APES
Evolution

http://evolution.berkeley.edu/evolibrary/article/evo_01

Evolution 9/11
Obj. TSW learn form mistakes made on the quiz, and take notes about evolution after the Environmental Science Current Events. P. 34NB

1. Make a food chain for the following organisms showing the energy arrows and the trophic levels for each one.

Grasshopper, fox, grass, bird

2. Watch video on % change. If the original population of badgers was 250 in 1980, and due to habitat loss the population is now 50 in 2013, what is the % change in the population?

3. When discussing evolution, why do we say population evolve, not individuals?
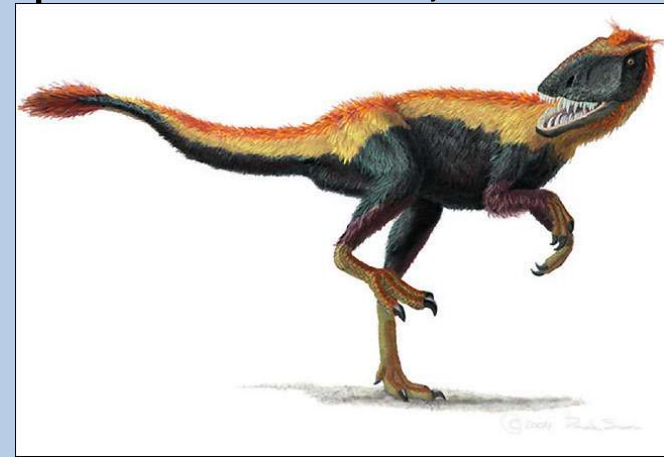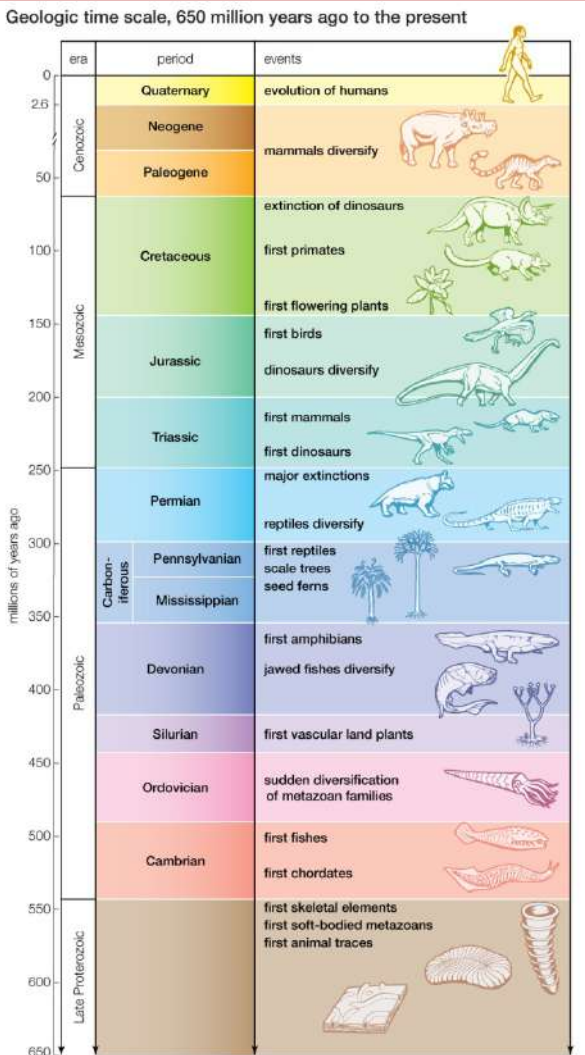
Bangladesh

Agenda 9/12

- Warm up – Natural Selection
- Alicia Current Event
- After school room 757 – 4 students take quiz
- Evolution Notes
- Into the Universe …
- Questions about Project?
- Time Line – Geologic Time scale Activity
- Water composed soil.

Natural Selection 9/12
Obj. TSW understand and discuss the random process of Evolution and the key ideas of Natural Selection P. 36 NB

Geologic time scale, 650 million years ago to the present

era	period	events
Cenozoic	Quaternary	evolution of humans
	Neogene	mammals diversify
	Paleogene	
Mesozoic	Cretaceous	extinction of dinosaurs, first primates, first flowering plants
	Jurassic	first birds, dinosaurs diversify
	Triassic	first mammals, first dinosaurs
Paleozoic	Permian	major extinctions, reptiles diversify
	Carboniferous Pennsylvanian	first reptiles, scale trees, seed ferns
	Carboniferous Mississippian	
	Devonian	first amphibians, jawed fishes diversify
	Silurian	first vascular land plants
	Ordovician	sudden diversification of metazoan families
	Cambrian	first fishes, first chordates
Late Proterozoic		first skeletal elements, first soft-bodied metazoans, first animal traces

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1. Evolution can be random. Describe each of the following in your own words: Mutation, Genetic Drift, Bottle Neck Effect & Founder Effect.

2. Write the key ideas to Darwin's Theory of Evolution by Natural Selection.

3. Draw the graphs and describe the three types of Selection.

[Evolution](#)- A change in species over time

- Evolution happens by Natural Selection
  - The population evolves over time not the individual.
  - Environment is the selective pressure
- Factors that Affect Natural Selection are:
  - Organisms have more offspring than can survive
  - Random gene mutations creating new Variations
  - That Variation gives the individual an advantage
  - Individual lives long enough to breed passing on the successful trait
  - Population changes over time due to selective advantage brought on by environmental pressures

# [Evolution]{.underline} is the mechanism underlying biodiversity

- Evolution- a change in the genetic composition of a population over time.

- Microevolution- evolution below the species level. Evolution of different types of potatoes, apples.

- Macroevolution- Evolution which gives rise to new species or new genera, family, class or phyla. Speciation – new species has evolved

Creating Genetic Diversity

- Genes- physical locations on chromosomes within each cell of an organism.

- Genotype- the complete set of genes in an individual. The letters that represent the trait, BB, Bb, bb.

- Mutation- a random change in the genetic code.

