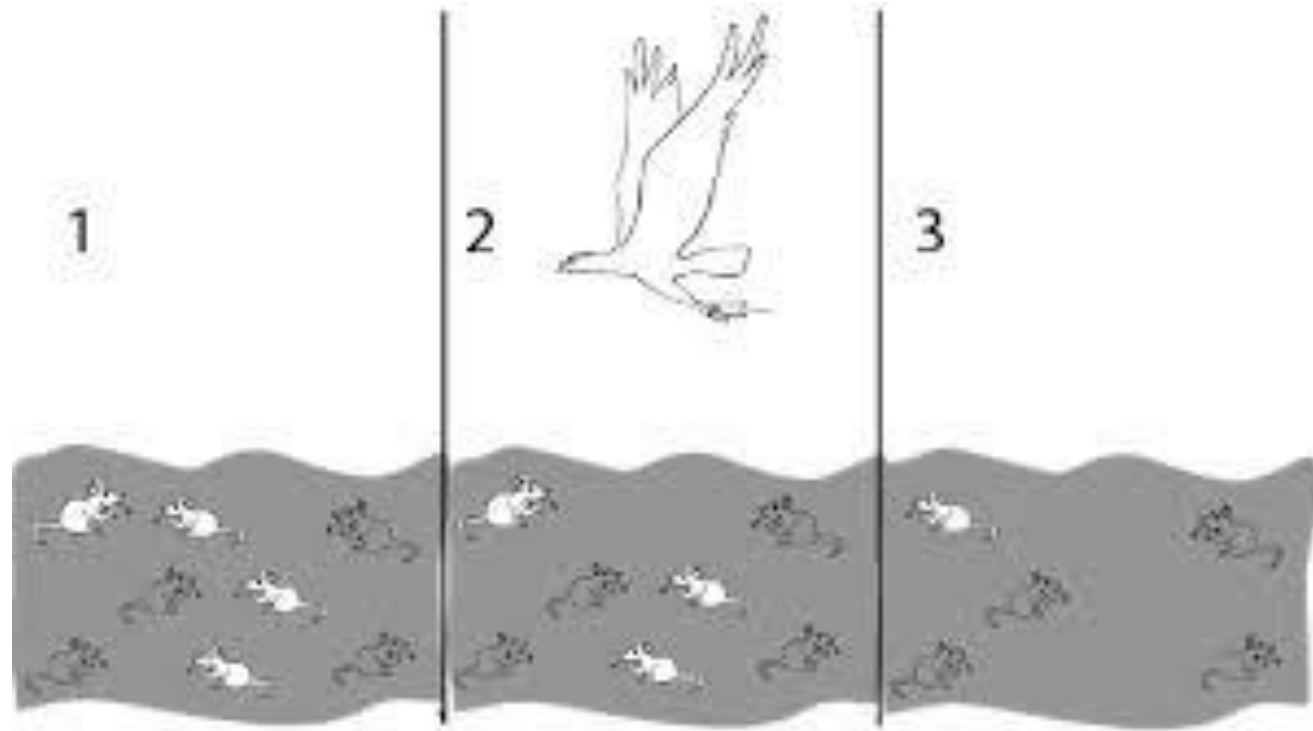
Finalmente apenas as girafas de pescoços longos sobreviveram à competição.

Fatos conhecidos sustentam esta teoria.

- <https://www.youtube.com/watch?v=1BLXV1q003w>
- <https://www.youtube.com/watch?v=pQp2IFcDEbw>

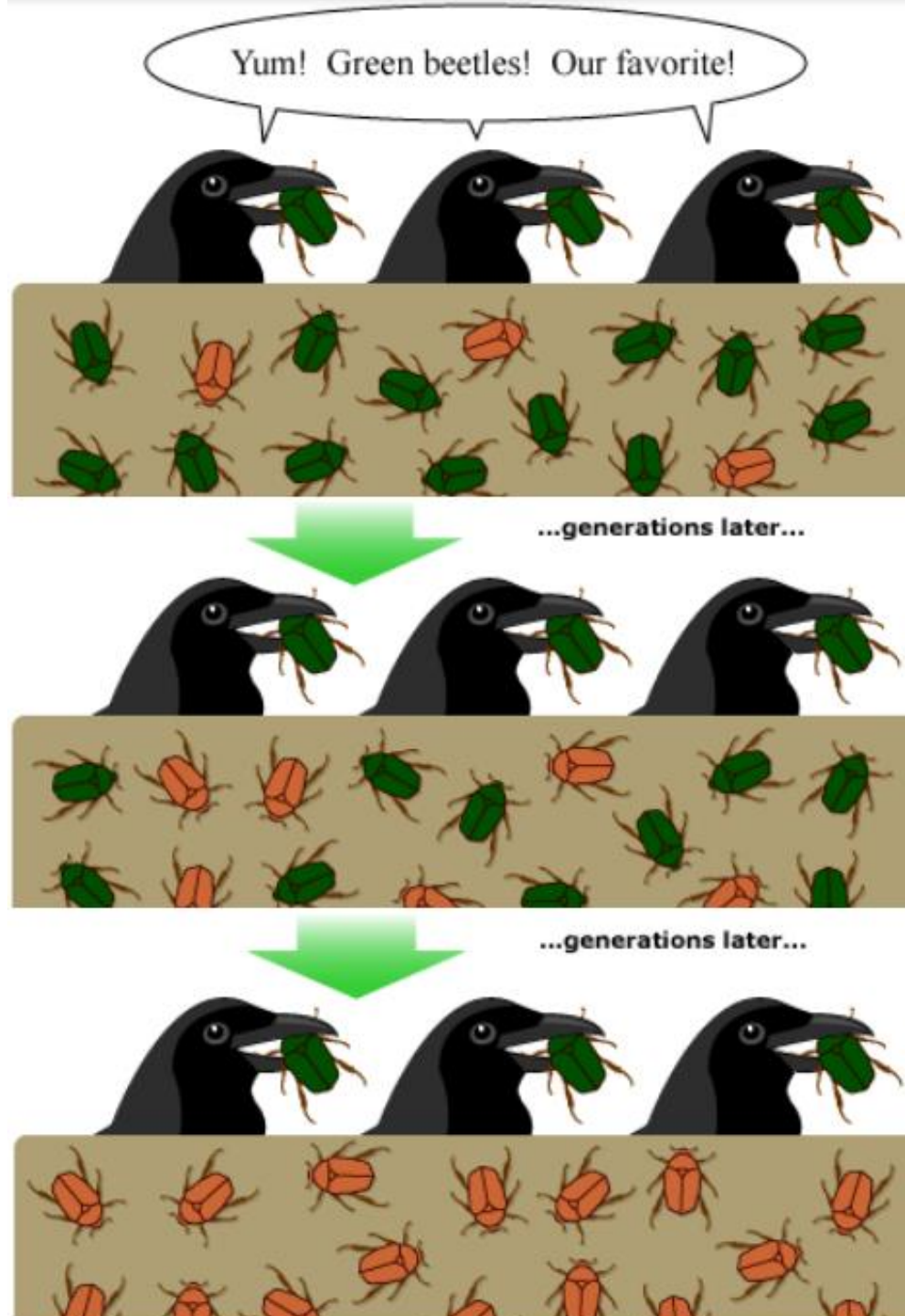
15-3 Natural Selection

- The process through which members of a species that are best suited to their environment survive and reproduce at a higher rate than other members of the species.

