Evolution, Evidence and Mechanisms

Primary TEKS Supported

Part I – Evidence of Evolution
7A – [Reporting Category 3] – analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental

7B – [Reporting Category 3] – analyze and evaluate scientific explanations concerning any data of sudden appearance, stasis, and sequential nature of groups in the fossil record

7G – [Reporting Category 3] – analyze and evaluate scientific explanations concerning the complexity of the cell

9D – [Reporting Category 1] – analyze and evaluate the evidence regarding formation of simple organic molecules and their organization into long complex molecules having information such as the DNA molecule for self-replicating life

12B – [Reporting Category 5] – compare variations and adaptations of organisms in different ecosystems

Part II - Mechanisms of Evolution
7C – [Reporting Category 3] – analyze and evaluate how natural selection produces change in populations, not individuals

7D – [Reporting Category 3] – 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

7E – [Reporting Category 3] – analyze and evaluate the relationship of natural selection to adaptation and to the development of diversity in and among species

7F – [Reporting Category 3] – analyze and evaluate the effects of other evolutionary mechanisms, including genetic drift, gene flow, mutation, and recombination
Evidence for Evolution: Evidence that supports the theory of evolution by looking at common ancestors

1. Fossil Records: records of lines of ancestry that are preserved through fossils locked in rock layers
   a. Gradualism – evidence of evolution would show gradual changes to the population as you examined the different layers of the fossil record.
   b. Punctuated equilibrium – Changes in the fossils of organisms would make a sudden appearance surrounded by periods of relative stability

2. Biogeography: species that live in the same area are closely related, but some ancestors are found living far apart; Pangaea → continents
   a. This is why fossils found in western Africa (near the Atlantic coast) show similarities to fossils found in the jungles of South America in Brazil

3. Anatomical Homologies: looking at structures vs. function
   a. Homologous Structures: structures that have evolved to have different functions = common ancestors
      i. Homologous structures often have similar characteristics in their bone structures
   b. Analogous Structures: structures have adapted to have similar functions, but they have different structures
4. Molecular/DNA Homologies: organisms that share common ancestors are related and can be proven by looking at DNA; similar DNA = common ancestor because you get your DNA from your parents

<table>
<thead>
<tr>
<th>Species</th>
<th>Sequence of Amino Acids in the Same Part of the Hemoglobin Molecules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>Lys-Glu-His-Iso</td>
</tr>
<tr>
<td>Horse</td>
<td>Arg-Lys-His-Lys</td>
</tr>
<tr>
<td>Gorilla</td>
<td>Lys-Glu-His-Lys</td>
</tr>
<tr>
<td>Chimpanzee</td>
<td>Lys-Glu-His-Iso</td>
</tr>
<tr>
<td>Zebra</td>
<td>Arg-Lys-His-Arg</td>
</tr>
</tbody>
</table>

5. Embryology: some organisms start developing in ways that are common = similar DNA that dictates how organisms develop = common ancestors

Mechanisms for Evolution: Explanation for diversity of organisms and how organisms change over time

1. Natural Selection
   a. Charles Darwin
   b. Survival of the Fittest
      i. The organisms with the best adaptations live to reproduce and pass on their DNA/Traits
      ii. Organisms without the best adaptations die, do not reproduce, their DNA/trait are lost
   c. Occurs in populations, not individuals
2. In order for Natural Selection to occur, the following must be true:
   a. Organisms must be able to inherit DNA/Traits from parents
   b. Finite Amount of Resource so organisms must compete in order to survive, otherwise, there’ll be enough food and shelter for all organisms to survive.
   c. Reproductive Success – organisms that die are replaced by new organisms (that are born)

3. Other Situations that may result in evolution
   a. Genetic Drift: A change in the gene pool (organisms that can reproduce) that causes the species to evolve change
     i. Bottleneck Effect: a disaster happens and part of the population dies resulting in genetic drift

        For example, an environmental disaster changes the appearance of an environment. Moths living on a tree are no longer camouflaged, except for those that blend in with the new color. Only those moths that survive are “let out of a bottle,” meaning that the new colors make up the new population.

     ii. Founder’s Effect: a small portion of the population leave the area and form a new gene pool

        For example, bacteria that are resistant to drugs are picked up after using the bathroom and placed on a new countertop where they grow. Everyone gets sick because the new drug-resistant bacteria grow and flourish in the new environment.

   b. Gene Flow (Migration): a change in the gene pool due to movement of organisms (migration). Birds and even people who move around spread their genes to new places.

   c. Mutation: changes in DNA can cause a change in the population traits; increases genetic variation/diversity