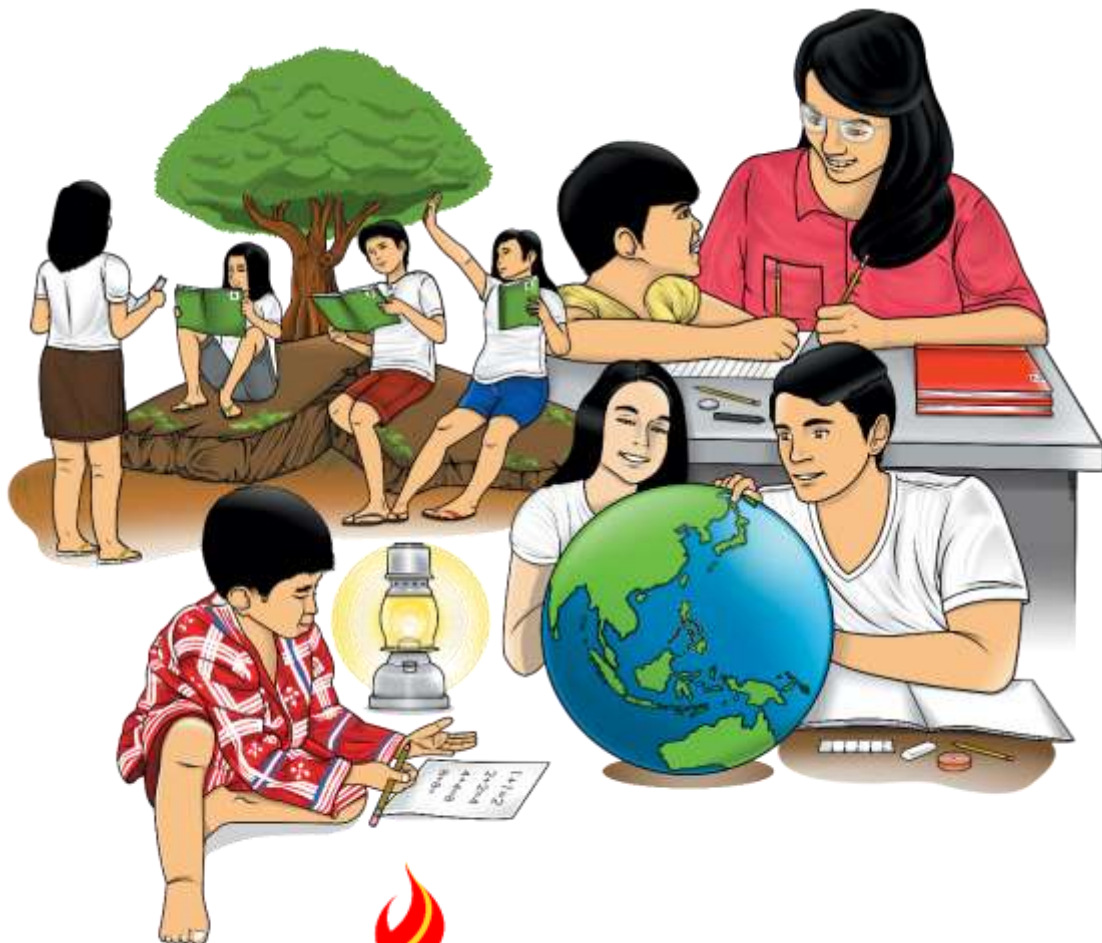


Science

Quarter 3 – Module 6: Evidence of Evolution



Science – Grade 10
Alternative Delivery Mode
Quarter 3 – Module 6: Evidence of Evolution
First Edition, 2020

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Science

**Quarter 3 – Module 6:
Evidence of Evolution**

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge of lessons in each SLM. This will tell you if you need to proceed with completing this module or if you need to ask your facilitator or your teacher's assistance for a better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



What I Need to Know

I Evolve, You Evolve, and They Evolve!

You may have met the term "evolve" in some popular comic series or video games and somehow developed an idea of what the word means. In this module, we will find out its meaning in biology and its role in tracing species' development.

Some organisms may look the same but have distinct differences from each other, others may not be related to each another, but they have similar functional features and characteristics. Some animals before are very different from the animals we have now.

This module will take you on a historic voyage that has changed our view of the history of life. Come and join in this exploration and discover what Charles Darwin and other scientists have written about how species evolve with time!

After going through this module, you should be able to:

1. Explain how fossil records, comparative anatomy, and genetic information provide evidence for evolution (**S1OLT-III-f-39**);
2. Compare homologous, analogous, and vestigial structures and analyze their significance in evolutionary history; and
3. Identify the effect of gene mutation on the evolution of the species.

*Before going on, check how much you know about this topic.
Answer the pretest on the next page in a separate sheet of paper*

Going through this module can be a meaningful learning experience. All you need to do is make use of your time and resources efficiently. To do this, here are some tips for you:

1. **Take the pre-test** before reading the rest of the module.
2. **Take time** to read and understand the lesson. Follow instructions carefully. Do all activities diligently. This module is designed for independent or self-paced study. It is better to be slow but sure than to hurry and miss the concepts you are supposed to learn.
3. Always **use a clean sheet of paper** for your answers in the activities or assessments. Don't forget to write your name and label them appropriately.
4. Try to **recall and connect the ideas** about the Earth that you had in the lower years. Use the concept discussed in the lesson to explain the results of activities or performance tasks. You may answer in English or a

combination of your vernacular and English.

5. **Be honest.** When doing the exercises, record what you have observed. Take the self-assessment after each activity, but do not turn to the Answer Key page unless you are done with the entire module.
6. **Don't hesitate to ask.** If you need to clarify something, approach or contact your teacher or any knowledgeable person to help you. You may also look into other references for further information. There is a list of references at the back part of this module.
7. **Take the post-test prepared at the end of the module to** assess how much you have learned from this module.
8. You can **check your answers** in the activities, self-assessments, and post-test after finishing the entire module to know how much you have gained from the lesson and the activities.

Before you study this module, let's check how much you know about this topic. An answer key is provided at the end of the module. But do not try to look at it while answering. You can check your answer after you are done with the pre-test.