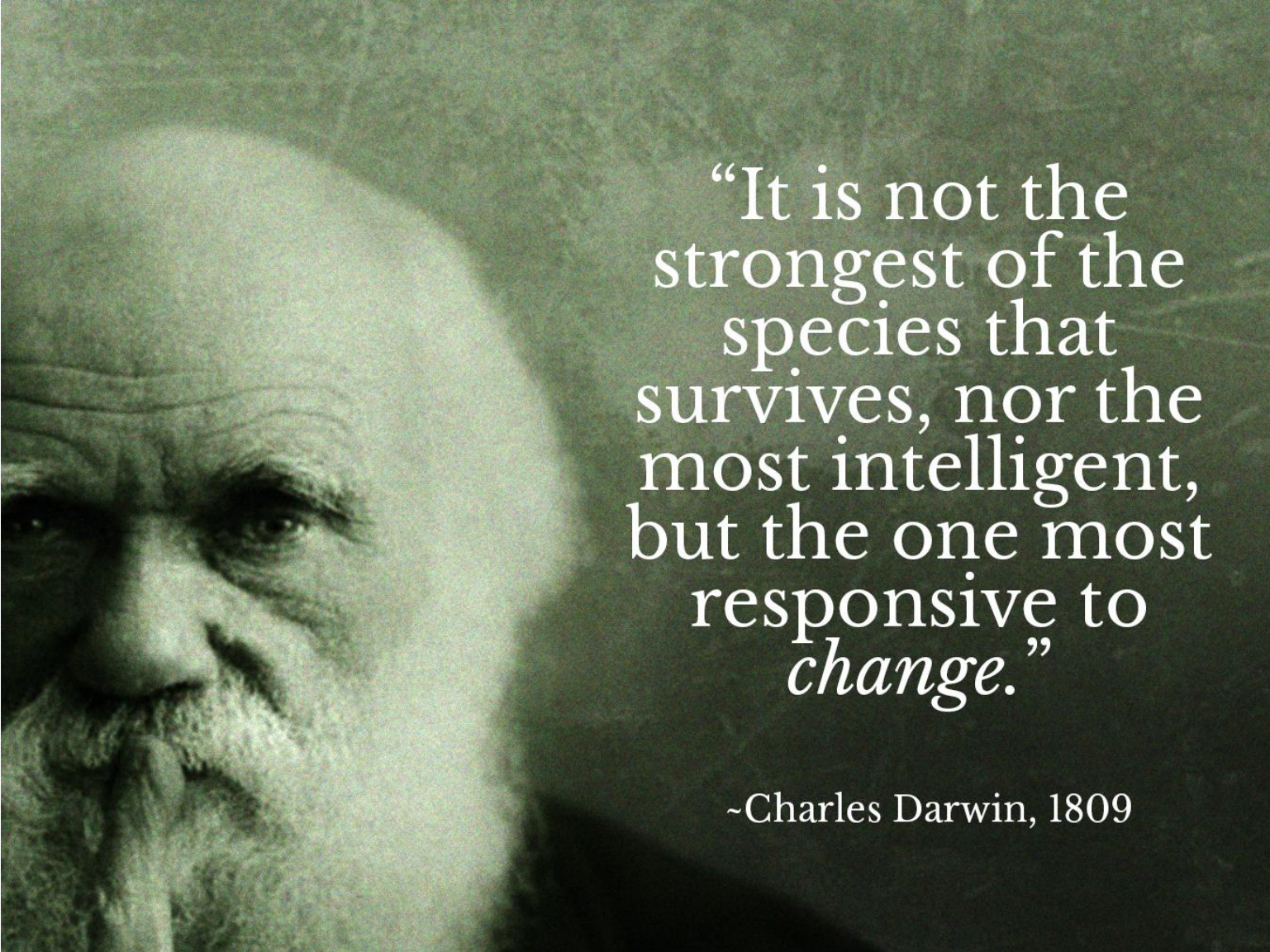


EVOLUTION BY NATURAL SELECTION

- organisms better adapted to their environment tend to survive and produce more offspring



Survival of the fittest



“It is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to *change*.”

~Charles Darwin, 1809

Survival of the fittest

- Individuals that are better suited to their environment survive and reproduce most successfully



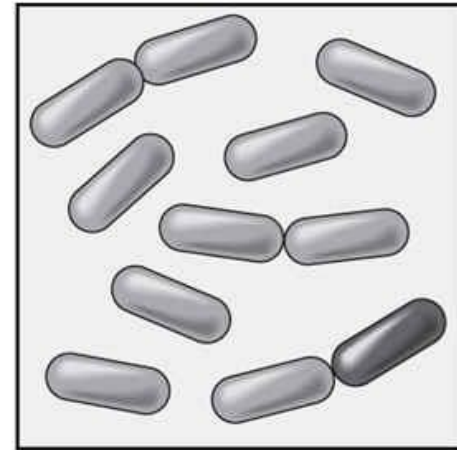
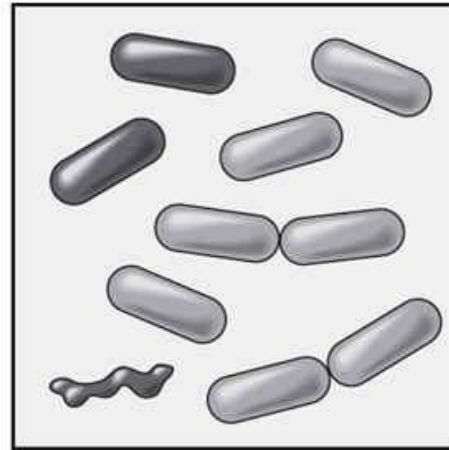
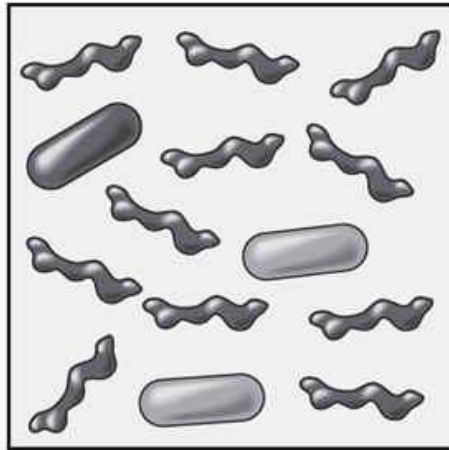
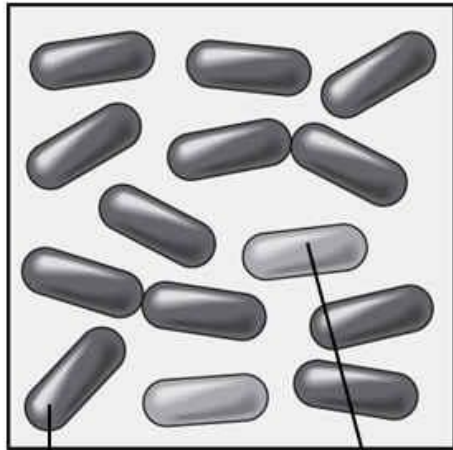
Natural Selection

A group of bacteria, including genetically resistant ones, are exposed to an antibiotic

