

Natural Selection and Evolution

TEKS

B.7C analyze and evaluate how natural selection produces change in populations, not individuals;

B.7D analyze and evaluate how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success;

B.7E analyze and evaluate the relationship of natural selection to adaptation and to the development of diversity in and among species

Prerequisite Questions

- How do mutations in DNA cause changes in proteins?
- How are proteins related to an organism's traits?

Essential Question

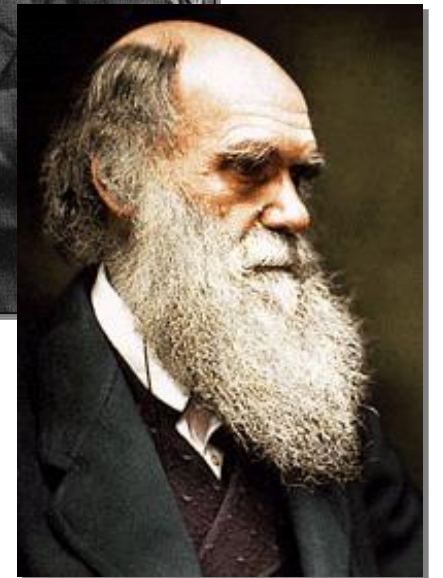
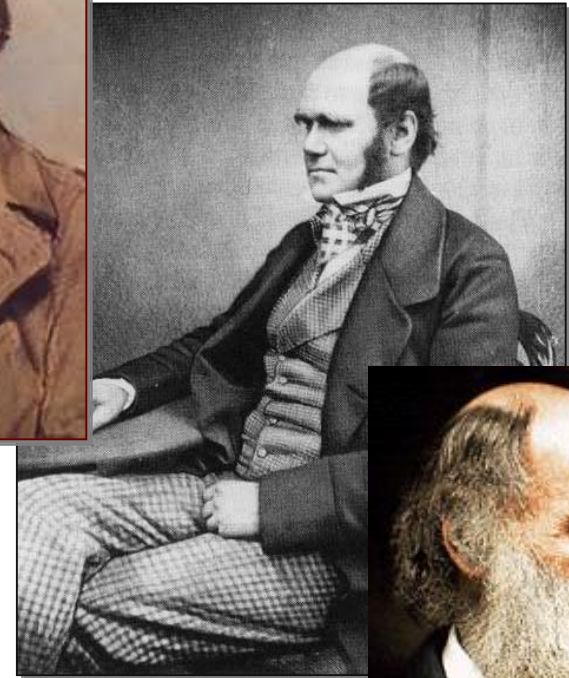
- How did Darwin's observations develop into the concept of how organisms evolve?

Vocabulary

- Naturalist
- Flora
- Fauna
- Mutation
- Trait
- Adaptation
- Species
- Natural Selection
- Decent with Modification
- Evolution
- Artificial Selection
- Convergent Evolution

The Journey of Charles Darwin

- British Naturalist, born in 1809 (died in 1882)
- Offered a job on the HMS Beagle to record local flora (plant) and fauna (animal) data in South America.
- Interested in how and why organisms were different around the world