What I Know

Multiple Choice. Write the **letter** of the best answer on your sheet of paper

1. Where can most fossils be found?
 - A. Black soil
 - B. Lava flows
 - C. Granite rock
 - D. Sedimentary rock
2. The following statements describe evolution EXCEPT
 - A. Evolution is continuous.
 - B. Evolution refers to change.
 - C. The world is stable and unchanging.
 - D. The mutation causes evolution only when it becomes heritable.
3. In what era are the oldest fossils located?
 - A. Mesozoic
 - B. Cenozoic
 - C. Paleozoic
 - D. Pre Cambrian

4. Which of the statements best describes the Theory of Natural Selection?
 - A. Acquired characteristics of parents can be passed on to offspring.
 - B. Organisms develop desirable structures to survive in a given environment.
 - C. Organs that are not used may disappear, while organs that are constantly utilized may develop.
 - D. In nature, the organisms with desirable characteristics may survive, while those with weaker traits may not.
5. Which idea best describes the theory of evolution?
 - A. Earth is relatively young.
 - B. Each organism is specially created
 - C. Species are related by common descent.
 - D. A mix of fossils in a region indicates that a local catastrophe occurred.
6. An adaptation promotes _____.
 - A. chance to survive
 - B. chance to reproduce
 - C. chance to survive and reproduce
 - D. None of the above
7. Vertebrate forelimbs are most likely to be studied in _____.
 - A. Ecology
 - B. Embryology
 - C. Biogeography
 - D. Comparative anatomy
8. All of these are true about fossils EXCEPT?
 - A. They indicate that life has a history.
 - B. They are pieces of evidence of life in the past.
 - C. The older the fossils, the less they resemble modern-day species.
 - D. They look precisely like modern-day species, regardless of their age.
9. Which is accurate about the description of homologous structures?
 - A. Structures are similar in origin and structure. They evolve to fit the animal's way of life.
 - B. Structure in different organisms that serve the same function. They show no evolutionary relationship between organisms.
 - C. Structure that functions and later on disappear
 - D. All of the above
10. Natural selection states that _____.
 - A. nature selects the variations within a species that are most useful for survival.
 - B. fitness is an organism's ability to survive and produce fertile offspring.
 - C. a change in a species occurs over time
 - D. all of the above
11. The criterion used to determine if an organism is a new species is based on _____.
 - A. time
 - B. geography
 - C. reproduction
 - D. physical traits

12. Which of the following statements does NOT describe Darwin's theory of natural selection?
- A. Members of a population will compete.
 - B. Populations tend to reproduce in small numbers.
 - C. Members of a population have heritable variations.
 - D. Some members of a population have adaptive traits.
13. Which of the following describes indirect pieces of evidence for evolution?
- A. It is observed or seen
 - B. It involves actual observations
 - C. It is something that does not involve actual observation of evolution but for which we can infer that change has taken place
 - D. None of the above.
14. The strongest evidence of evolution from a common ancestor is _____
- A. similar embryological structures.
 - B. similar DNA sequences.
 - C. similar body structures.
 - D. similar fossils.
15. What does it mean by direct evidence for evolution?
- A. It consists of observations of actual evolution
 - B. It does not involve direct observation of the evolution
 - C. It is something that is not observed or seen
 - D. None of the above.

*How did you find the pretest? What was your score? If you got 15 items correctly, you may skip the module. But if your score is 14 and below, you must proceed with the module.
Have fun learning!*

Lesson

1

Evidence of Evolution

Evolution is not just a matter of change over time. Many things evolve such trees lose their leaves, mountain ranges rise and erode, but they aren't examples of biological evolution since they don't involve through genetic inheritance.

The central idea of evolution is that life on Earth shares a mutual ancestor, as you and your cousin share a common grandparent.

Through the development with change, the common ancestor of life on Earth pave way to the fantastic diversity that we see documented in the fossil record and around us today. Evolution means that we're all distant cousins: humans and oak trees, hummingbirds and whales.



What's In

Activity 1 - What Am I

Fill up the missing letters to identify a term related to Origins of Evolution.

		Definition
1	MY _ _	Refers to ancient story or set of stories, especially explaining the early history of a group of people.
2	CRE_TIONI_M	Held the idea that all forms of life were evolved in their present form by a divine being, and they remain unchanged from the beginning.
3	FO_SI_S	Any preserved remains impression or trace of any once-living thing from a past geological age.
4	CATA_TRO_HISM	The doctrine that sudden catastrophes, rather than continuous change, cause the main features of the Earth's crust
5	UN_FORMI_ARIANISM	It is a geological theory that describes the processes shaping the Earth and the Universe. It states that changes in the Earth's crust throughout history have resulted from uniform, continuous functions that are still occurring today.

Activity 2

Match It Down: Match column A with the correct answer on column B, write only the letter of response on the blank provided in the test paper. You may choose an option in column B twice.

Column A

_____ 1. Georges Cuvier

_____ 2. James Hutton

_____ 3. Jean Baptiste de Lamarck

_____ 4. Charles Darwin

_____ 5. Charles Lyell

Column B

A. Theory of Acquired characteristics

B. Theory of Natural Selection

C. Theory of Catastrophism

D. Theory of Uniformitarianism



Notes to the Teacher

This module contains brief but substantial concepts of Evidence of Evolution. Enrichment activities and assessments for the learners are provided.

The teacher will assist and guide the learners while going through this module.