- Phenotype- the actual set of traits expressed in an individual. The physical characteristic – Brown hair.

Evolution by artificial and natural selection

- Evolution by artificial selection- when humans determine which individuals breed.
- Evolution by natural selection- the environment determines which individuals are most likely to survive and reproduce.
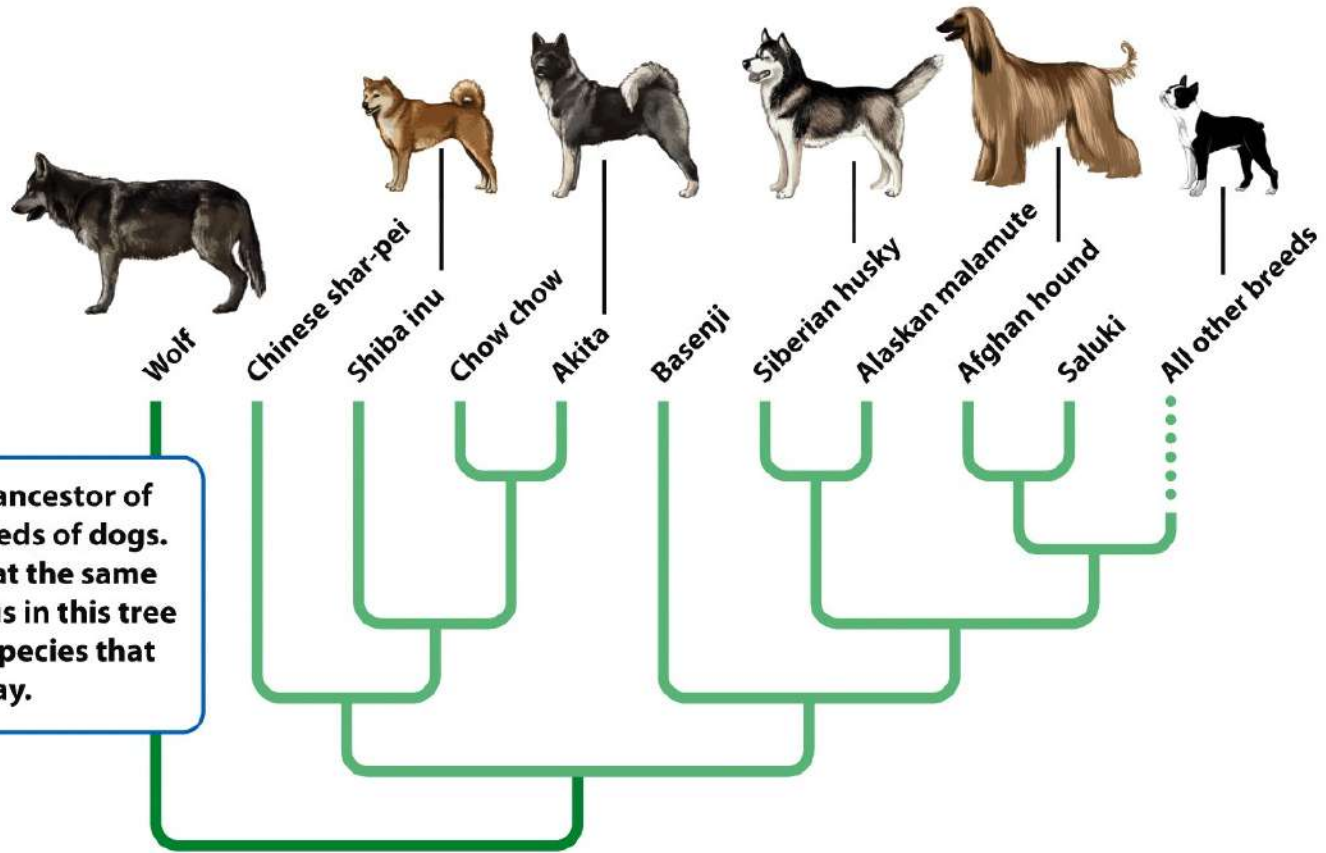
The wolf is the ancestor of the various breeds of dogs. It is illustrated at the same level as the dogs in this tree because it is a species that is still alive today.

Wolf, Chinese shar-pei, Shiba inu, Chow chow, Akita, Basenji, Siberian husky, Alaskan malamute, Afghan hound, Saluki, All other breeds

Figure 5.8
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Darwin's theory of evolution by natural selection

- Individuals produce an excess of offspring.

- Not all offspring can survive.

- Individuals differ in their traits.

- Differences in traits can be passed on from parents to offspring.

- Differences in traits are associated with differences in the ability to survive and reproduce.