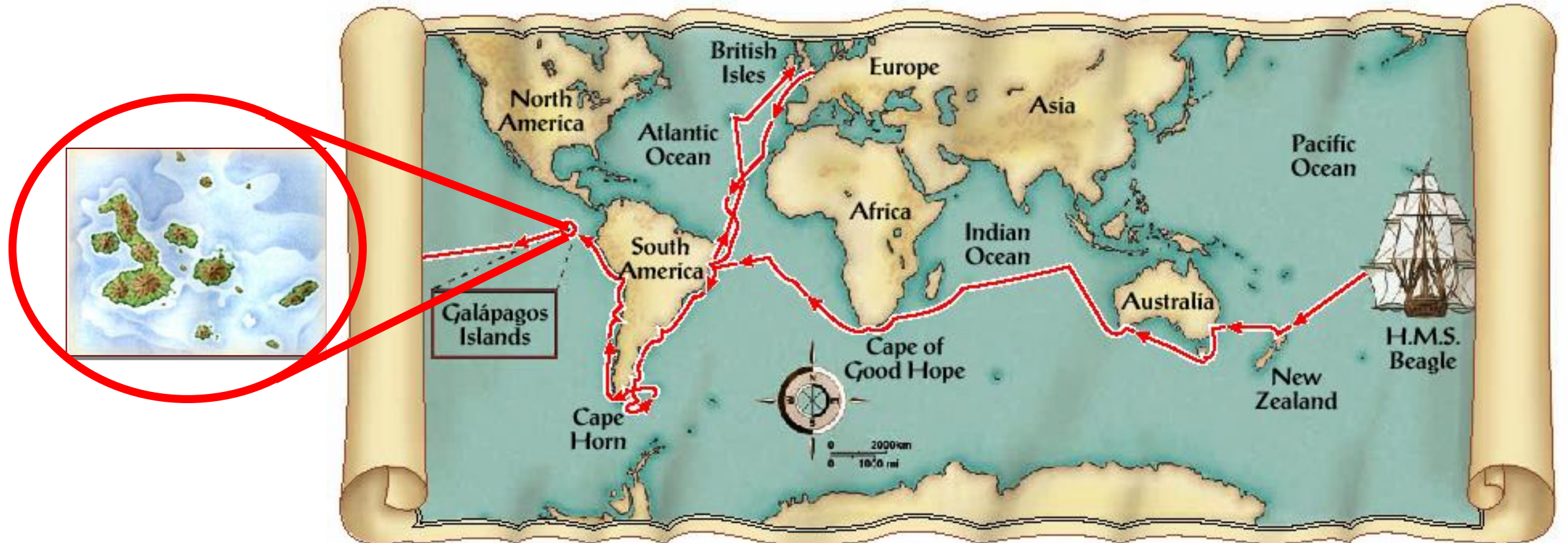


Voyage of the HMS Beagle

- Original trip was to last 1 year. Travel from England to the eastern coast of South America and back.
- Darwin was to use the time in port to explore the surrounding lands and collect specimens and record data.
- Trip ended up taking 5 years (1831 -1836) and going all the way around the world

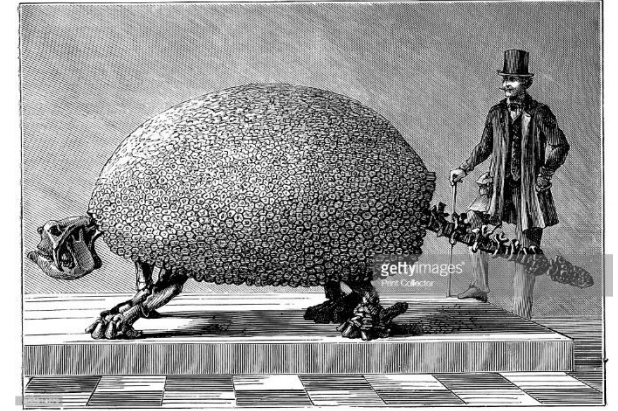
Voyage of the HMS Beagle

- On the western side of South America, Darwin visits the Galapagos Islands (500 miles off the coast of Ecuador)



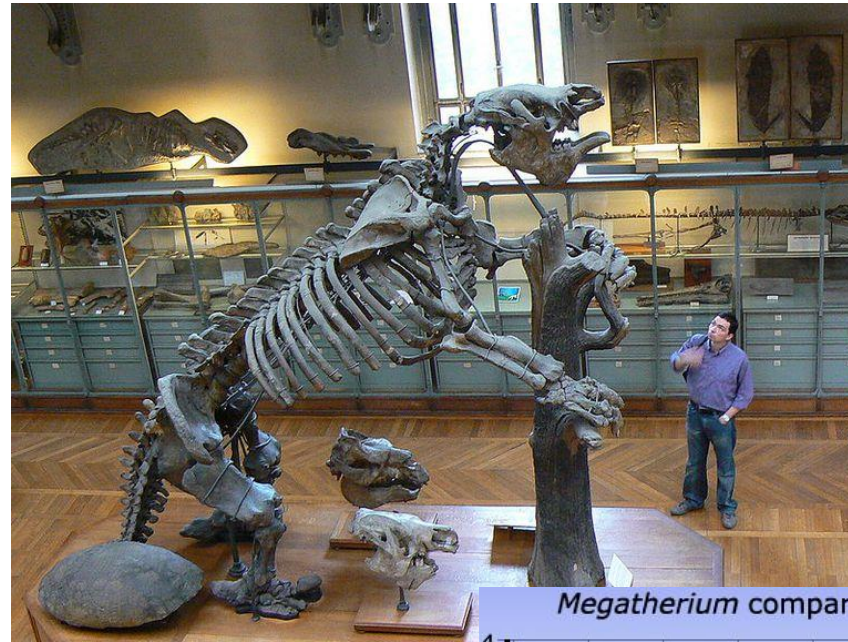
Fossil Evidence During the trip

- Darwin stopped at many natural history museums and examined the fossils.
- He wondered why giant armadillos no longer existed in South America.
- Or why Giant sloths did not roam the forests.