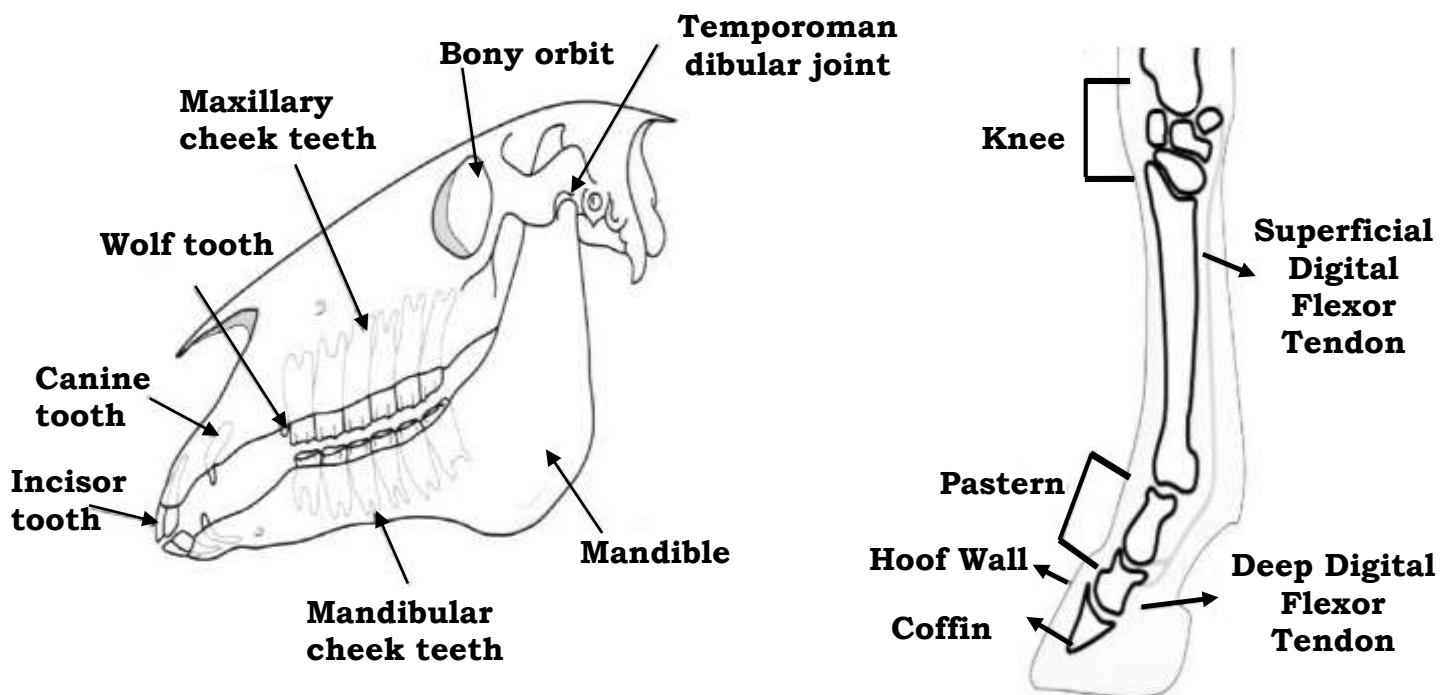


What's New

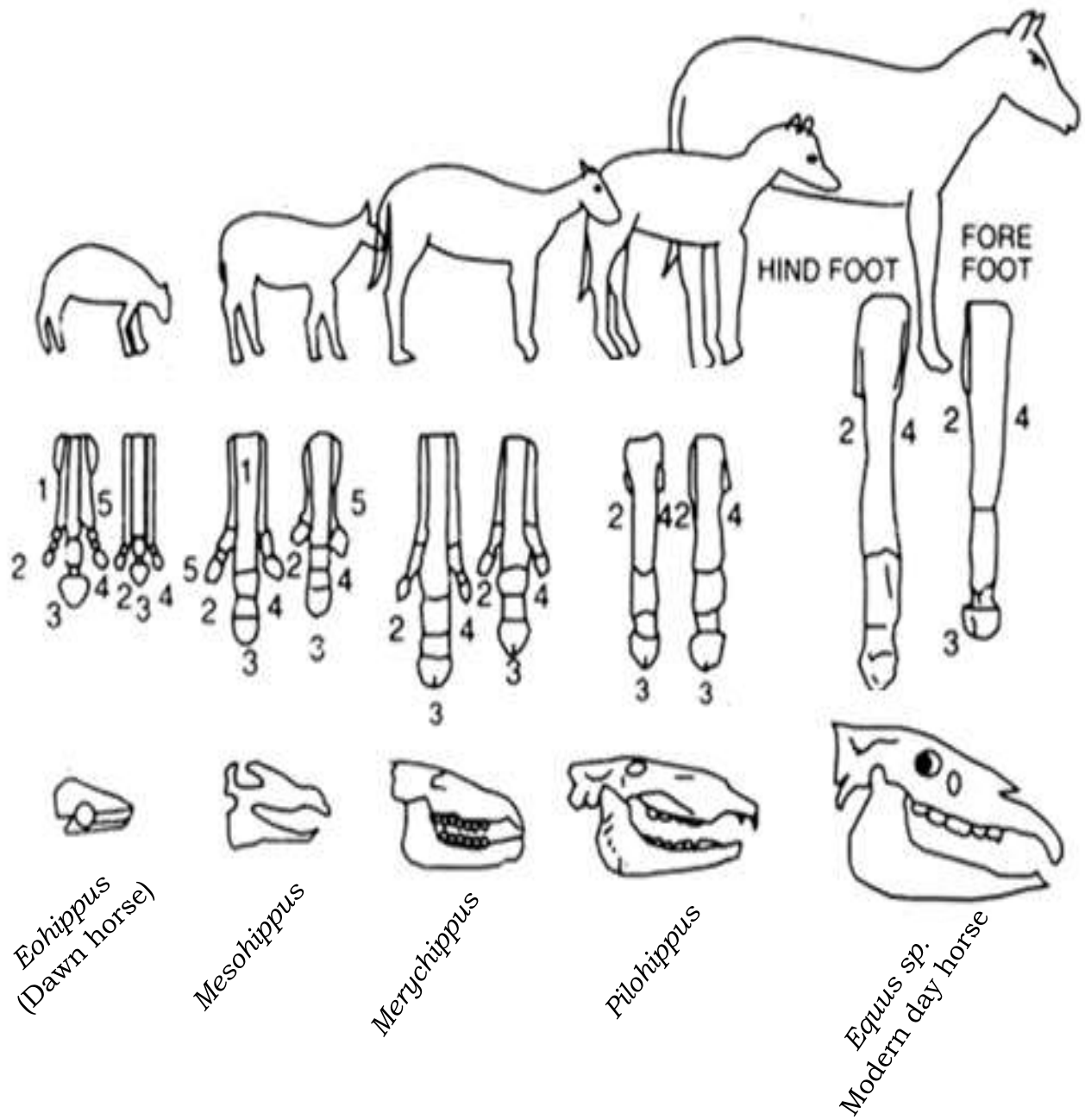
For you to understand the lesson well, do the following activities.
Have fun and good luck!

Activity 1 - I CAN SEE YOU!