Evolution is affected by the environmental pressures, in this case, it is the predator that is putting pressure on the population of Amphipods.
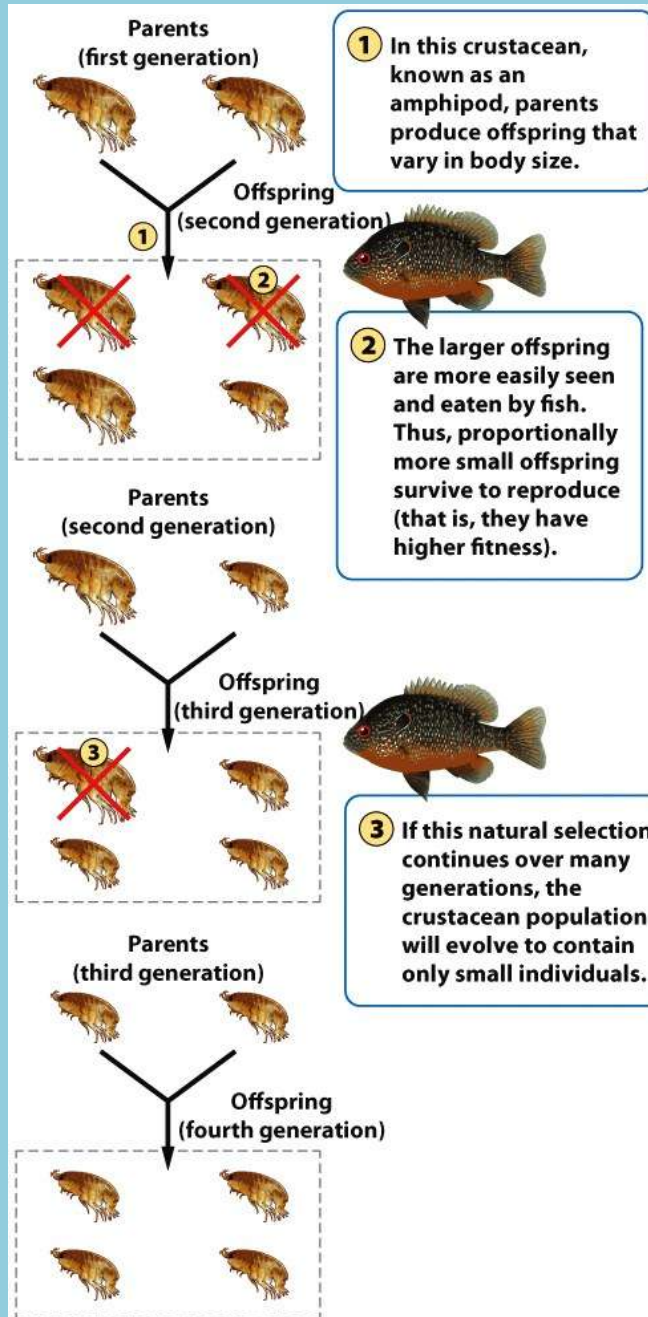

1. In this crustacean, known as an amphipod, parents produce offspring that vary in body size.

2. The larger offspring are more easily seen and eaten by fish. Thus, proportionally more small offspring survive to reproduce (that is, they have higher fitness).

3. If this natural selection continues over many generations, the crustacean population will evolve to contain only small individuals.

Figure 5.10
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Evolution by Random Processes

- Mutation- occur randomly and can add to the genetic variation of a population. Blond Hair

- Genetic drift- change in the genetic composition of a population over time as a result of random mating. Amish Population

- Bottleneck effect- a reduction in the genetic diversity of a population caused by a reduction in its size. Cheetah, Sea Lions, Northern Elephant Seal

- Founder effect- a change in a population descended from a small number of colonizing individuals. Afrikaner Population of Dutch settlers in South Africa, higher incidence of Huntington's disease.

(a) Mutation
A mutation can arise in a population and, if it is not lost, may increase in frequency over time.

Mutation occurs in the population

10% black
90% white

Time and multiple generations

30% black
70% white

(b) Genetic drift
In a large population, the genetic composition tends to remain the same over time. In a small population, however, some genotypes can be lost by chance and the genetic composition can change over time.

40% black
60% white

40% black
60% white

Large population

40% black
60% white

20% black
80% white

0% black
100% white

Small population
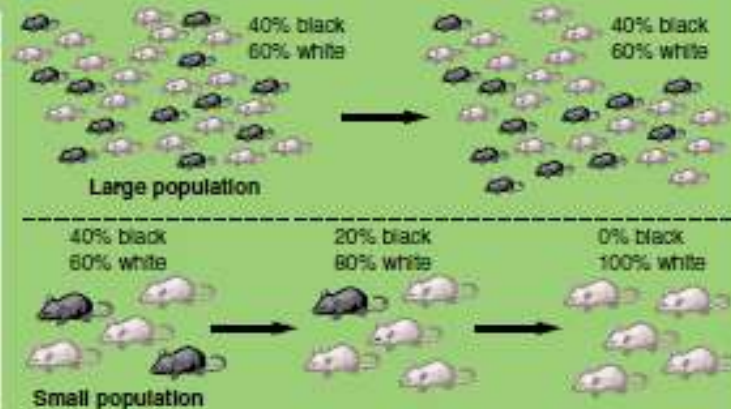
(c) Bottleneck effect
If a population experiences a drastic decrease in size (goes through a "bottleneck"), some genotypes will be lost, and the genetic composition of the survivors will differ from the composition of the original group.

