Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

James Hutton

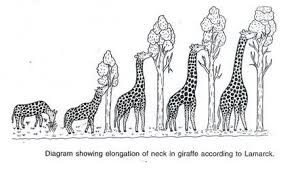
* In 1785, James Hutton proposed that the Earth was shaped by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that took place over extremely long periods of time
* These geological forces included earth being pushed up into mountain ranges, or pushed down; as well as the natural forces such as weather that act on rocks.
* He was one of the first to believe that the Earth was \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of years old, rather than thousands.

Charles Lyell

* Lyell stressed that scientists must explain \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ in terms of processes they can actually observe
* Processes that shaped the Earth millions of years earlier continue in the present
  + Volcanoes release hot lava and gases now, just as they did on ancient earth
  + Erosion still carves out canyons
* This understanding of geology influenced Darwin in 2 ways:
  + First, Darwin asked himself: If the Earth could change over time, might \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?
  + Second, he realized that it would have taken many, many years for life to change in the way he suggested.
    - * This would only have been possible if Earth were extremely old.

Jean Baptiste Lamarck

* Jean-Baptiste Lamarck was among the first scientists to recognize that living things changed over time – that all species were descended from other species.
* He also realized that organisms were somehow \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Lamarck proposed that by selective \_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_ of organs, organisms acquired or lost certain traits during their lifetime.

These traits could then be passed to their offspring. Over time, this process led to change in a species.

[A giraffe stretches its neck to reach leaves higher in the tree. The neck becomes progressively longer. Later, the giraffe has offspring with longer necks]

For example, Fiddler Crabs have a large claw…

* Lamarck believed that as the crabs used their claw to attract mates and ward off predators, the claw grew larger
* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is then passed to offspring
  + Note: This is incorrect!!
* “\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_” is what shaped the body.

[If I kept trying to use my arms for flying, I could develop wings]

* If I alter my structure (by body-building, for example), I can pass those acquired traits to my offspring.

If Lamarckian theory is so ridiculous and confusing to students, why do we study it???

* Lamarck was mistaken about many things, but he was one of the first to develop a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and to realize that organisms are adapted to their environments.
* *“If I have seen further than others, it is by standing on the shoulders of giants.”* –Isaac Newton

Thomas Malthus

In 1798, economist Thomas Malthus published a book that noted that people were being born faster than they were dying.

* If population continued to grow unchecked, sooner or later, there would be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ food and living space for everyone.
* The only forces working against this growth were \_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 natural checks on population!

When Darwin read Malthus’s work, he realized that his reasoning applied even more strongly to \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than it did to humans!

* A single maple tree can produce thousands of seeds in a single summer and a single oyster can produce millions of eggs each year…

If all of the offspring of any species survived for several generations, they would overrun the world.

* The overwhelming majority of a species’ offspring die.

Further, only a few of those offspring that survive \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

* What causes the death of so many individuals? What factors determine which ones \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and which do not?

Answers to these questions became central to Darwin’s explanation of evolutionary change.