- I. Material: Activity sheet
- II. Procedure: The figure below is a series of skulls and front leg fossils of organisms believed to be the modern-day horse's ancestors—answer the following Guide Questions based on the figure. Please be guided by the labeled figures below.



Lateral View of the Skull and Front leg of Horse
(Illustrated by Marcelo John V. Lagonoy)



Modern Day Horse Evolution
(Illustrated by Marcelo John V. Lagonoy)

III. Guide Questions:

1. Give atleast two resemblances between each of the skulls that might conclude that these are all related species.

2. What is the most significant change in skull anatomy from the dawn horse to the modern horse?

3. What is the most significant change in leg anatomy from the dawn horse to the modern horse?



What is It

Evidence of Evolution

Evolution is not a historical process; it occurs at this moment. Populations constantly adapt to variations in their environment and thereby gather changes in the genes that are existing to the species through its gene pool.

Charles Darwin proposed the idea that all new species descend from an ancestor. Thus, he performed an exhaustive amount of research to provide as much evidence as possible. Today, the significant evidence for this theory is the fossil record, embryology, comparative anatomy, and molecular biology.

Evidence to support the theory of evolution comes from different fields of science. However, pieces of evidence of evolution are divided into two groups: direct and indirect. Direct evidence can be directly observed or seen, such as fossil evidence. On the other hand, indirect evidence does not involve actual observation of evolution. We can conclude that evolution has taken place such of homologous, analogous, and vestigial structures, embryology, and biogeography.

Geological Time Scale and Evolution of Animals and Plants

Giovanni Avduina developed the first geological time scale. The oldness of the Earth is about 4600 million years. Life first initiated in water (3600 million years ago). The history of the Earth has been separated into several major divisions called eras. The modern periods are divided into epochs.

The origin of vertebrates took place in the Ordovician period in ostracoderms (jawless vertebrates related to cyclostomes). Ostracoderms were small, jawless bony fish-like forms. After the ostracoderms, acanthodians (the earliest known vertebrates with lower jaws) appeared in the Silurian period. Placoderms (the ancient gnathostomes- jawed vertebrates) also emerged in the Silurian period. Also, the origin of amphibians occurred in the Devonian period. Reptiles appeared in the Carboniferous period. The origin of dinosaurs and mammals took place in the Triassic period. Toothed birds (first birds) appeared in the Jurassic Period. Thus, fishes' origin took place first, with amphibians next, followed by reptiles, then mammals and birds.

Different kinds of algae were present in the Cambrian period. Marine algae were abundant in the Ordovician period. The origin of bryophytes took place before vascular plants' appearance (pteridophytes, gymnosperms, and angiosperms). The origin of vascular plants took place in the Silurian period. First gymnosperms appeared in the Devonian period. The origin of the first seed plants occurred in the Carboniferous period. Angiosperms appeared in the Cretaceous period. Angiosperms diversified in the Miocene, and their adaptive radiation occurred in the Pliocene.

PART 1: EVIDENCE OF FOSSIL

Fossils are the remnants of an creature from the primitive times. Most organisms do not fossilize, and geological processes usually destroy those that do, or they never surface for examination. Fossils are generally formed when an organism is covered by sediments that then harden into sandstone, slate, mudstone, or flint. Organisms also fossilize when buried in volcanic ash or entombed in tar or tree sap.

According to experts, fossil provides direct evidence for evolution because it can tell what has happened. By simply studying fossils occurring in different strata of rocks, geologists can reconstruct evolutionary change time and course. It can show that variation in time has happened. When fossils are set in the order of how old they are, we can directly compare their body structures. Through these, fossils' experts can confirm that species are not fixed but can evolve into other species over time.

Experts have difficulty interpreting fossil evidence because the fossil record is relatively incomplete since a small number of fossils are found. Moreover, the remains of organisms are preserved only in places where the condition is favorable.

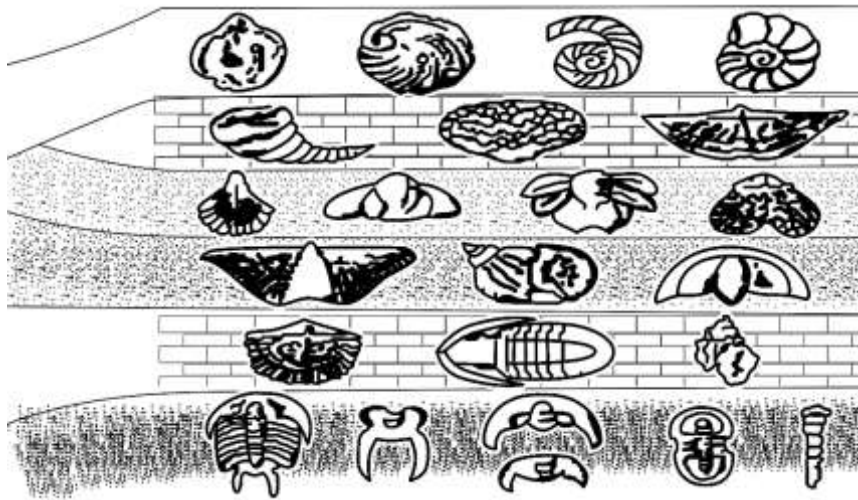


Figure 2 Fossil Identification Based on their Method of Formation
(Illustrated by: Marcelo John V. Lagonoy)