40% black
10% brown
50% white

67% black
33% brown
0% white

67% black
33% brown
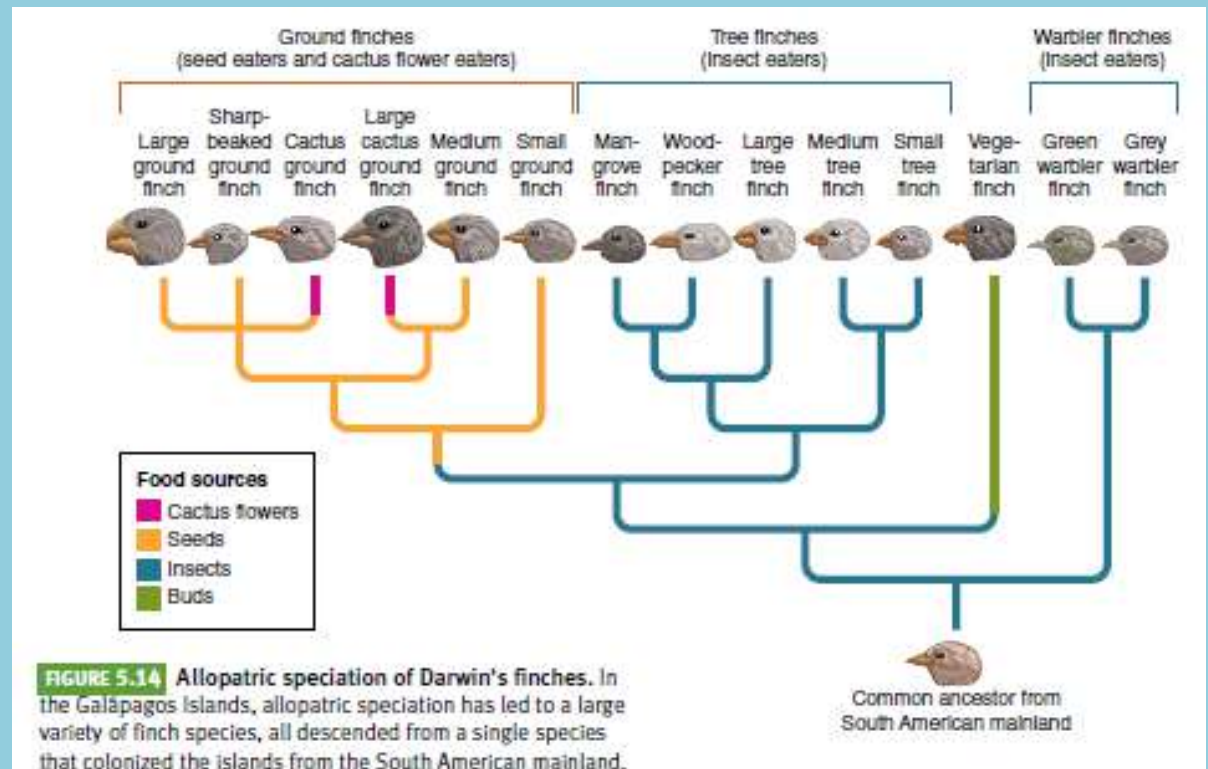0% white

Bottleneck

The survivors
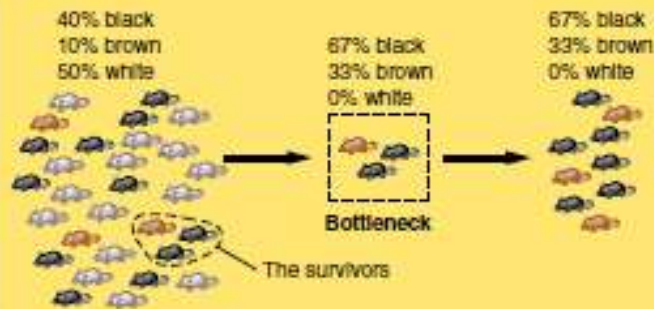
(d) Founder effect
If a few individuals from a mainland population colonize an island, the genotypes on the island will represent only a subset of the genotypes present in the mainland population. As with the bottleneck effect, some genotypes will not be present in the new population.
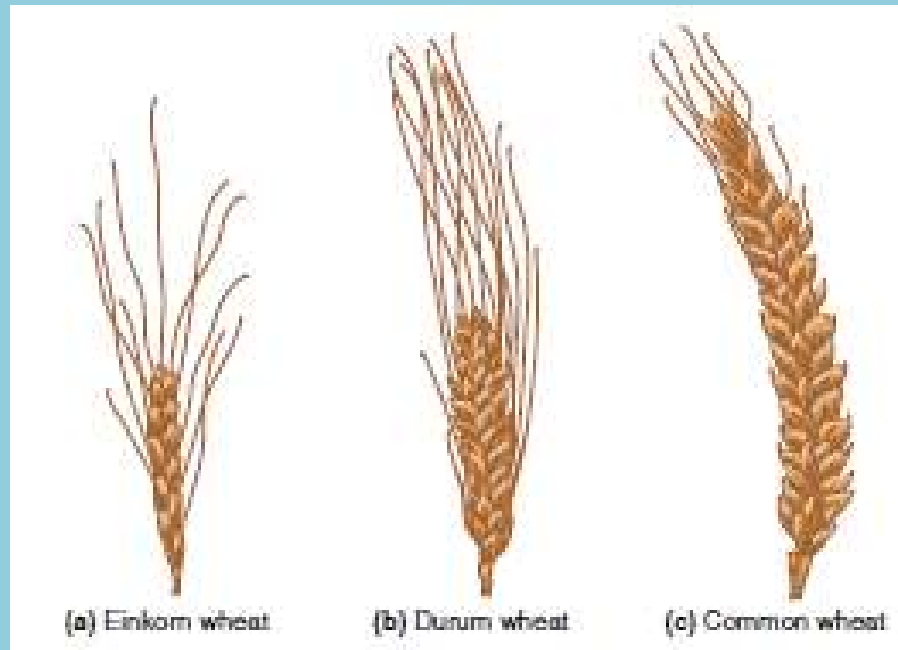
Mainland

40% black
10% brown
50% white

25% black
0% brown
75% white

Island

The founders of the new population
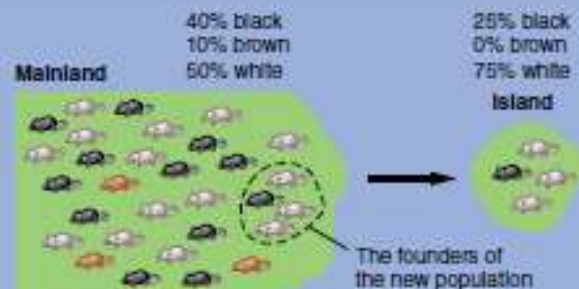
Speciation and extinction determine biodiversity

- Allopatric speciation- when new species are created by geographic or reproductive isolation.

FIGURE 5.14 Allopatric speciation of Darwin's finches. In the Galápagos Islands, allopatric speciation has led to a large variety of finch species, all descended from a single species that colonized the islands from the South American mainland.

- Sympatric speciation- the evolution of one species into two species in the absence of geographic isolation, usually through the process of polyploidy, an increase in the number of sets of chromosomes.

(a) Einkorn wheat   (b) Durum wheat   (c) Common wheat

The pace of evolution

(a) A slowly changing environment gives species more time to adapt to the changes.

(b) Less genetic variation means there is less chance for the species to adapt to changing conditions.

(c) If a beneficial mutation occurs, it can spread more rapidly in a small population than in a large population.

(d) Shorter generation times increase the chance that beneficial mutations will occur within a given amount of time and allow them to spread throughout a population faster.

Ability of a species to adapt to change

Evolution shapes ecological niches and determines species distributions

- Range of tolerance- all species have an optimal environment in which it performs well. The limit to the abiotic conditions they can tolerate is known as the range of tolerance.