Most of the normal bacteria die

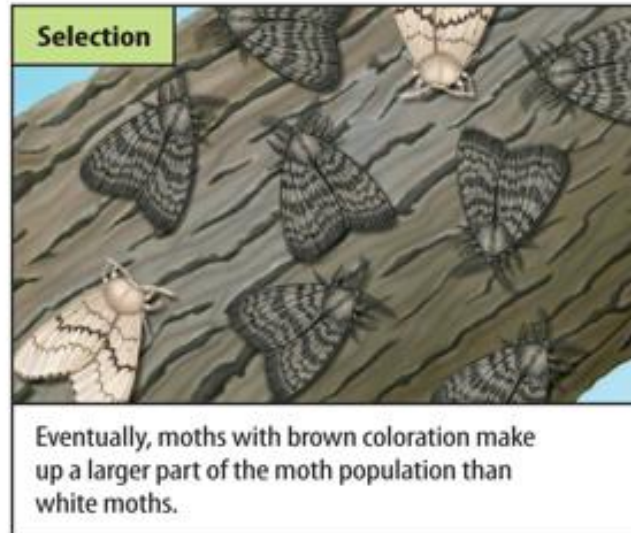
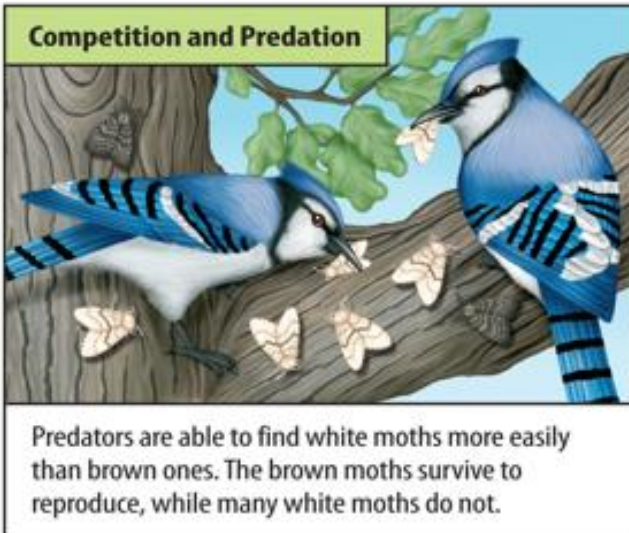
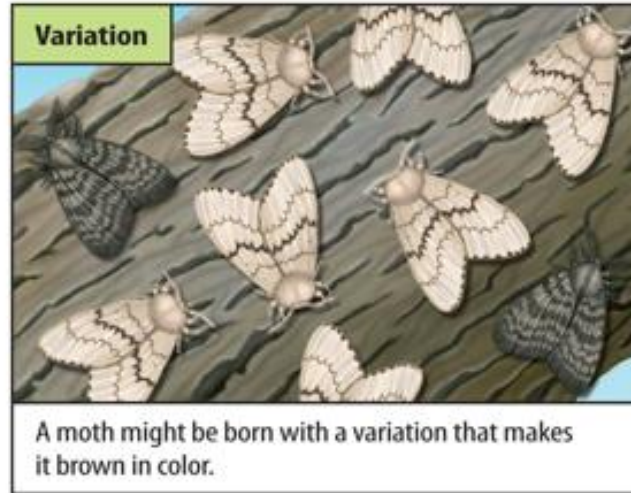
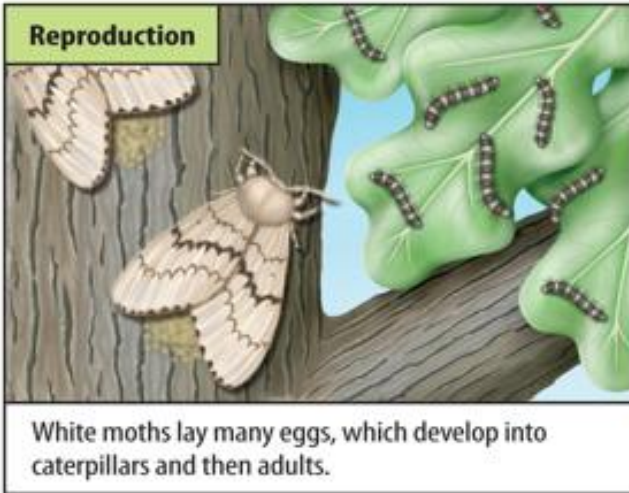
The genetically resistant bacteria start multiplying

Eventually the resistant strain replaces the strain affected by the antibiotic



Normal bacterium
Resistant bacterium

Natural Selection



Natural Selection



The akiapola'au
forages for insects,
often under bark



The iiwi
feeds on nectar
from ohia flowers



The 'Apapane
feeds on insects
and ohia nectar



The Maui parrotbill
tears back bark in
search of beetles



The original species,
now extinct,
probably ate
insects and nectar



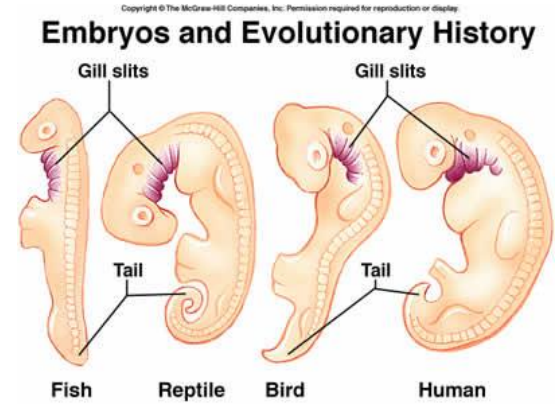
The Nihoa finch
uses its heavy bill
to crush seeds



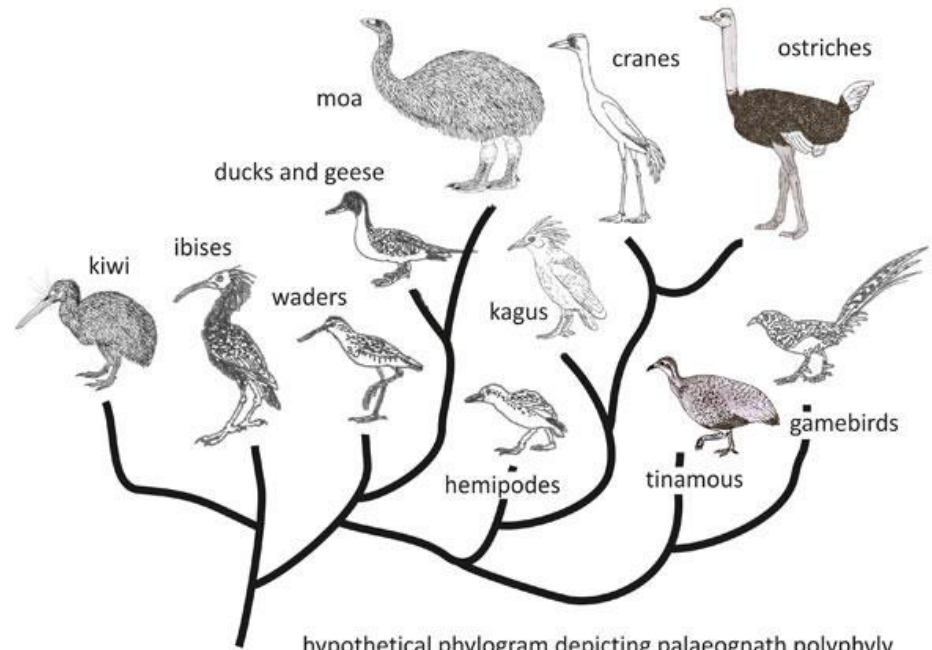
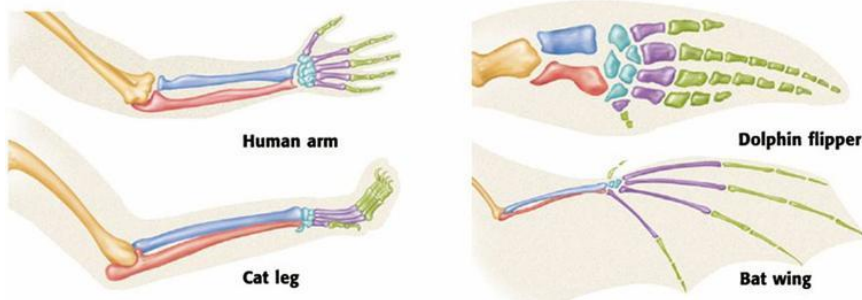
The Amakihi
is a nectar-feeder,
like the iiwi