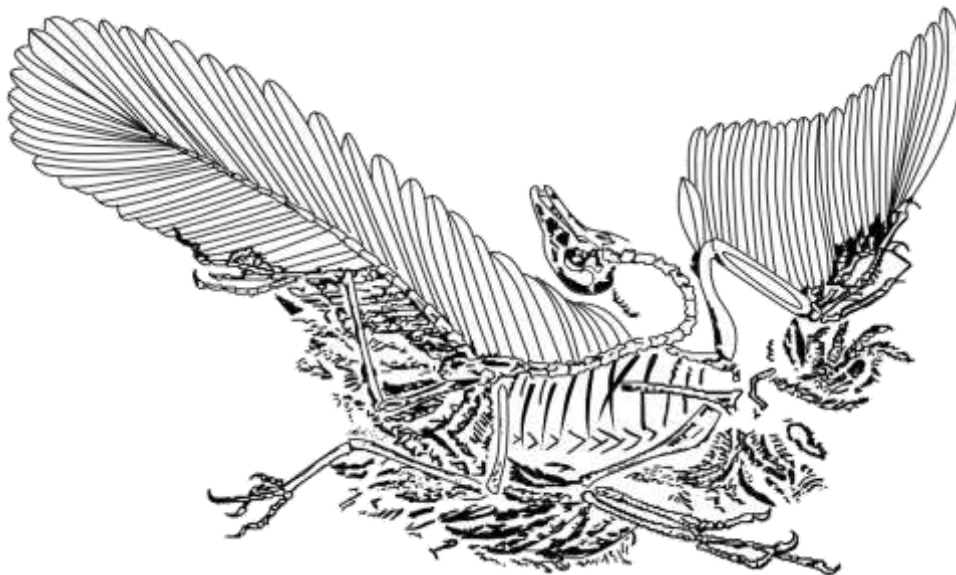


Figure 3 Fossil of Archaeopteryx Bird
(Illustrated by: Marcelo John V. Lagonoy)

PART II: COMPARATIVE ANATOMY

A. Homologous and Analogous Structure

The discipline of comparative anatomy is vital in understanding relationships among creatures. Structures are classified to be homologous if they have similar embryonic origins and analogous if they are identical only in function. For instance, birds' and flies' wings are examples of comparable structures in which they serve the same function but have different embryonic origins (one is made of bone and flesh, the other is mainly composed of non-living chitin). On the other hand, birds' wings and the foreleg of a frog are considered homologous structures (though limbs have different functions, their embryonic origins are alike). For some comparative anatomists, homologous structures are important because they imply an

evolutionary linkage between two species. However, comparing the anatomy and the development of organisms reveals a unity of plan among those strictly connected. The more species have the same functions in terms of body, the nearer they are related.

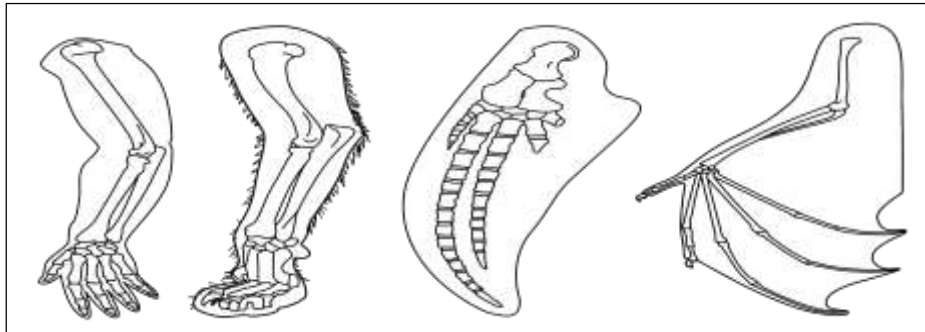


Figure 4 Showing the Difference between Homologous Structures of Different Species
(Illustrated by: Marcelo John V. Lagonoy)

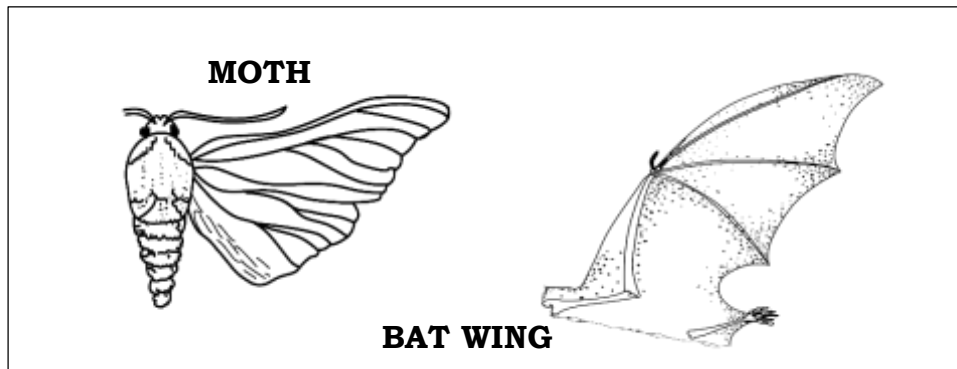


Figure 5 Showing Analogous Structure of Different Species
(Illustrated by: Marcelo John V. Lagonoy)

B. Vestigial Structure

Gradual changes have occurred through time that has, in some cases, reduced or removed the function of somebody's organs and structure. The human's appendix that is reduced and no longer digests rough vegetation (Figure 5) and pelvic bones of snakes with reduced hind legs (Figure 6) are examples of this phenomenon. Moreover, vestigial structures are structures that have gone their function in the organism and have become reduced in size (because of efficiency).

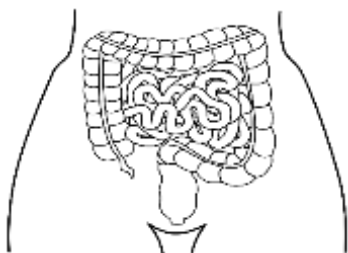


Figure 6 Human Digestive System showing the appendix
(Illustrated by: Marcelo John V. Lagonoy)

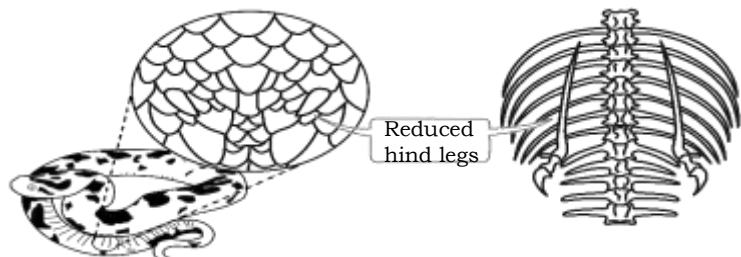


Figure 7 Pelvic bone of a Snake showing a reduced hind limb (Illustrated by: Marcelo John V. Lagonoy)

PART III: EMBRYOLOGY

A study of organism's embryonic progress provides further clues to its evolutionary past. Scientists proclaimed that "ontogeny summarizes phylogeny." Simply means that this theory proposes that if a certain organism undergo its embryonic development (ontogeny), it duplicates (recapitulates) the stages in its evolutionary history (phylogeny). For example, during your development, human folds in the neck area are referred to as pharyngeal pouches, which in some animals become gills. This notion of embryology as an "instant replay" of evolution has been called the biogenetic law.