- Fundamental niche- the ideal conditions for a species.
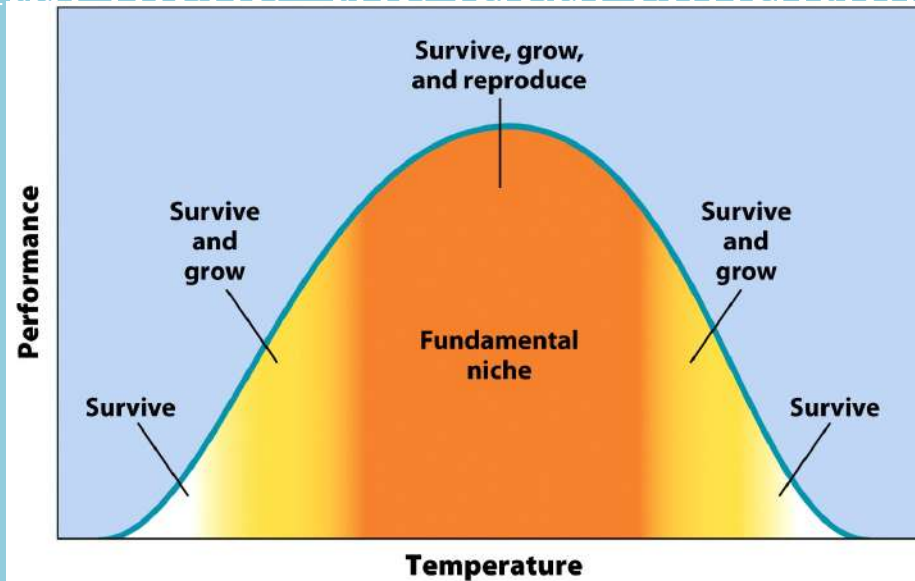
Figure 5.18
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Niches

- Realized niche- the range of abiotic and biotic conditions under which a species lives. This determines the species distribution, or areas of the world where it lives.

- Niche generalist- species that live under a wide range of conditions.Meadow Spittlebug: broad diet, wide habitat

- Niche specialist- species that live only in specific habitats. Skeletonized Leaf Beetle, Narrow diet, specific habitat

The Fossil Record

- Fossils- remains of organisms that have been preserved in rock. Much of what we know about evolution comes from the fossil record
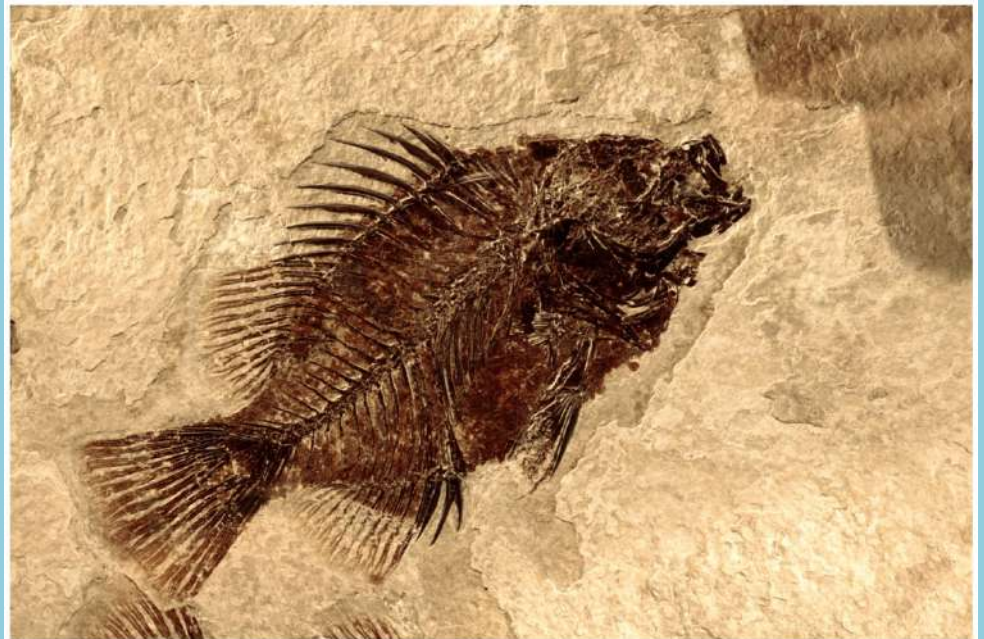
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The Five Global Mass Extinctions

- Mass extinction- when large numbers of species went extinct over a relatively short period of time.
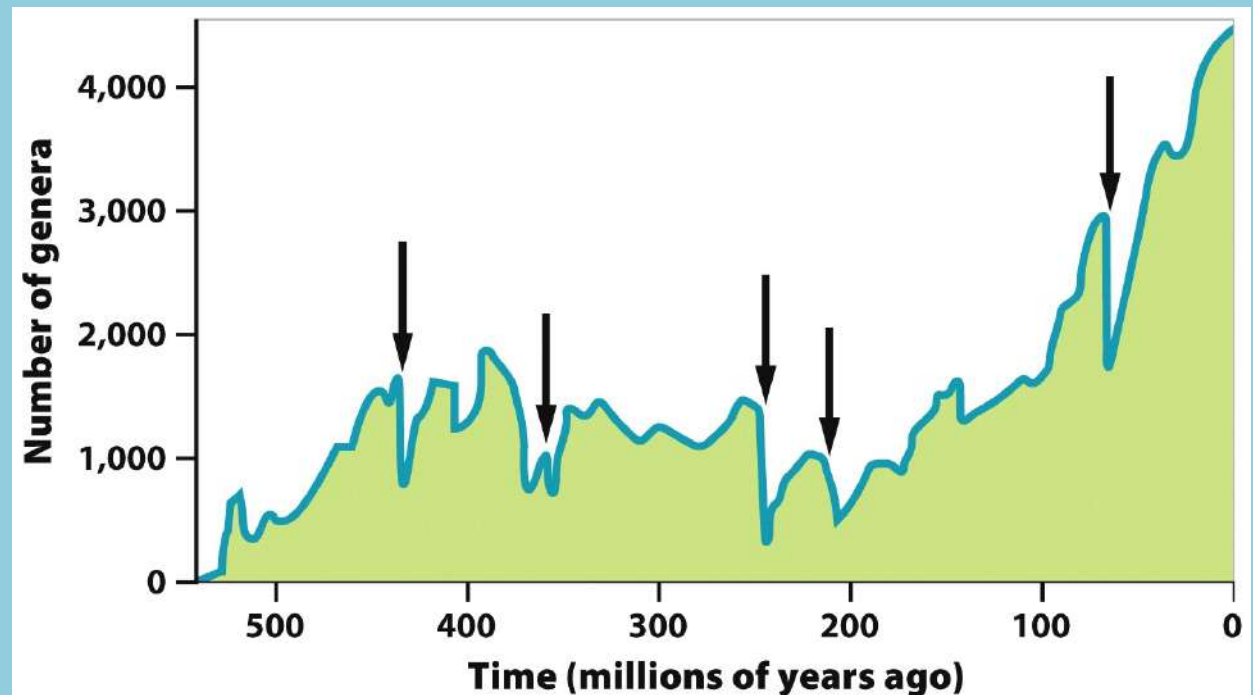