Evidence for natural selection

- Fossils
- DNA
- Similar structures
- Embryology



Comparing Skeletal Structures



hypothetical phylogram depicting palaeognath polyphyly
Darren Naish – Tetrapod Zoology

Evidence for natural selection

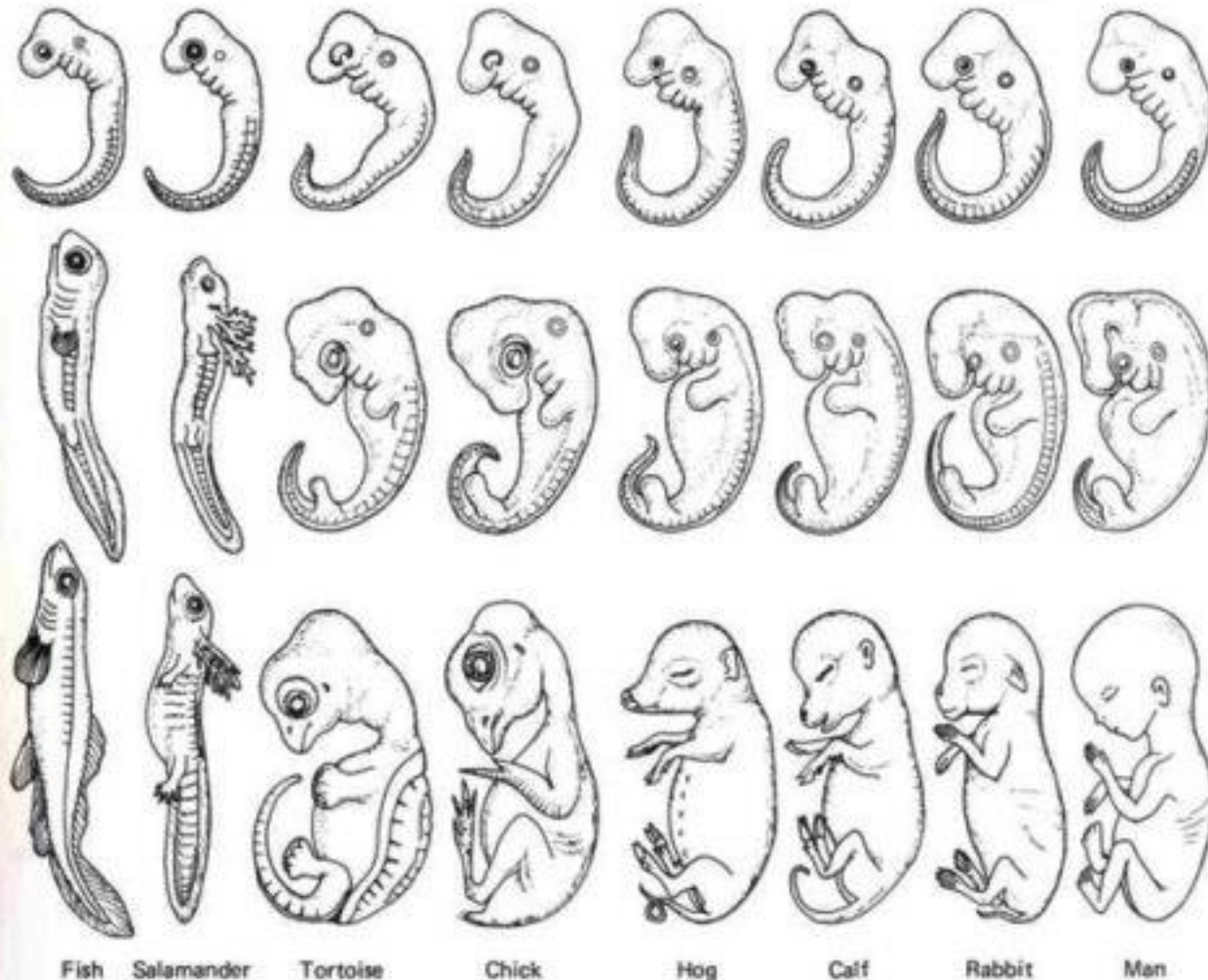
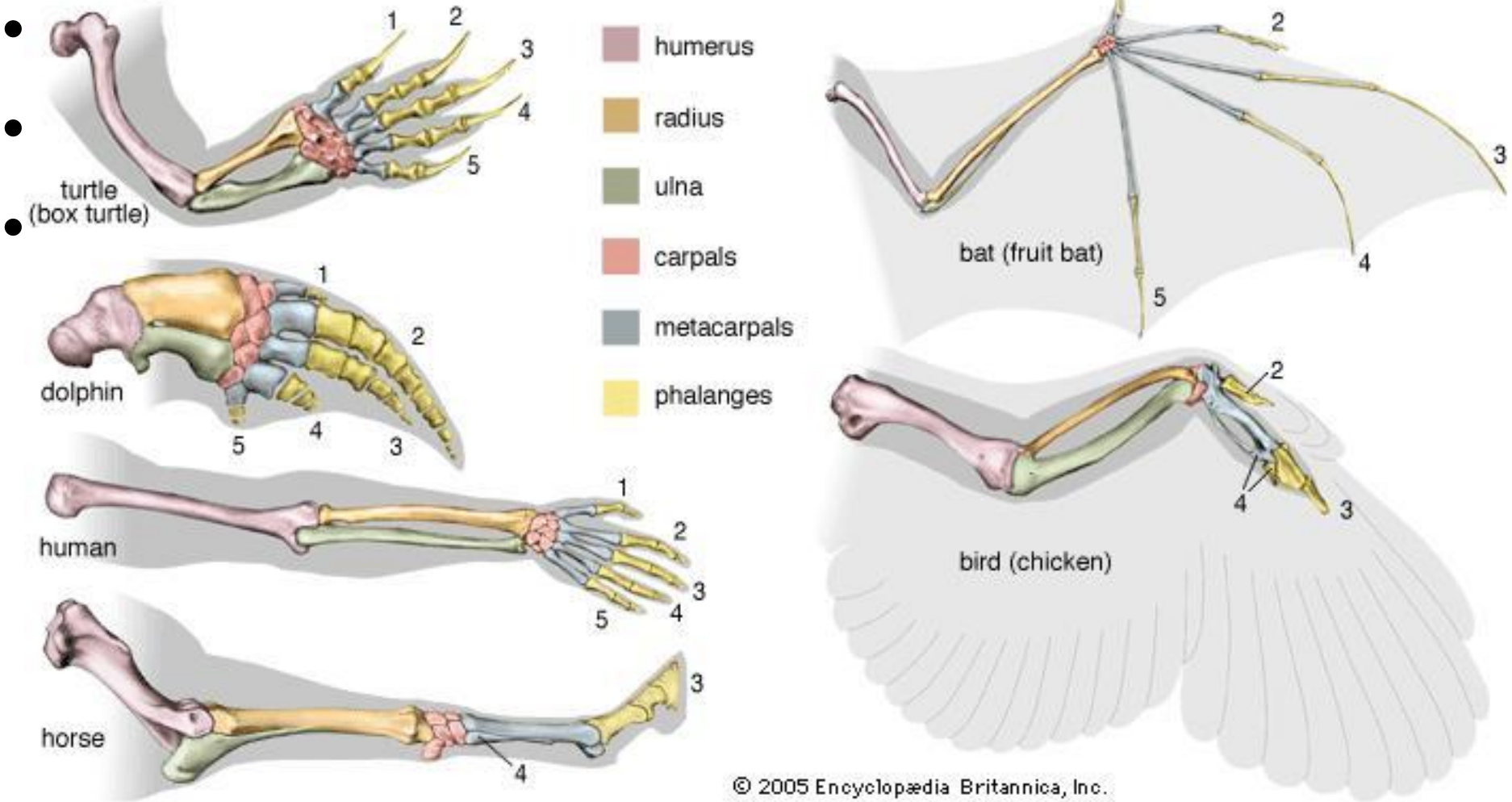