Although the connection between evolution and embryonic development is more complex than once thought, related organisms do show similarities in their embryonic development (see figure 5). These resemblances can be traced to the conservative nature of embryology: small changes on the early development can have severe significances in advanced phases concluded a "domino" effect. Gills are not found in adult humans therefore all vertebrates have comparable pouches from which they ascend. For humans, these pharyngeal pouches go on to develop muscles for eating and facial appearance, endocrine glands in the neck and bones of the middle ear. From an evolutionary perspective, many people believe similarities in embryology are valuable because they reveal our kinship with other phylum members.

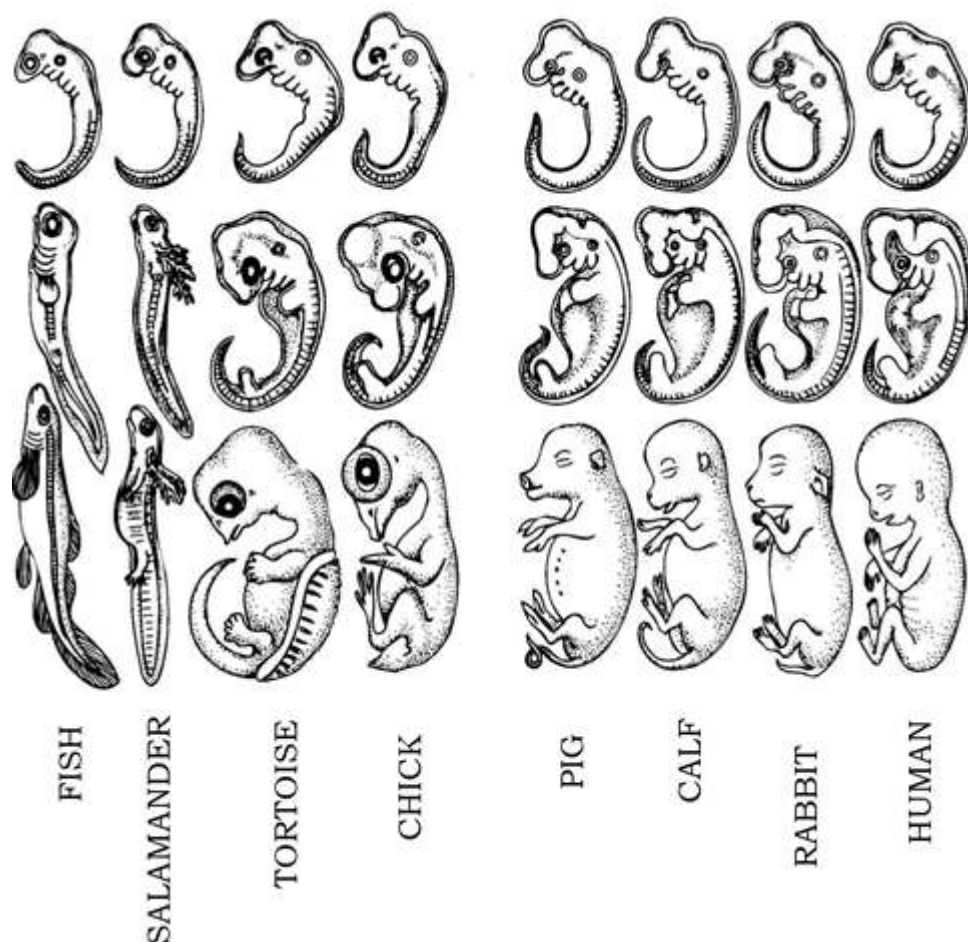


Figure 8. Early Embryonic Stages of the Different Vertebrates showing Similar Embryonic Structures

Illustrated by: Marcelo John V. Lagonoy

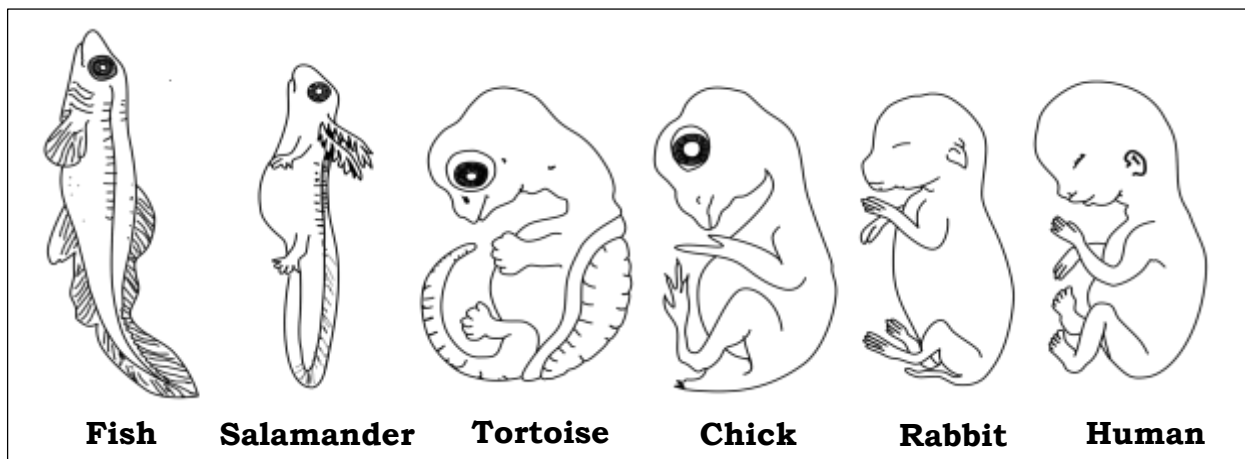
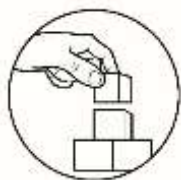


Figure 8.B Series of Vertebrate Embryos at their Most Advanced Stage
(Illustrated by: Marcelo John V. Lagonoy)



What's More

Here are some enrichment activities for you to work on to master and strengthen the basic concepts you have learned from this lesson.

Activity 1 – TAKE MY HANDS!

