**Name**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**Block**\_\_\_\_\_\_\_

**Theory of Evolution Unit**

* **Evolution and Natural Selection**
* **Theories of the Origin of Life on Earth (Single Cell 4 Billion Years Old)**
* **Multicellular Life**
* **Anatomical and Molecular Evidence of Relationships**
* **Classification**

**Evolution and Natural Selection**

**Objectives**

Explain that the theory of evolution is a theory about how living things evolved from simple to more complex forms over time

Describe how organisms with beneficial traits are more likely to survive, reproduce and pass on their genetic information

Compare “artificial selection” and “natural selection”.

**Notes**

**Darwin and Natural Selection**

* The theory of evolution is a theory about how living things evolved from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ forms over time.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is known as “The Father of Evolution” because he proposed the idea of “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_” as a mechanism or way for species to evolve or change over time, supporting the idea that all life might have evolved from a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Natural Selection theprocess by which organisms that can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to changes in their environment are able to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**4 Principles of Natural Selection**

**1.Variation:**There must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ within a population that is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is difference within a population.

**2.Adaptation:** There must be a certain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that allows the organism to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ against its environment.

* An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a feature that allows an organism to better survive in its environment.

**3. Overproduction:** There must be an overproduction of offspring resulting in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4. Decent with Modification:** There must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of descendents with adaptations suited for their environments.

**Peppered Moth Illustration**

1. What was the variation in the moth population?

2. What was the adaptation in the moth population?

3. What resource was limited due to overcrowding?

4. How were the descendants modified?

5. Later, pollution was controlled. What do you think happened to the moth population then?

6. Predict what would have happened to peppered moths if the pollution was a worldwide problem?

**EdPuzzle Videos in Google Classroom**

Watch the following videos and answer questions as prompted:

* *What is Evolution?- by Stated Clearly*
* *What is Natural Selection?- by Stated Clearly*
* *Does the Theory of Evolution Really Matter? - by Stated Clearly*

**POGIL**

* Evolution and Selection

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lab \_\_\_\_
**Origin of Life and Evidence of Evolution**

**Objectives**
Understand there are various hypothesis about the origin of life

Explain the role cyanobacteria played in the origin of life on Earth

Understand the hypothesis of Endosymbiotic theory resulting in multicellular life

Understand the fossil record establishes there was life on earth in the form of bacteria approximately 4 billion years ago

Use anatomical and molecular evidence to establish evolutionary relationships among organisms.

**NOTES**

**From Inorganic to Organic**

How did something \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (organic) arise from something \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(inorganic)?

**Miller-Urey Experiment**

 Fill in the blanks:

**Meteorite Hypothesis**

 **In 1969 a meteorite crashed into Murchison, Australia. Scientists found the meteorite contained over 90 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, 19 of which have been found on Earth, remember all of life is made up of \_\_\_\_\_\_\_\_\_\_\_\_ amino acids. This resulted in the “Murchison Hypothesis” that life may have originated from amino acids in a meteorite.**

**Primordial Soup Hypothesis**

The Primordial Soup hypothesis suggests that life began in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as a result of the combination of chemicals from the atmosphere and some form of energy to make \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the building blocks of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which would then evolve into the first life on Earth.

**Deep-Sea Vent Hypothesis**
The deep-sea vent hypothesis suggests that life may have begun deep within the ocean where \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ spewed key hydrogen-rich molecules. Their rocky nooks could then have concentrated these molecules together and provided mineral catalysts for critical reactions.

**The Fossil Record**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are single-celled prokaryotes thought to be the first living organisms on Earth. The fossil record estimates they were in existence \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_years ago.

**Earth’s Atmosphere is Oxygenated**

These \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ may have formed Stromatolites and released \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ through \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ creating an atmosphere in which life could survive.

## From Single Celled to Multicellular

## How did a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organism arise from a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organism?

## Endosymbiotic TheoryEndosymbiotic Theory suggests that eukaryotes were formed when prokaryotes were \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (or swallowed up) by larger prokaryotes and somehow survived instead of being digested. Some scientists believe that chloroplasts and mitochondria were formerly prokaryotes. This theory is based on several factors. Unlike other organelles, chloroplasts and mitochondria have their own DNA and ribosomes. They can make copies of themselves, they are about the same size as prokaryotes, and they have circular DNA similar to that of bacteria.

**Homologous Structures**

Homologous structures have the same bones suggesting \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_common ancestors.

**Analogous Structures and Convergent Evolution**

Analogous structures have different bones but perform the same function. This suggests \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a process whereby organisms that are not closely related independently evolve \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as a result of having to \_\_\_\_\_\_\_\_\_\_\_\_\_to similar environments.

**Vestigial Structures**

Remnants of an organ, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that had a function in an earlier ancestor. Examples: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Embryology**

Similarities in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ development suggest common ancestry

**Molecular Biology**

Study of living things at the molecular level such as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, RNA and proteins.

This is useful in determining how closely related ancestors may be.