Figure 5.7. Comparison of vertebrate embryos at three different stages of embryonic development (early at top through late at bottom).

Evidence for natural selection

Homologies of the forelimb in six vertebrates



Questions

- Pg 372 Q1,2,3,4,5
- Pg 377 Q2,
- P386 Q1,2,3,4
- Pg389 Q1,2,3,4,5,6, 8,9,10,11,12, 16,17,
19,20,21, 24,25

Grade 9 don't need to do
questions in red

Chapter 16

Evolution of Populations

VARIATIONS AND GENE POOL

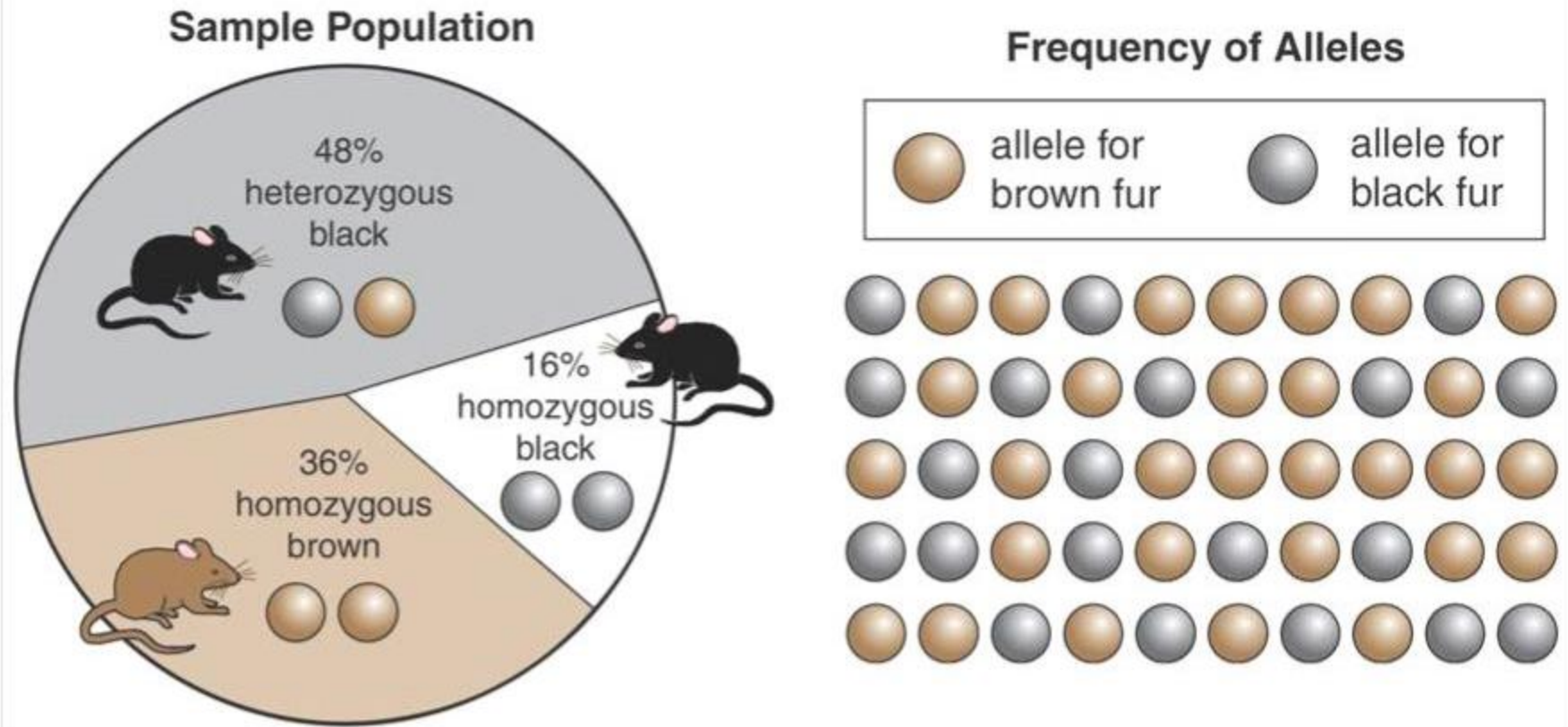


Fig. 16 – 2 Page 394 When scientists determine whether a population is evolving, they may look at the sum of the population's alleles, or its gene pool. This diagram shows the gene pool for fur color in a population of mice.