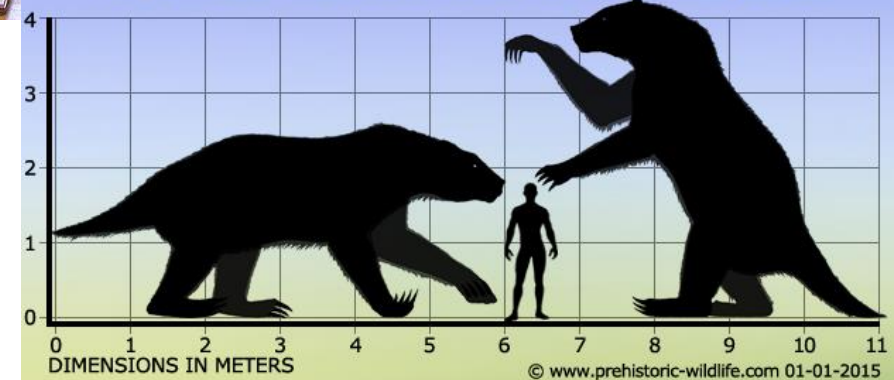


Giant Sloth fossil

- Giant Sloth, Megatherium



Megatherium compared with a 1.8 meter tall person.



- Modern day sloth



Galapagos Islands

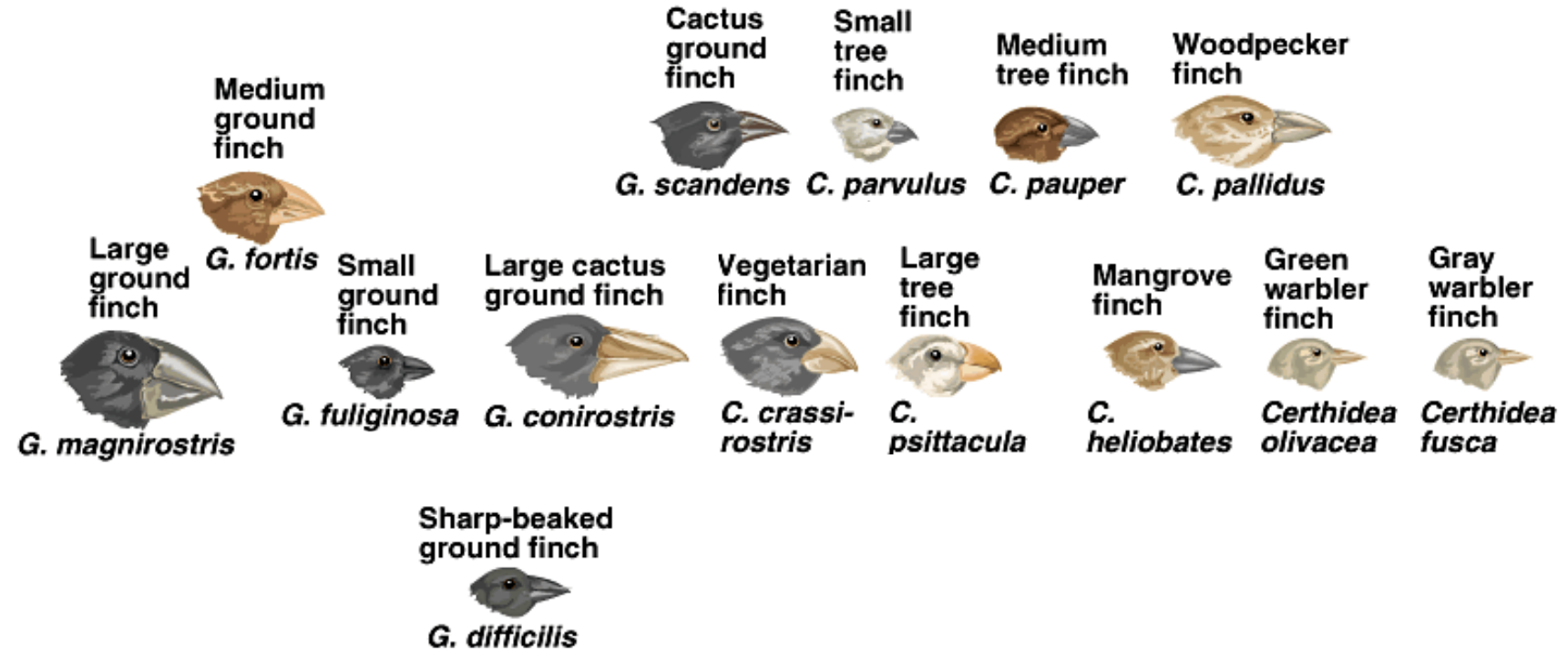
- The origin of the fauna (animals) of the Galapagos puzzled Darwin.
- The Galapagos Islands were 900km west of the South American coast
- Darwin noticed that animals species on the Galapagos existed nowhere else, but looked similar to living species on South American mainland.
- It appeared that animals and plants colonized the islands and then diversified on the different islands.