**Molecular Evidence**

**Background information:** DNA is transcribed into RNA. RNA codes for amino acids that build proteins.

**Amino Acid Sequencing**

This is a chart of amino acid sequences for eight mammals. Each letter stands for a different amino acid. The numbers at the top of the chart indicate where each amino acid is located on the protein chain.

*Instructions: Compare the amino acid sequences between seven animals and the human. Circle any amino acid that is different than that of a human. Record the number of differences in the data table:*

|  |
| --- |
| **Data Table** |
| **Mammal** | **Number of Differences Amino Acid Sequence** |
| Bear |  |
| Chimpanzee |  |
| Gibbon |  |
| Gorilla |  |
| Monkey |  |
| Mouse |  |
| Shrew |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Location | 4 | 5 | 6 | 9 | 10 | 12 | 13 | 20 | 25 | 33 | 41 | 43 | 50 | 51 | 52 |
| Human | T | P | E | S | A | T | A | V | G | V | F | E | T | P | D |
| Bear | T | G | E | S | L | T | G | V | G | V | F | D | S | A | D |
| Chimpanzee | T | P | E | S | A | T | A | V | G | V | F | E | T | P | D |
| Gibbon | T | P | E | S | A | T | A | V | G | V | F | E | T | P | D |
| Gorilla | T | P | E | S | A | T | A | V | G | V | F | E | T | P | D |
| Monkey | T | P | E | N | A | T | T | V | G | L | F | E | S | P | D |
| Mouse | T | D | A | A | A | S | C | S | G | V | Y | D | S | A | S |
| Shrew | S | G | E | A | C | T | G | E | A | V | F | D | S | A | S |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Location | 54 | 56 | 58 | 68 | 69 | 70 | 71 | 72 | 73 | 75 | 76 | 77 | 80 | 87 | 104 |
| Human | V | G | P | L | G | A | F | S | D | L | A | H | N | T | R |
| Bear | I | N | P | L | N | S | F | S | D | L | K | N | N | K | K |
| Chimpanzee | V | G | P | L | G | A | F | S | D | L | A | H | N | T | R |
| Gibbon | V | G | P | L | G | A | F | S | D | L | A | H | N | Q | R |
| Gorilla | V | G | P | L | G | A | F | S | D | L | A | H | N | T | K |
| Monkey | V | G | P | L | G | A | F | S | D | L | N | H | N | Q | K |
| Mouse | I | G | A | I | T | A | F | N | D | L | N | H | S | S | R |
| Shrew | V | G | P | L | H | S | L | G | E | V | A | N | N | K | R |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Location | 109 | 110 | 112 | 115 | 116 | 117 | 118 | 121 | 125 | 126 | 130 | 139 |
| Human | V | L | C | A | H | H | F | E | P | V | Y | N |
| Bear | V | L | C | A | H | H | F | E | Q | V | Y | N |
| Chimpanzee | V | L | C | A | H | H | F | E | P | V | Y | N |
| Gibbon | V | L | C | A | H | H | F | E | Q | V | Y | N |
| Gorilla | V | L | C | A | H | H | F | E | P | V | Y | N |
| Monkey | V | L | C | A | H | H | F | E | Q | V | Y | N |
| Mouse | M | I | I | G | H | H | L | D | A | A | F | T |
| Shrew | V | L | V | A | S | K | F | E | P | V | F | N |

**Questions**

Based on your data, which mammal is most closely related to humans?

Based on your data, which is most distant from humans?

**Ed Puzzle Videos in Google Classroom**

Watch the following videos and answer questions as prompted:

* *What is Chemical Evolution? by Stated Clearly*
* *What was that Miller Urey Experiment? by Stated Clearly*
* *How Does Genetic Information Evolve Part 1? by Stated Clearly*

**POGIL**

Complete the “Evidence for Evolution” POGIL

**Classification of Life**

**Three Domains**

Instructions:

* Label Domain Eukarya, Domain Archaea and Domain Bacteria
* Label the node that indicates where life’s most common ancestor is located
* Circle the kingdom that includes humans
* Label the Eukaryotic Domain (all have cells with membrane bound organelles & a nucleus)
* Label the Prokaryotic Domains (cells have no membrane bound organelles & free floating DNA)
* Using arrows, show the crossover of mitochondria and chloroplasts into kingdom Eukarya

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**Cladistics**



**Cladistics**

Cladistics is the processes of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_organisms based on common ancestry on a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

*Label the cladogram.*

**Clades**

Each species branches out to a new \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on the cladogram.

*Circle the clades on the cladogram.*

*How many clades are there?*

**Derived Characters**

Derived characters are \_\_\_\_\_\_\_\_\_\_\_\_\_ that differ in structure or function than traits found in ancestral line for a group of species.

*What derived character caused a branch in the cladogram that separates the lizard from the hamster?*

**Node**

Each place the branch splits is called a node. Nodes represent most common ancestors.

*Circle the node where a salmon and salamander share the most common ancestor.*

**Linnaean System of Classification**

Taxonomy

Taxon (plural = taxa)

Binomial Nomenclature

First part of the two part name is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What are the rules of writing the first part of the name?

Second part of the two part name is the:

What are the naming rules of writing the second part of the name?