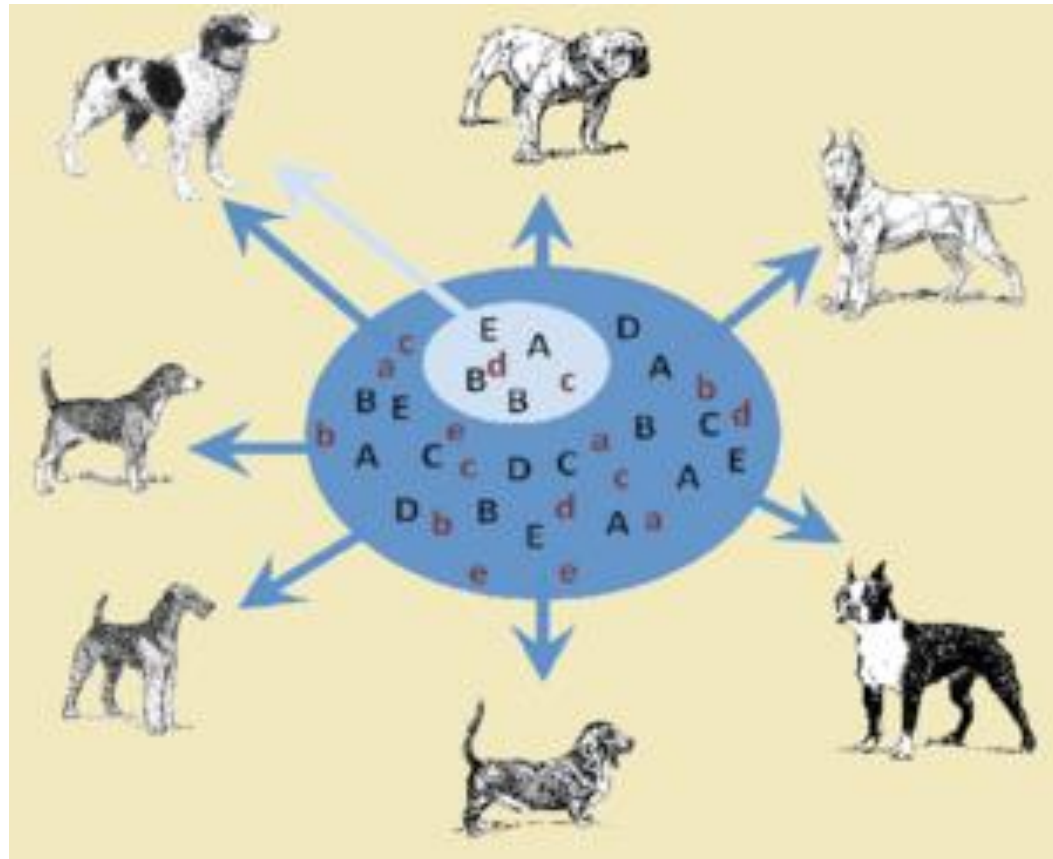
VARIATIONS AND GENE POOL

Variation populations have variety caused by variation in alleles.












VARIATIONS AND GENE POOL

Gene pool: set of all the genes in a population



NATURAL SELECTION ON SINGLE-GENE TRAITS










- Evolution: change in the gene pool of a population over time

Effect of Color Mutations on Lizard Survival			
Initial Population	Generation 10	Generation 20	Generation 30
 80%	 80%	 70%	 40%
 10%	0%	0%	0%
 10%	 20%	 30%	 60%

Predict what it will the gene frequency be at Gen 40

NATURAL SELECTION ON SINGLE-GENE TRAITS

- Natural selection on single gene traits can lead to changes in allele frequency → evolution

Effect of Color Mutations on Lizard Survival			
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Predict what it will the gene frequency be at Gen 40

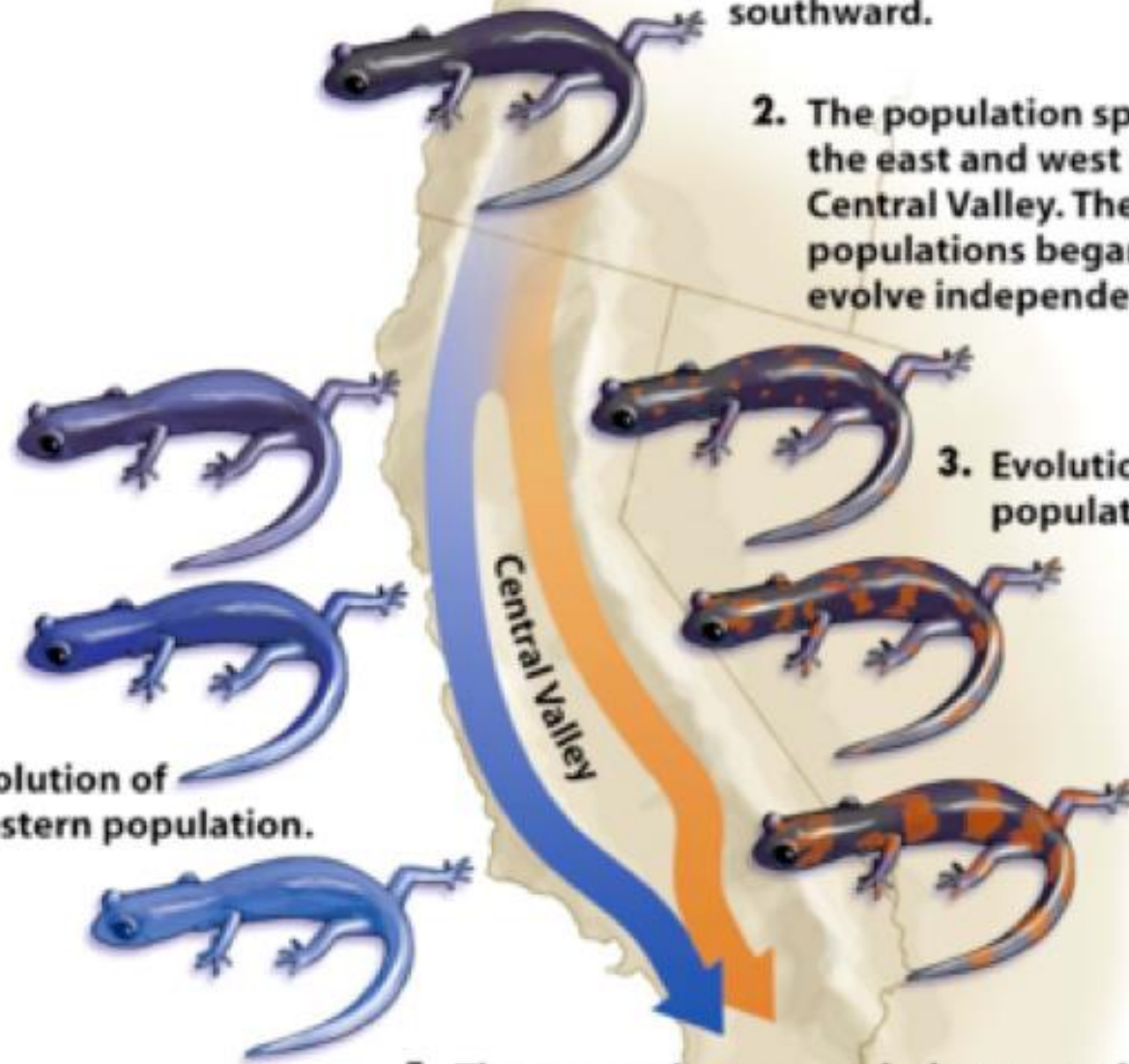
1. The original population started in the north and migrated southward.

2. The population split to the east and west of the Central Valley. Then two populations began to evolve independently.

3. Evolution of eastern population.

4. Evolution of western population.

5. The east and west populations came back together in Southern California, but could no longer interbreed (or produced infertile hybrid offspring).

