How Does Evolution Happen?

Charles Darwin

- Just graduated college, didn't know what he wanted to do with his life. His dad wanted him to become a doctor, but Darwin was really interested in plants and animals
- Observations on trip w/ *HMS Beagle* (5 year voyage) helped Darwin form his theory of how evolution happens
  - Collected thousands of plant & animal samples
  - Galápagos Islands

Darwin's Finches

Noticed many plants & animals on the Galápagos Islands were similar to plants & animals in Ecuador

Example: Finches (birds)

- Slightly different than those in Ecuador
- Beaks different depending on which island they are on
- Beak of each finch is adapted to the way the bird usually gets food.

The **large ground finch** has a wide, strong beak that it uses to crack open big, hard seeds. This beak works like a nutcracker.

The **cactus finch** has a tough beak that it uses for eating cactus parts and insects. This beak works like a pair of needle-nose pliers.

The **warbler finch** has a small, narrow beak that it uses to catch small insects. This beak works like a pair of tweezers.

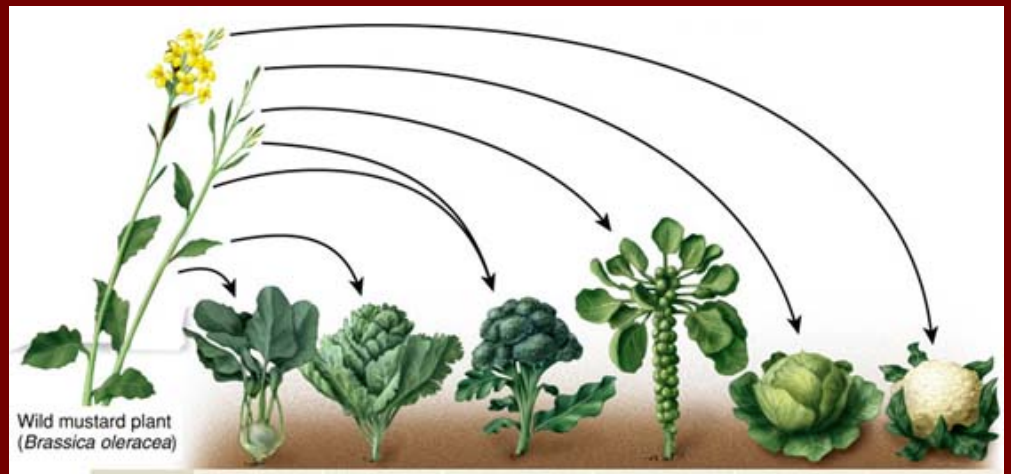
Theory of Natural Selection

- Darwin's book: *On the Origin of Species by Means of Natural Selection*
  - proposed the theory that evolution happens through *natural selection*
- **Natural Selection**: the process by which organisms that are better adapted to their environment survive and reproduce more successfully than those organisms that are less adapted to their environment

  -differential survival and reproduction of individuals due to differences in phenotype

Darwin learned from farmers and animal and plant breeders

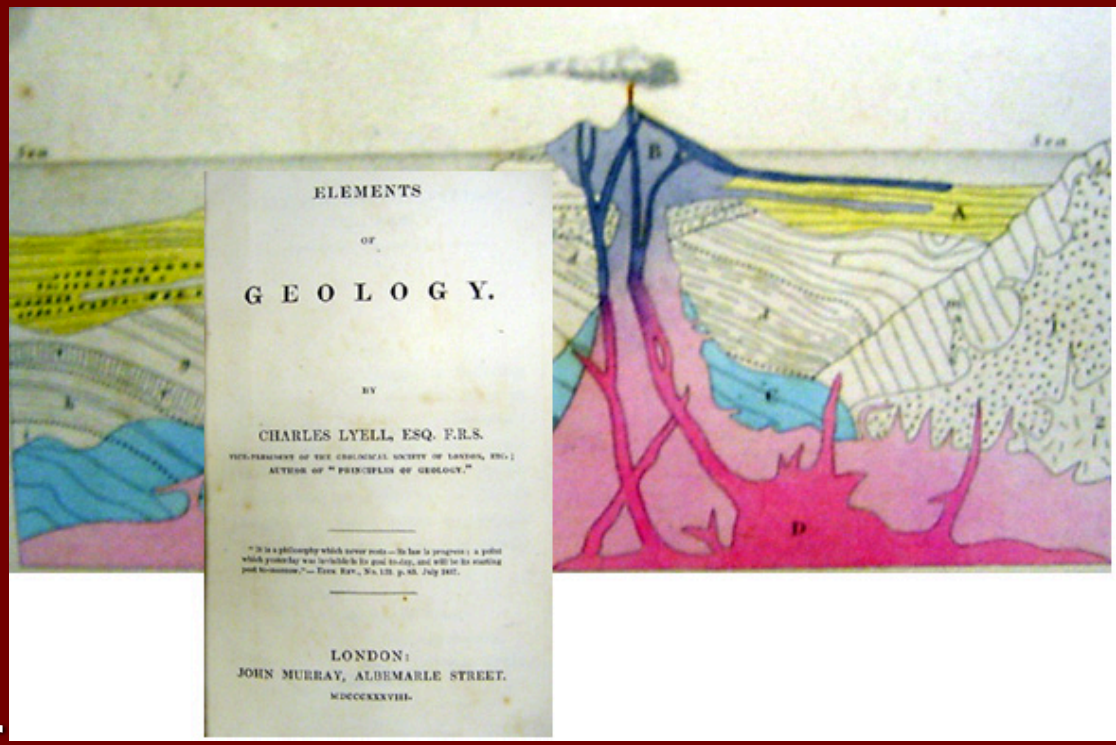
- In Darwin's time, many varieties of farm animal and plants had been selectively produced
- Darwin was impressed that farmers and breeders could direct and shape traits to make dramatic changes in animals and plants in a few short generations



