**Darwin’s Ideas Notes 2019**

**Concept: The Darwinian revolution challenged traditional views of a young Earth inhabited by unchanging species**

Darwin’s Finches:

Differences in beaks allowed some finches to……eat seeds, insects, blood, vegetation, pollen, flesh. Successful variations are passed onto offspring.

Historical context:

Other people’s ideas paved the path for Darwin’s thinking

Darwin published “On the Origin of Species by Means of Natural Selection”

LaMarck: Developed an early theory of evolution based on two principles:

Use and disuse is the idea that parts of the body that are used extensively become larger and stronger, while those that are not used deteriorate.

Inheritance of acquired characteristics assumes that characteristics acquired during an organism’s lifetime could be passed on to the next generation. Example: A weightlifter’s child could be born with a more muscular anatomy.

Importance: Lamarck recognized that species evolve and the match of organisms to their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ occurs through gradual evolutionary change. His explanatory mechanism, however, was flawed.

Binomial Nomenclature:

-Carolus Linnaeus (1707-1778) grouped similar species into increasingly general categories, reflecting what he considered the pattern of their creation.

-Developed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the branch of biology dedicated to the naming and classification of all forms of life.

-Developed binomial nomenclature, a two-part naming system that includes the organism’s genus and species

**Concept: Descent with modification by natural selection explains the adaptations of organisms and the unity and diversity of life**

Evidence of Evolution by Natural Selection:

Natural Selection explains how adaptations arise.

Adaptations are heritable characteristics that enhance organisms’ ability to survive and reproduce in specific environments. Example: Desert foxes have large ears, which radiate heat. Arctic foxes have small ears, which conserve body heat.

Darwin’s theory of natural selection involves these important points:

1. Individuals in a population vary in their traits, many of which are heritable.

2. A population can produce far more offspring than can survive. With more individuals than the environment can support, competition is inevitable.

3. Individuals with inherited traits that are better suited to the local environment are more likely to survive and reproduce than individuals less well-suited. This is sometimes phrased as “differential reproductive success.”

4. Evolution occurs as the unequal reproductive success of individuals ultimately leading to adaptations to their environment. Over time, natural selection can increase the match between organisms and their environment.

If an environment changes, or if individuals move to a new environment, natural selection may result in adaptation to these new conditions, sometimes giving rise to new species in the process.

Artificial Selection:

The process by which species are modified by humans. Example: Selective breeding for milk or meat production; development of dog breeds.

Individuals do NOT evolve! Populations evolve.

Sexual Selection:

The choosing of a mate by specific characteristics that may not be beneficial to the population. Example: Peacocks.

**Concept: Evolution is supported by an overwhelming amount of scientific evidence**

What are the lines of evidence that support Darwin’s ideas?

1. Direct Observations of Evolutionary Change

-Insect populations can rapidly become resistant to pesticides such as DDT.

-Evolution of drug-resistant viruses and antibiotic-resistant bacteria.

2. Fossil record: Fossils provide evidence for the theory of evolution.

-Fossils are remains or traces of organisms from the past. They are found in sedimentary rock. Paleontology is the study of fossils.

-Fossils show that evolutionary changes have occurred over time and the origin of major new groups of organisms.

-Darwin’s theory of evolution through natural selection explains the succession of forms in the fossil record. Transitional fossils have been found that link ancient organism to modern species, just as Darwin’s theory predicts.

3. Artificial selection: selective breeding

4. Anatomical evidence: Homologous structures/Analogous structures/Convergent evolution/vestigial organs

-Homology: Characteristics in related species can have an underlying similarity even though they have very different functions. Similarity resulting from common ancestry is known a homology.

-Homologous structures are anatomical signs of evolution. Examples: Forelimbs of mammals that are now used for a variety of purposes, such as flying in bats or swimming in whales, but were present and used in a common ancestor for walking.

-Convergent evolution explain why distantly related species can resemble one another. Convergent evolution has taken place when two organisms developed similarities as they adapted to similar environmental challenges-not because they evolved from a common ancestor. The likenesses that result from convergent evolution are considered analogous rather than homologous. Think of it like this: Similar problems have similar solutions. Here are some examples:

-The torpedo shapes of a penguin, dolphin, and shark are the solution to movement through an aqueous environment.

-Sugar gliders (marsupial mammals) and flying squirrels (eutherian mammals) occupy similar niches and their respective habitats.

5. Comparative hemoglobin structure/molecular relationships

-Embryonic homologies: Comparison of early stages of animal development reveals many anatomical homologies in embryos that are not visible in adult organisms. Examples: All vertebrate embryos have a post-anal tail and pharyngeal pouches.

-Vestigial organs are structure so marginal, if any, importance to the organism. They are remnants of structures that served important functions in the organisms’ ancestors. Example: Remnants of the pelvis and leg bones are found in some snakes.

-Molecular homologies are shared characteristics on the molecular level. Examples: all life-forms use the same genetic language of DNA and RNA. Amino acid sequences coding for hemoglobin in primate species shows great similarity, thus indicating a common ancestor.

6. Biogeography: The geographic distribution of species.

-Species in a discrete geographic area tend to be more closely related to each other than to species in distant geographic areas. Example: In South America, desert animals are more closely related to local animals in other habitats than they are to the desert animals of Asia. This reflects evolution, not creation.

-Continental drift and the break-up of Pangaea can explain the similarity of species on continents that are distant today.

-Endemic species are found at a certain geographic location and nowhere else. Example: Marine iguanas are endemic to the Galapagos.