Shown below are images of the skeletal assembly of the front appendages of six animals: whale, crocodile, cat, bird, human and bat. Each animal has a similar set of bones. Color code each of the bones according to this key:

Humerus	[blue]	Carpals	[black]
Ulna	[red]	Metacarpals	[orange]
Radius	[green]	Phalanges	[brown]

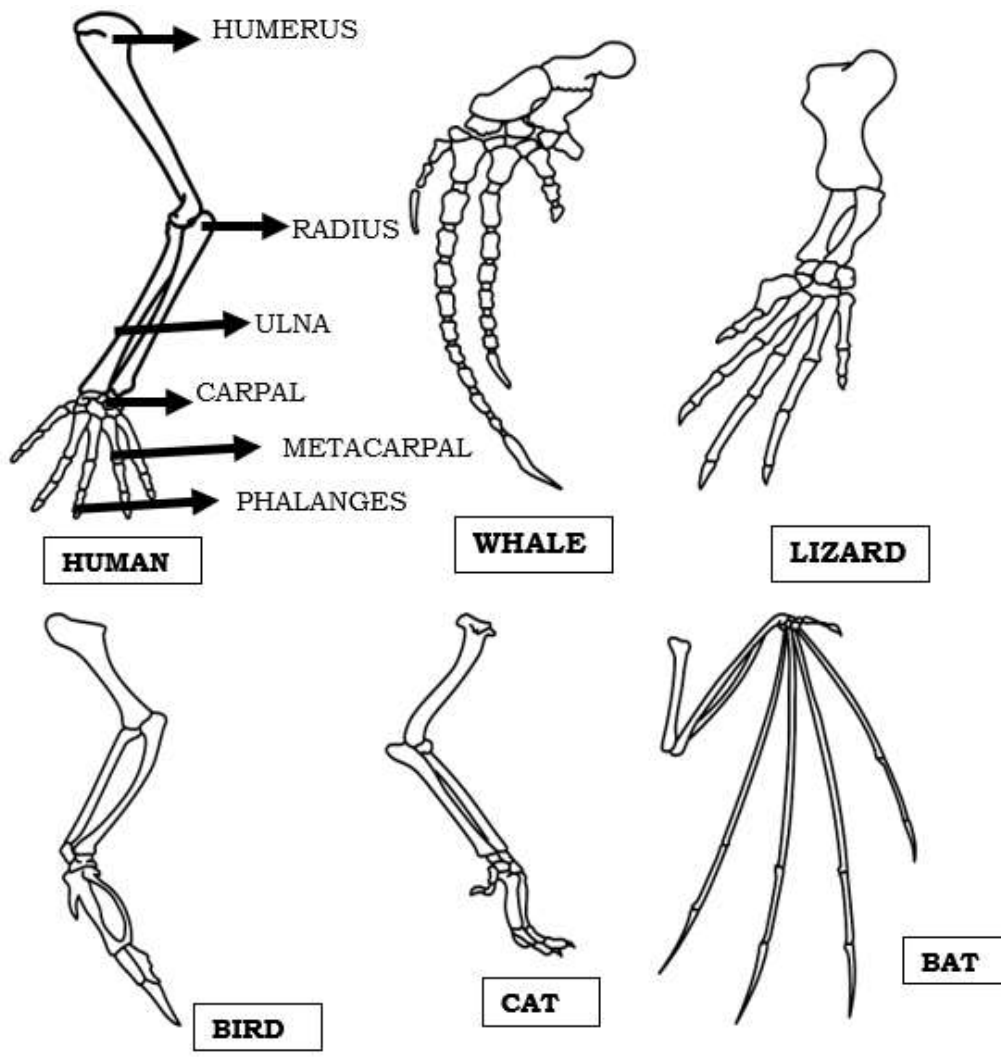


Figure 9: Images of the Skeletal Structure of the Front Limbs of Different Animals (Illustrated by: Marcelo John V. Lagonoy)

Assessment 1: For each animal, indicate what type of movement each limb is responsible for.

Animal	Primary Functions
Human	Using tools, picking up and holding objects
Whale	
Cat	
Bat	
Bird	
Crocodile	

Activity 2: On the WINGS of Evolution!

Direction: Compare the anatomy of the butterfly and bird wing below.

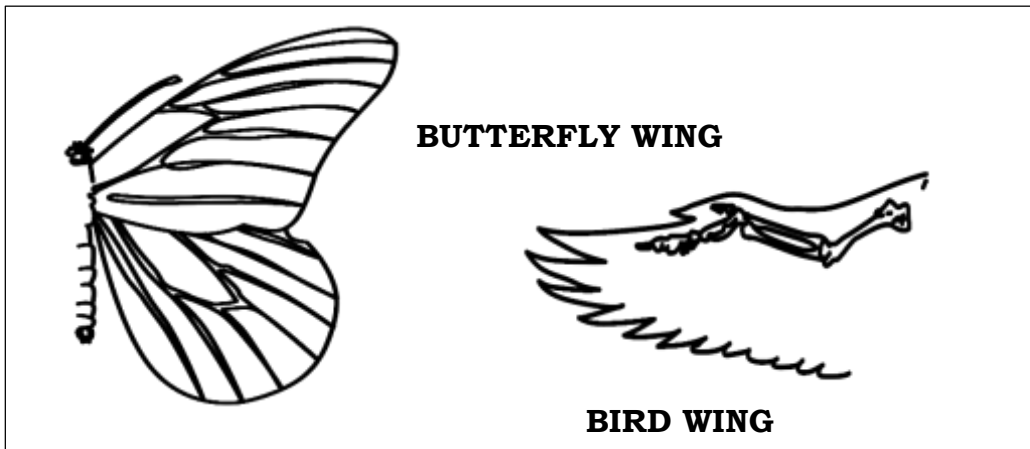


Figure 10 Comparative Anatomy of the Butterfly and Bird's wing
(Illustrated by: Marcelo John V. Lagonoy)

Guide Questions:

1. What is the function of each structures?

2. How are they different in form? Give specific differences.

Activity 3: VESTIGIAL: Look What Is Missing?

Direction: Compare the cave fish's overall body structure (*Phreatichthys andruzzii*) and the minnow (*Phoxinus phoxinus*) below.