Animals of the Galapagos



Darwin's Finches

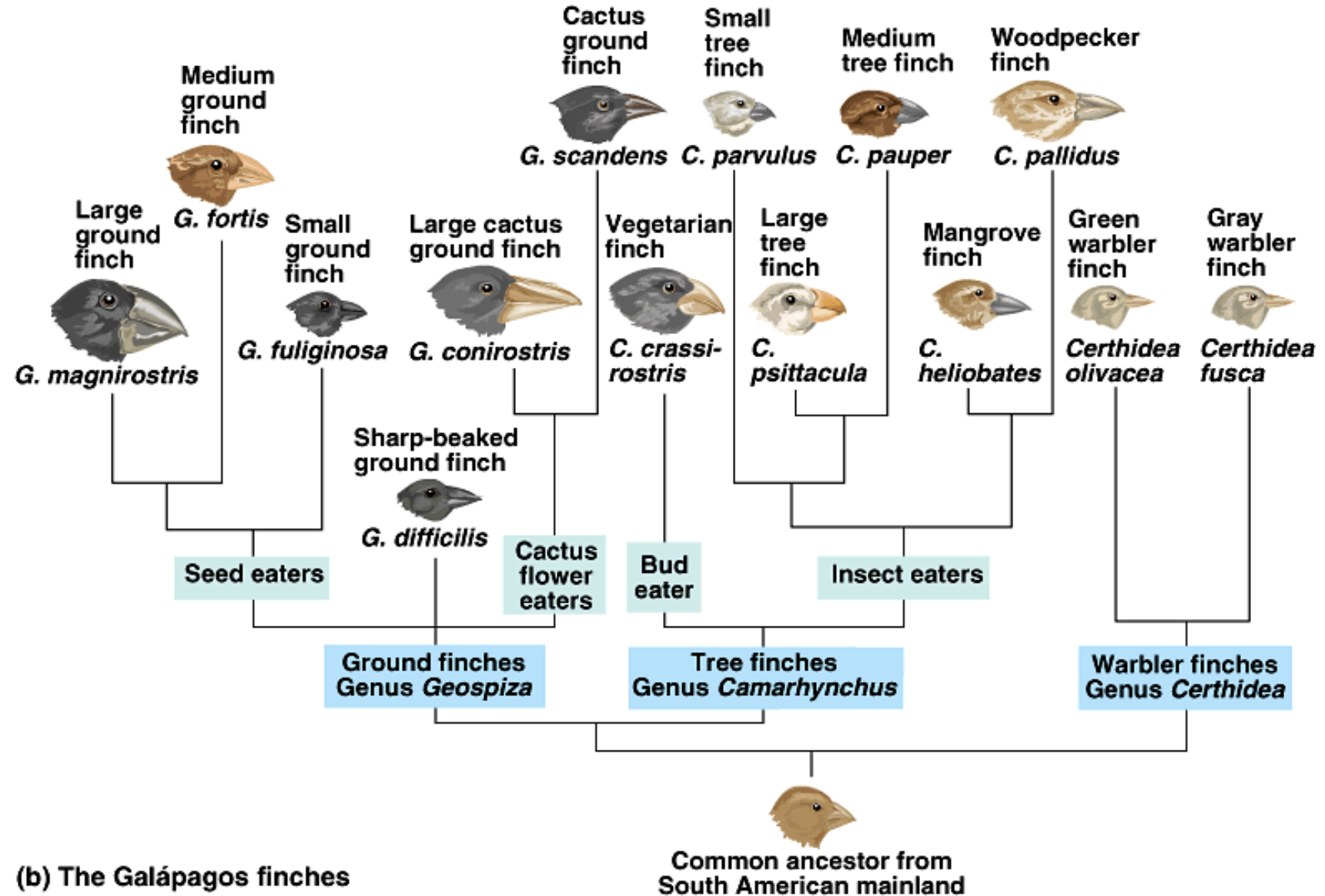
- Darwin found many “different” birds on the Galapagos