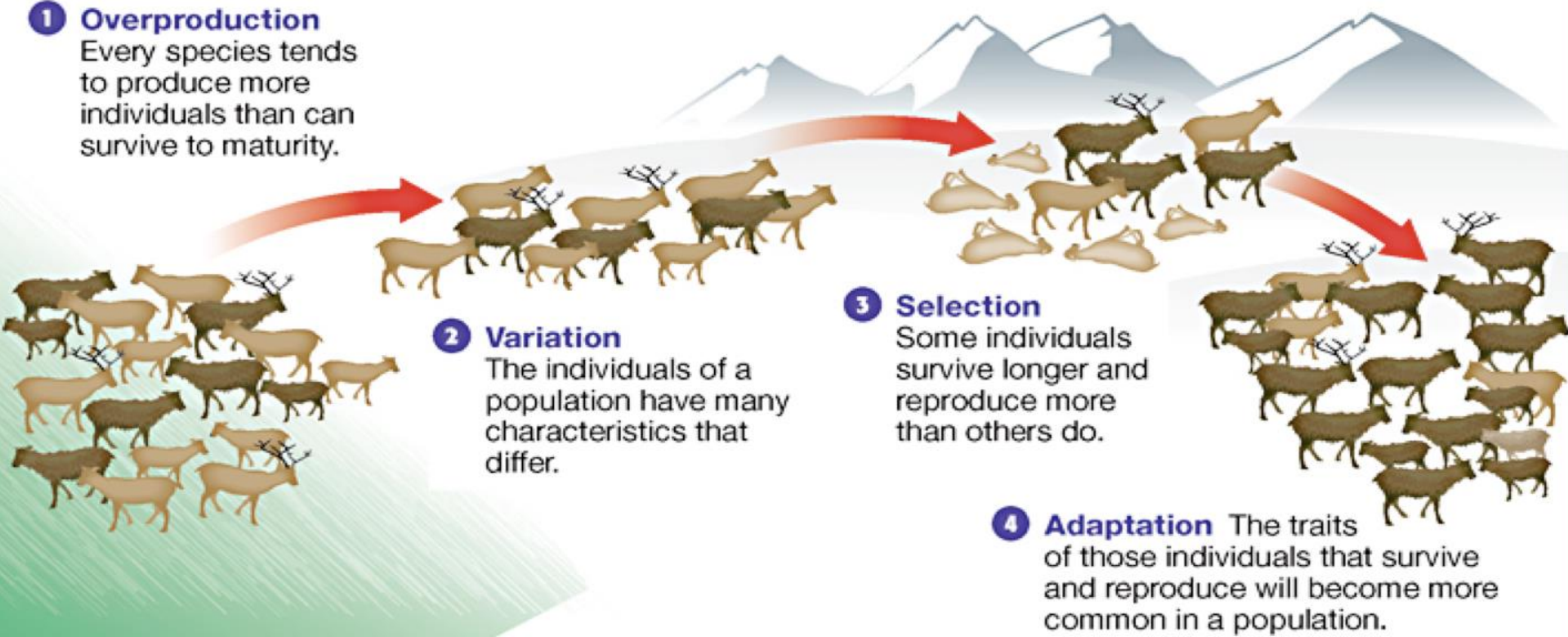


NATURAL SELECTION ON SINGLE-GENE TRAITS

The Theory of Evolution by Natural Selection

1 Overproduction

Every species tends to produce more individuals than can survive to maturity.



2 Variation

The individuals of a population have many characteristics that differ.

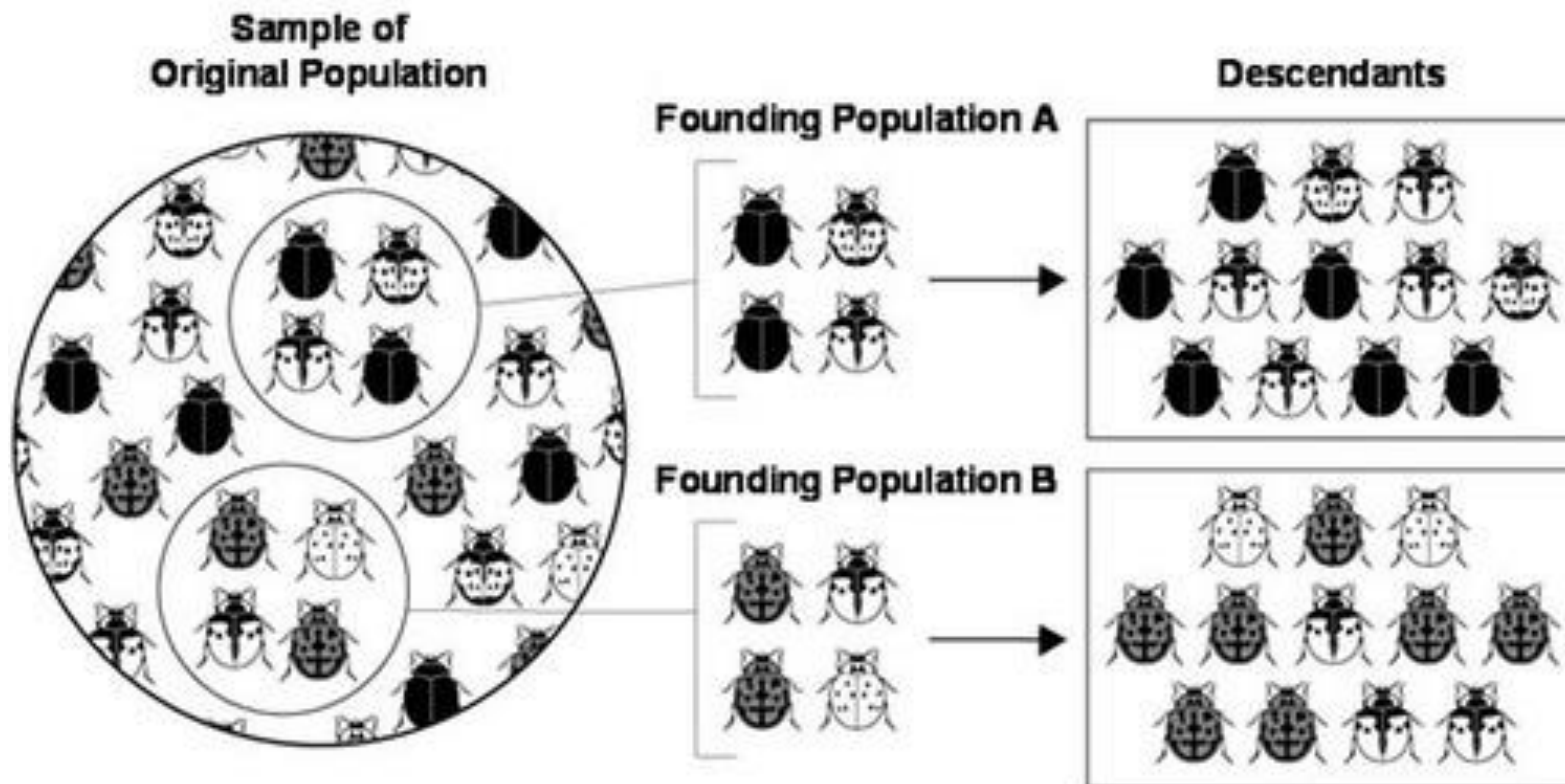
3 Selection

Some individuals survive longer and reproduce more than others do.