Strain	Kohlrabi	Kale	Broccoli	Brussels sprouts	Cabbage	Cauliflower
Modified trait	Stem	Leaves	Flower buds and stem	Lateral leaf buds	Terminal leaf bud	Flower buds

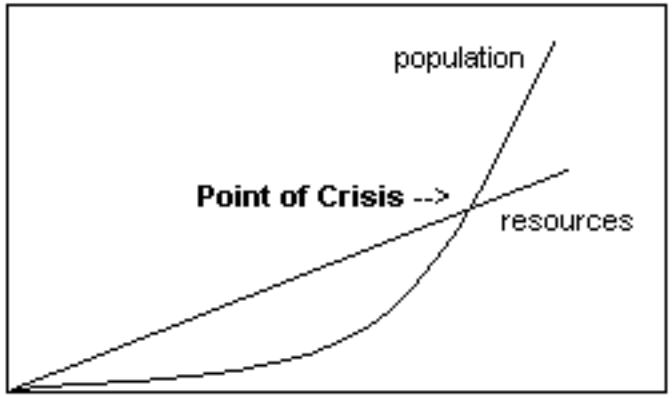
Darwin learned from geologists

- Geologists told Darwin that they had evidence that the Earth was much older than anyone had imagined.
- He learned from reading *Principles of Geology,* by Charles Lyell, that the Earth has been formed by natural processed over a long period of time



Thomas Malthus

- Darwin learned from the work of Thomas Malthus
- Malthus proposed that humans have the potential to reproduce beyond capacity of their food supplies
- Also, death caused by starvation, disease, and war affects the size of human populations