- He assumed they were all different kinds of birds...
- He sends samples back to England for study...

Darwin's Finches

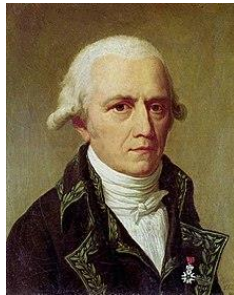
- Turned out, they were all finches from the same ancestor.



(b) The Galápagos finches

Other Ideas of Evolution

- Other naturalists also tried to define how organisms change.

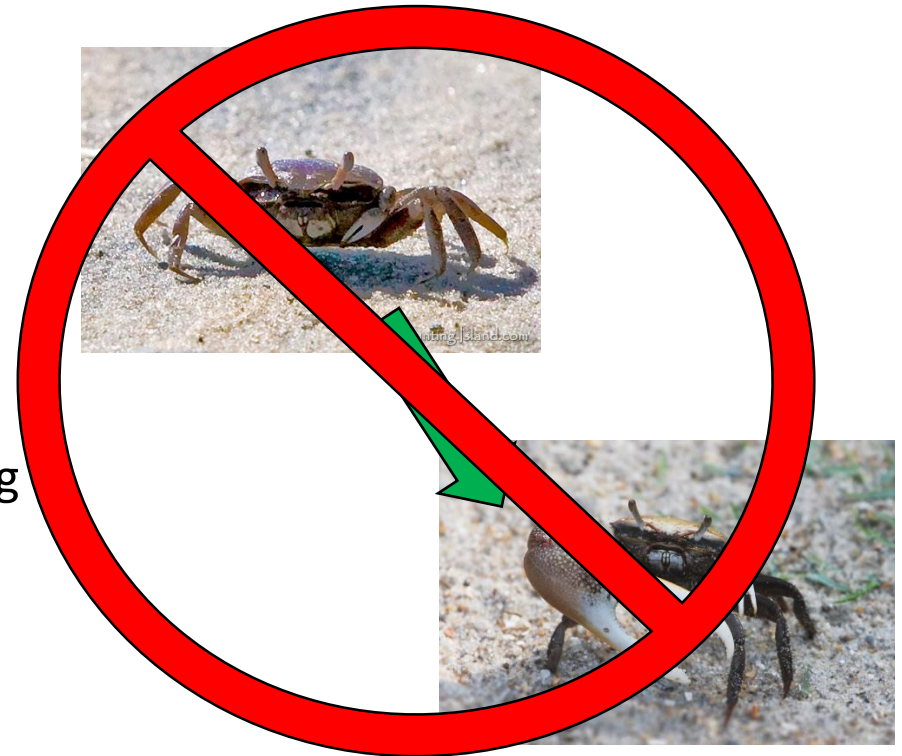


- John Baptiste LaMarck

- Idea of Evolution by Acquired Traits

- The more an adaptation is used, the more it changes
 - The organism can change during its lifetime
 - Parents can pass modified adaptations to their offspring

- Was **NOT** accepted as valid explanation



Darwin's Idea of Decent with Modification

- **Decent with Modification** means an organism's decedents are born different (modified) from the parents.
 - *Random mutations create variation in DNA and eventually proteins*
- **An organism's adaptations are there at birth**, and those traits can give it a better chance at surviving, and passing on those traits.