Figure 5.23
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The Sixth Mass Extinction

- Scientists feel that we are in our sixth mass extinction, occurring in the last two decades.
- Estimates of extinction rates vary widely, from 2 % to 25% by 2020.
- In contrast to previous mass extinctions, scientists agree that this one is caused by humans.

Evidence for feathers

Tyrannosaurus rex
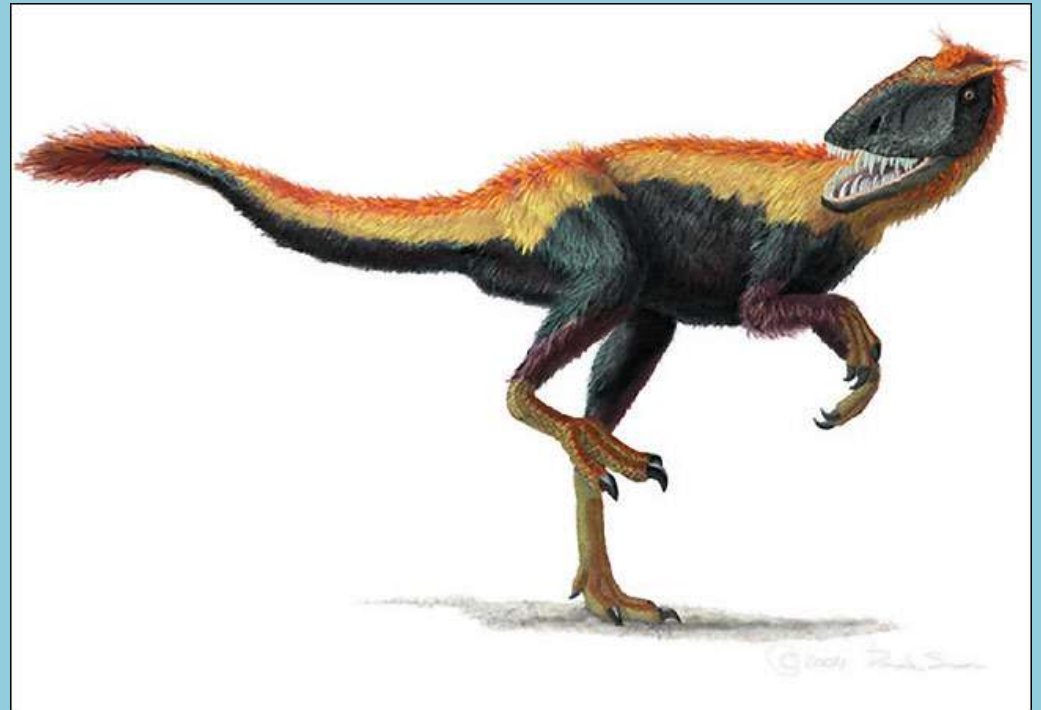
Dilong paradoxus

Geologic Time Scale Activity

- 8 groups
- Each group cuts a roll of receipt paper, 1 meter = 1 Billion Years
- It must be the length that the Earth is old.
- How long should it be?
- Mark each Billion years, each Era, each Significant Event: Prokaryotes, Eukaryotes, First Skeletonized fossils, Invertebrates, Vertebrates- (Fish, amphibian, reptile, bird, Mammals), Vascular Plants, Flowering Plants, Land animals, Land Mammals, Humans.
- Label the 5 Mass Extinctions
- Color and draw the events on your timeline.
- If the entire Geologic Time Scale were a Calendar year, When would humans appear?
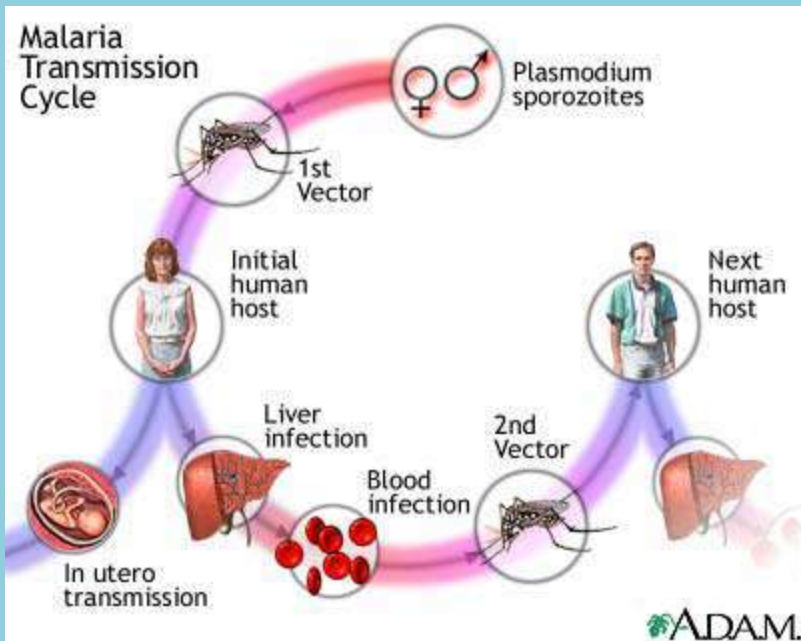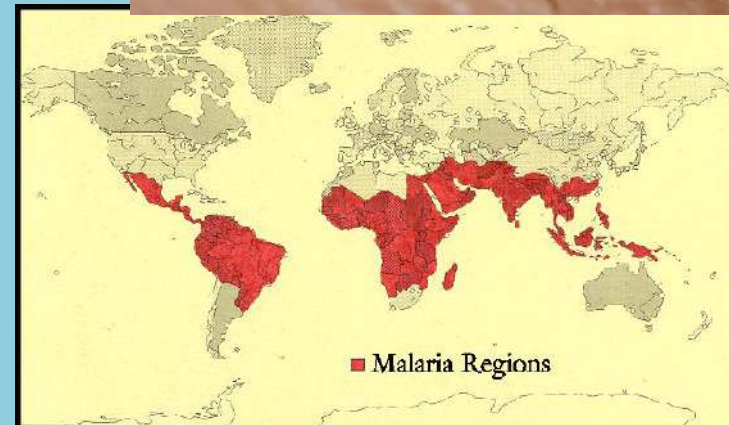
Charles Darwin Galapagos Islands