4 Adaptation The traits of those individuals that survive and reproduce will become more common in a population.

Genetic drift

- Change in population due to random chance

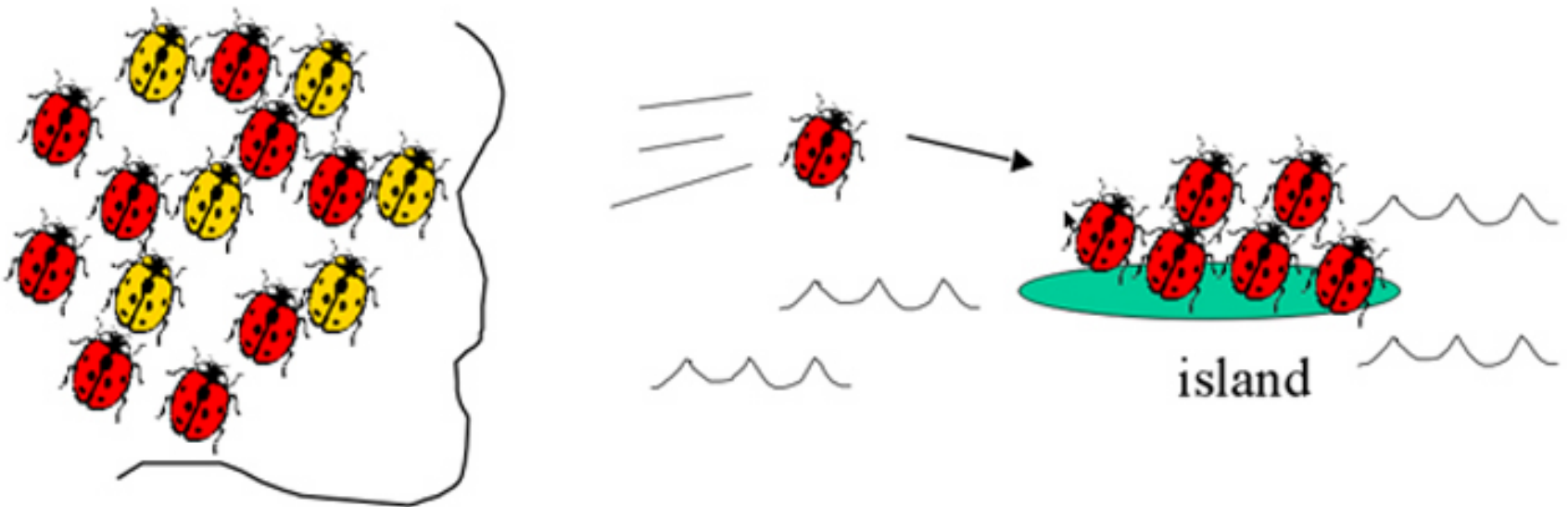


- 9 can stop here.

Genetic Drift

- Founder effect

- **founder effect**: a few individuals from a population start a new population with a different allele frequency than the original population



Speciation

- Formation of a new species



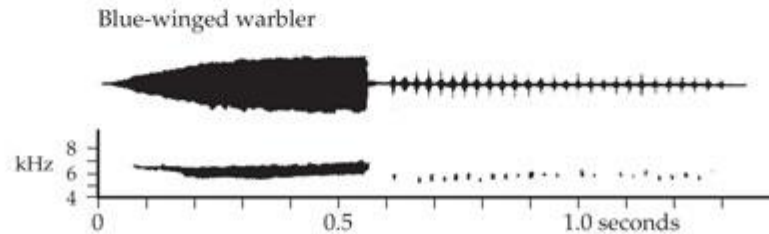
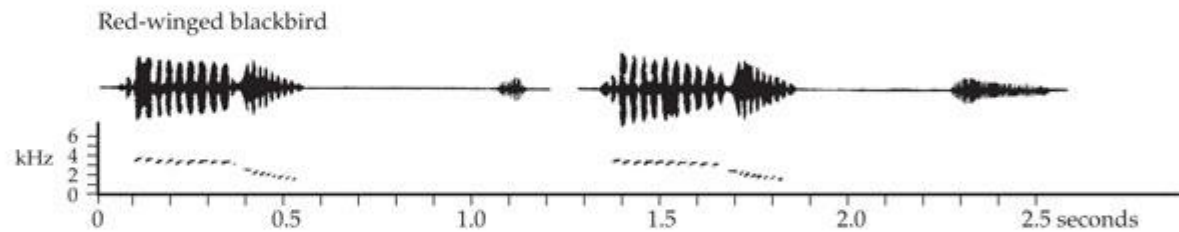
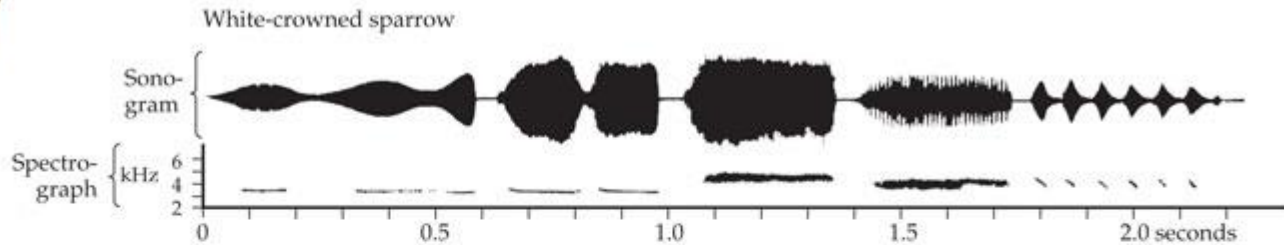
South



North

Speciation

- Behavioral isolation



Speciation

- Temporal isolation



Temporal Isolation: The difference in their mating season means they don't interbreed.

Questions

- Pg 372 Q1,2,3,4,5
- Pg 377 Q2,
- P386 Q1,2,3,4
- Pg389 Q1,2,3,4,5,6, 8,9,10,11,12, 16,17,
19,20,21, 24,25

Grade 9 don't need to do
questions in red

- What was Charles Darwin's contribution to science?
- What did Darwin notice about the shape of the different birds beaks on the different galapagos island?
- According to Lamarck, how did species evolve?
- How is natural selection related to a species' fitness?
- **Define:** Evolution,fitness,Adaptation,Survival of the fittest,Natural Selection
- <https://quizlet.com/24008619/chapter-15-darwins-theory-of-evolution-prentice-hall-biology-flash-cards/>
-

1. Charles Darwin went on a five-year voyage on the *Beagle*. Where did he go during this voyage [1 mark] and what scientific activities did he carry out on land and at sea [2 marks]? Do NOT include anything mentioned in question 6).
2. Give two things that most Europeans in Darwin's day believed about the Earth and life on it. [2 marks]
3. Darwin and others found and collected fossils. What did these fossils indicate about life on Earth in the past compared with the present?
4. What was Lamarck's hypothesis regarding evolution and give one reason why it was incorrect. [2 marks]
5. In biological/evolutionary terms, what is an adaptation? Give your answer and an example of an adaptation, explaining why it is an adaptation. [2 marks]
6. Which are more likely to die before having offspring; individuals with high fitness or individuals with low fitness?
7. When Darwin looked at similar environments on different continents, he sometimes saw different animals that had similar anatomies and behaviors. Explain using evolutionary ideas how this could have happened, even though the animals had different ancestors. You may get more credit if you use your own words in your explanation, rather than quoting phrases (even short ones) from the textbook. [1 or 2 marks]
8. Imagine there is a population of organisms that is well-adapted to a specific environment, but that the environment changes a lot in a just a few years.
 - a) Explain why the population might all die off.
 - b) Explain how/ why the population might survive.