- A modern day giraffe has a long neck because of random mutations.
- The longer neck trait allowed those organisms to outcompete the shorter necked giraffes.

Natural Selection

1. Nature creates difficulties to survive. (Lack of resources and stresses)
2. This creates competition among organisms for food, water, mates, habitats, etc.
3. Each generation, more organisms are born than can be supported by their environment.
4. Organisms that have the best adaptations will outcompete others, allowing them to reproduce more. **The other organisms are less successful and die.**
YOU CAN'T PASS ON YOUR TRAITS IF YOU ARE DEAD!
5. Reproduction passes the genes for the best traits and new mutations onto the next generation.

Biological Fitness

- **Fitness** in biology means how well an organism's adaptations allow it to survive (*how well it "fits" the environment*)
- **Survival of the Fittest** = organisms with the "best" traits/adaptations survive to pass on their genes (codes for traits)



Great fitness
for here

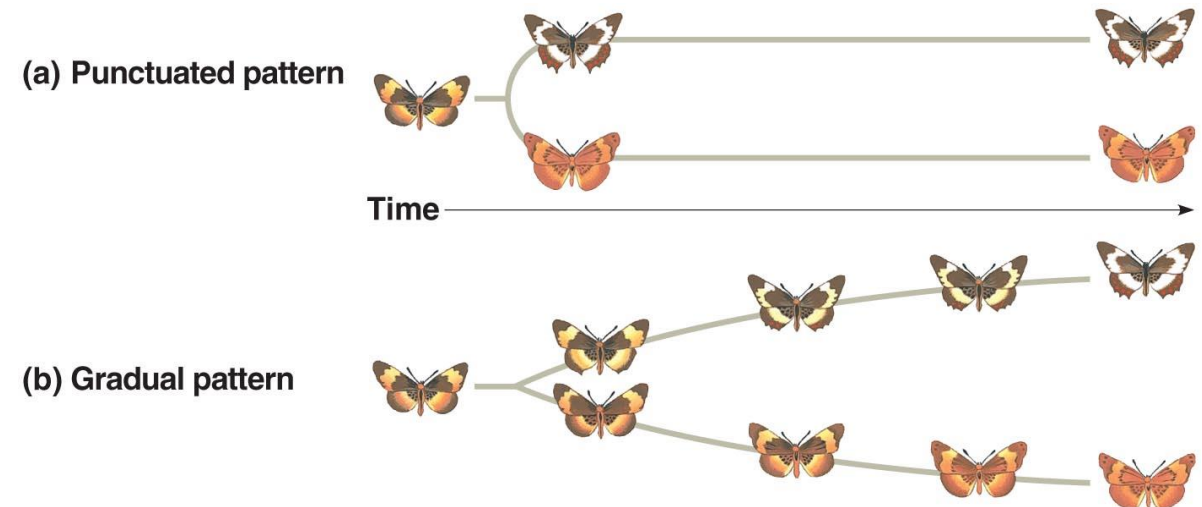


Poor fitness
for here



Speciation

- When new adaptations arise from random mutations, it is possible to create an organism that uses different resources.
- If this new **population** of organisms continues to mutate away from the ancestral population, then a new species can come into existence.
- This process of creating new species through mutations is called **Speciation**.



Darwin Concluded:

Each species has descended, with changes, from other species over time.

Darwin called this...

Descent With Modification

Today, we call it...

EVOLUTION

(change in a **population** over time)

Artificial Selection

- Humans have been using their influence to change the paths of evolution for the past 30,000+ years.
- When humans determine the best traits to be passed on, it is call **Artificial Selection**.
- All breeds of domesticated animals and plants can be tracked back to humans choosing the “best” offspring to survive.



Evidence of Evolution

Evolution is the change in a population over time (not individuals)

Forms of Evidence:

1. Fossil Record and Biogeography
2. Embryology
3. Homologous structures
4. Vestigial structures
5. Molecular sequences (DNA and protein amino acids)

All of the above show some **EVIDENCE** of **COMMON ANCESTRY**

What is NOT evidence of Common Ancestry...?

- **Convergent evolution** is when a useful trait appears in MANY different species lines but they **DO NOT** come from a common ancestor.

An example is the ability to fly.

- MANY animal lines have evolved the ability to fly but all of the wing structures point to different ancestors not a single flying ancestor.



Technically, these two glide,
but same concept →