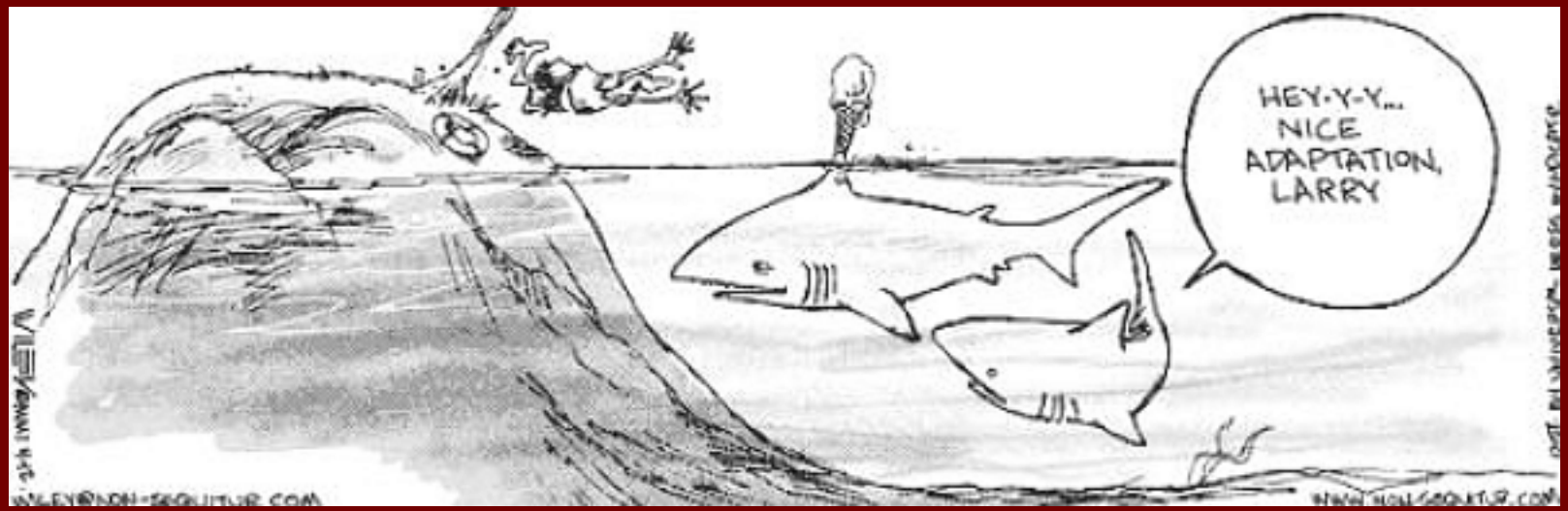


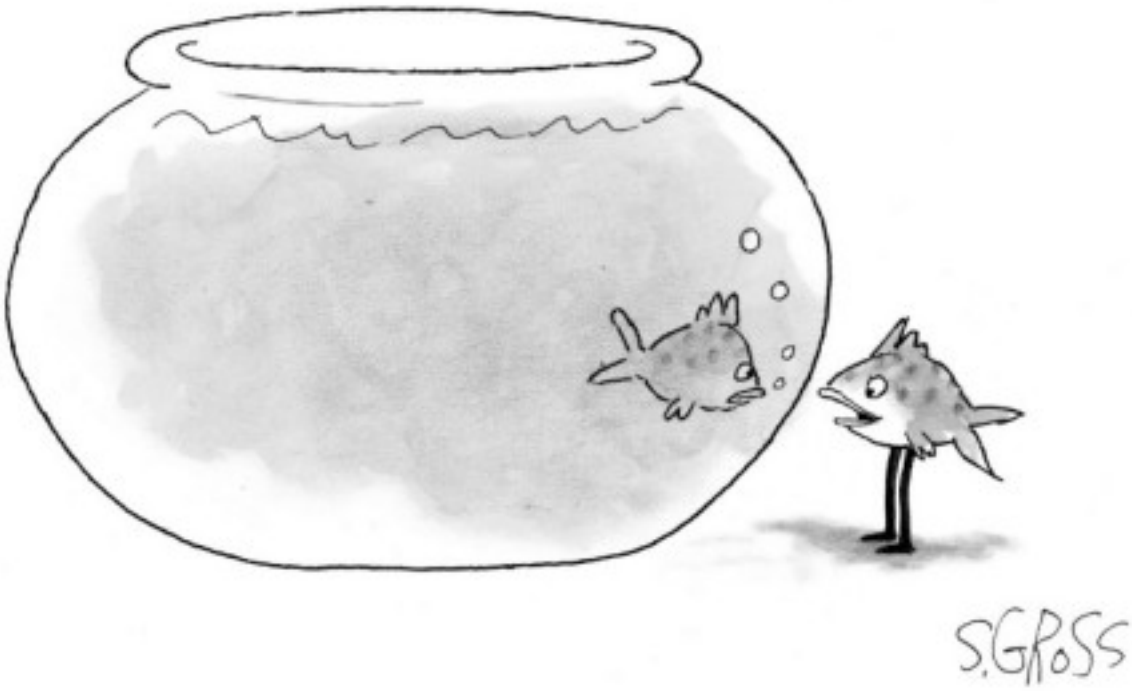
Malthus' Basic Theory

Darwin

- Darwin realized that other animal species are also capable of producing too many offspring
- For these animal species, starvation, disease, and predators affect the size of populations—Only a limited number survive to reproduce…WHY?

- Offspring of survivors inherit traits that help them survive in their environment





"In order to be free I had to make certain adjustments."

Populations

- Limited by:
  1. Starvation
  2. Disease
  3. Competition
  4. Predation
- Only a limited # of a species can survive to reproduce
- Offspring of the survivors inherit traits that help the offspring survive in their environment

1 Overproduction A tarantula's egg sac may hold 500–1,000 eggs. Some of the eggs will survive and develop into adult spiders. Some will not.

2 Inherited Variation Every individual has its own combination of traits. Each tarantula is similar to, but not identical to, its parents.

3 Struggle to Survive Some tarantulas may be caught by predators, such as this wasp. Other tarantulas may starve or get a disease. Only some of the tarantulas will survive to adulthood.

4 Successful Reproduction The tarantulas that are best adapted to their environment are likely to have many offspring that survive.

Darwin's Theory

1. Each species produces more offspring than will survive to reproduce.
2. Individuals within a population have slightly different traits.
3. Individuals within a population compete with each other for limited resources.
4. Individuals that are better equipped to live in an environment are more likely to survive to reproduce.