Variations can be advantageous

- The pocket mouse population lives in the desert

- Originally they were white, but a mutation turned them black.

- Pocket mouse video

Malaria

Malaria Transmission Cycle

Plasmodium sporozoites

1st Vector

Initial human host

Next human host

Liver infection

2nd Vector

Blood infection

In utero transmission

ADAM.

Malaria Regions

Stickleback Fossil Record

Salamander Evolution

Physiological adaptations can develop rapidly and show direct evidence for Evolution.

Non-resistant bacterium

Antibiotic

Resistant bacterium
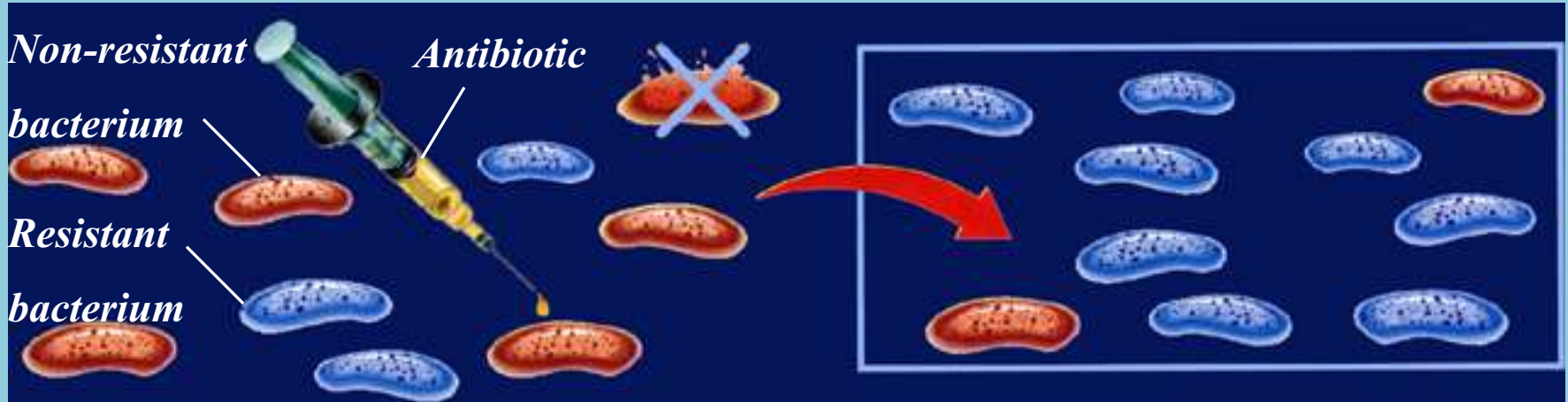
The bacteria in a population vary in their ability to resist antibiotics.

When the population is exposed to an antibiotic, only the resistant bacteria survive.

