**Evolution Notes**

**BIG IDEA**: Evolution by natural selection provides an explanation for the diversity and survival of living things.

**Content Elaborations:**

* **Organisms have evolved over time:** change in traits of population over time
* **Survival needs:** all organisms need space, food, water, and access to resources in order to survive
* **Natural selection:** the natural process by which certain traits have a greater fitness for their environment lead to a reproductive advantage; this process happens within a population over time because of genetic variation

**Essential Questions:**

· What do organisms need to survive?

· Why do living things change over time?

· How do adaptations assist survival?

· How do adaptations, isolation, and natural selection, lead to increased biodiversity?

· How does natural selection result in evolution of a species?

**Unit Understandings:**

· Organisms’ basic needs to survive and reproduce drive selection for adaptations.

· Natural selection acts on genetic variations within a species; the traits and adaptations that help an organism be the most successful in a particular environment will be selected for.

· Continuous selection of certain traits over an extended period of time leads to the evolution of a population coupled with isolation, resulting in speciation. This explains the diversity of life on Earth.

**Key Points:**

* All organisms on earth have descended from a common ancestor.
* Evolution is the process by which modern organisms have descended from ancient ancestors.
* Evolution is responsible for both the remarkable similarities we see across all life and the amazing diversity of that life

**Natural selection is a primary mechanism leading to change over time in organisms:**

For natural selection to occur **4 conditions must be met**:

1. Traits in a population of organisms exhibit variation
2. In any given population not all individuals survive to reproduce
3. Survivors must have an advantage over those that don’t survive a favourable trait gives the organism and adaptive advantage
4. The survivor’s advantageous traits must be heritable

**Variation + Differential Reproduction + Heredity = Natural Selection**

**There are four essential components of natural selection:**

1. **Variation**: All life forms vary genetically within a population.
2. **Inheritance**: Genetic traits are inherited from parents and are passed on to offspring.
3. **Selection**: Organisms with traits that are favorable to their survival and reproduction are more likely to pass on their genes to the next generation.
4. **Time**: Evolutionary change can happen in a few generations, but major change, such as speciation, often takes many thousands of generations.

**A good understanding of evolution requires comprehension of three main concepts:**

**1)    Variation is the fuel of evolution**

* Organisms within a species are similar but not identical.
* Offspring are similar but not identical to their parents. The similarity occurs because most characteristics are genetically inherited from parents.
* Natural populations contain useful variation within them.
* Some characteristics can be new, and arrive through mutations (which are always occurring by chance). Mutations can be positive, negative or neutral. In other words, they can improve, reduce or have no effect on an organism’s fitness (survival and reproduction).

**2)    Adaptation is key to surviving**

* The adjustment or changes in behavior, physiology, and structure of an organism to become more suited to an environment.
* An adaptation is a characteristic that has become common in a population because it provides improved success under the given environmental conditions.
* According to Charles Darwin's theory of evolution by natural selection, organisms that possess heritable traits that enable them to better adapt to their environment compared with other members of their species will be more likely to survive, reproduce, and pass more of their genes on to the next generation.
* Variation within a population is important because it is the fuel for improvement, and can lead to increased success given a change in environment. The peppered moth is a good example of this. Originally light coloured moths flourished. However, once pollution darkened the trees, the number of dark moths increased as they had higher success than the lighter coloured moths, due to camouflage.
* Adaptations can be a behaviour and physical/structural.

**3)    Natural Selection causes organisms to adapt and evolve**

* Offspring that inherit a certain characteristic (which makes the organism more “fit”), are more likely to survive and reproduce in certain environments, than offspring that don’t.
* The favouring of a certain characteristic naturally by the environment is what is known as Natural selection.
* The “fit” characteristic that helps an organism to survive in a certain environment will be more common in the next generation than characteristics that are less “fit”.

**Evolution**

* Evolution usually happens very **slowly** over many generations.
* Evolution consists of changes in the heritable traits of a population of organisms as successive generations replace one another. It is populations of organisms that evolve, not individual organisms.
* Acquired traits, such as losing a limb in an accident, are not passed on to offspring, i.e. they are **not heritable**. They are therefore not the result of evolution and do not lead to changes in the population’s characteristics.
* The **rate of reproduction** also plays a significant role in evolution. A species which reproduces quickly will evolve quickly (insects) whilst a species which has very long generations will evolve slowly (elephant).