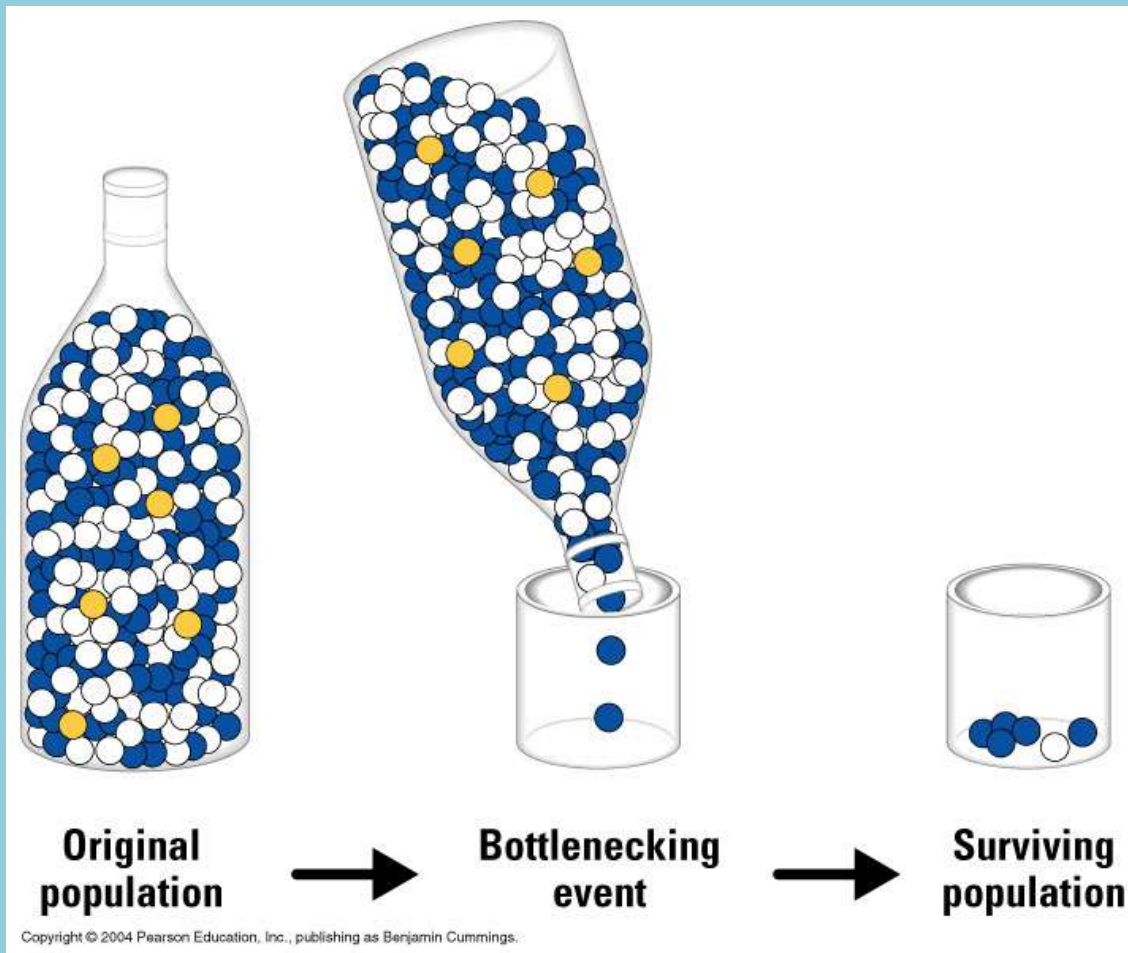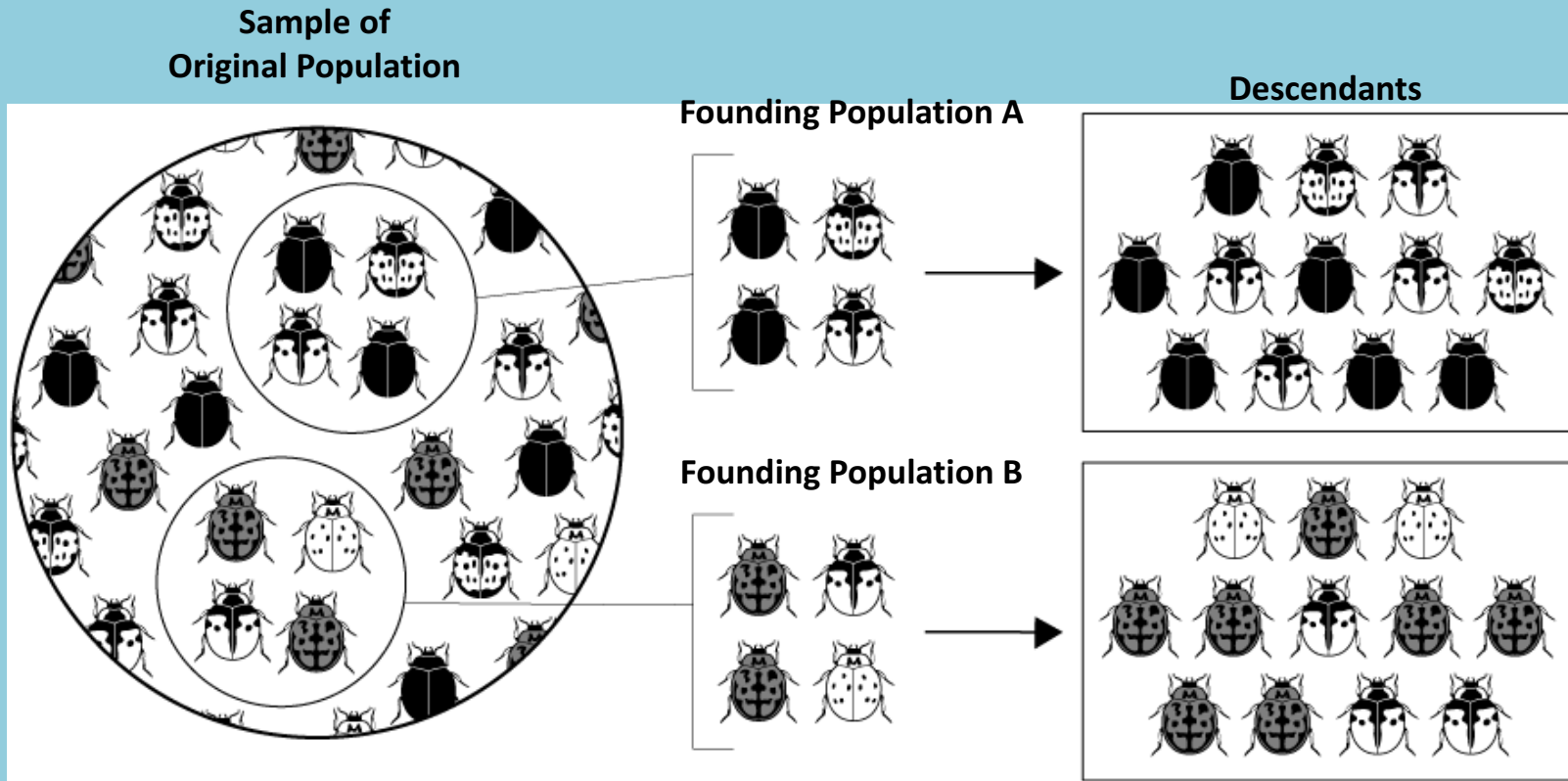**The resistant bacteria live and produce more resistant bacteria.**

Genetic Bottleneck

Original population → **Bottlenecking event** → **Surviving population**

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Figure 16-9: Founder Effect

Sample of
Original Population

Founding Population A

Founding Population B

Descendants

Allopatric Speciation