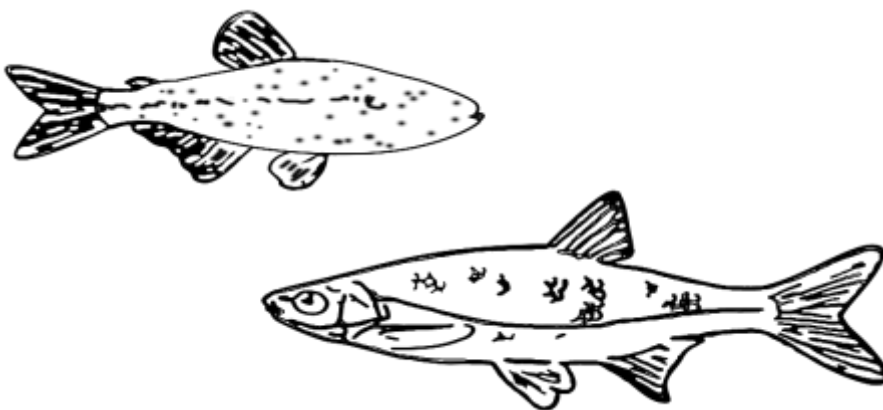


Figure 11 Body Structure of Cave Fish and Minnow Fish
(Illustrated by: Marcelo John V. Lagonoy)

Guide Questions:

1. What is the most apparent difference between the body structure of these two fish?

2. Assume two fish came from the same original ancestor. Why might the cavefish have evolved without eyesight?

3. What kind of sensory variation would you hypothesize if the cavefish has to allow it to direct in a cave, including catching and ingestion of food?

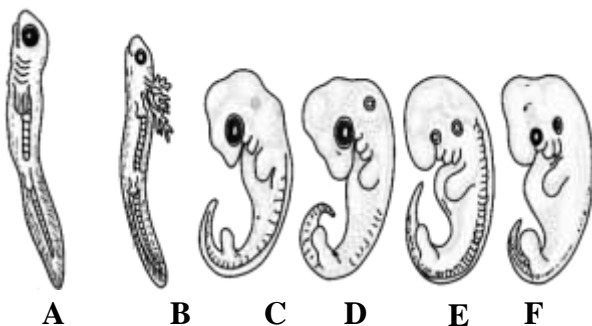
Activity 4: THE BIRTH OF THE EMBRYO!

Direction: Closely related organisms may have physical resemblances before they are born. Take a look at the 6 different structure of the embryos below:



A B C D E F

Figure 12 Series of vertebrate embryos in Older and More Developed Embryos from the same Organisms. (Illustrated by: Marcelo John V. Lagonoy)



A B C D E F

Figure 13 Series of vertebrate embryos at the Early Stage (Illustrated by: Marcelo John V. Lagonoy)

Table 1. Hypothesize which embryo is from each of the following organisms. Write the letter only.

Species	Embryo
Human	
Chicken	
Rabbit	
Tortoise	
Salamander	
Fish	

Table 2

Species	Embryo
Human	
Chicken	
Rabbit	
Tortoise	
Salamander	
Fish	

Direction: Describe how the embryos changed for each of these organisms from their earliest to the latest stages based on the figures shown above. (The first item is given as an example)

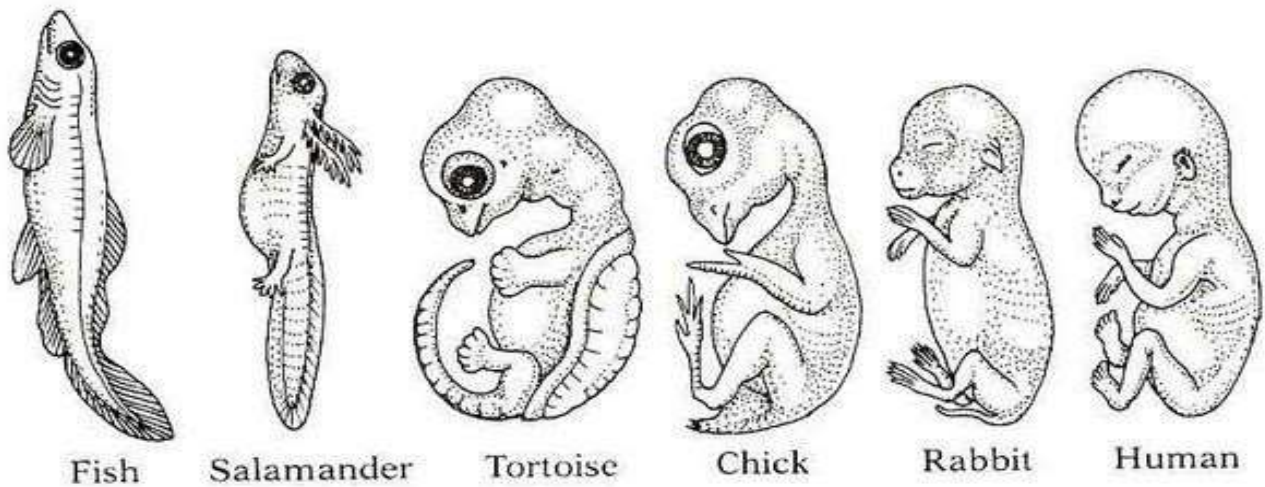


Figure 14 Series of Vertebrate Embryos at their Most Advanced Stage, shortly Before Birth (Illustrated by: Marcelo John V. Lagonoy)

Species	Anatomical Changes from Early to Late Stages
Human	Example: Developed limbs, external ears, a large head, and a nose
Chicken	
Rabbit	
Tortoise	
Salamander	
Fish	

Guide Questions:

1. Look at the six embryos in their earliest stage. Describe the patterns you observed. What physical similarities exist among the embryos?

2. Does this suggest an evolutionary relationship among the organisms? Explain how embryos can be used as indication of common ancestor among these six organisms.

Activity 5 – CREATION TO RESURRECTION: A MYSTERY OF HISTORY

Creationism believes that a higher power created the animals and everything that exists today through supernatural intervention. Religious beliefs, such as creationism, are accepted based on faith and cannot be tested or investigated. While evolution is a slow process in which something changes into a different and usually more complex or better-adapted form.

Conflicts between Evolution and Creationism happen when evolutionists claim that creationism is not a scientific theory because it cannot be verified by the scientific method. In contrast, creationists argue that evolutionists do not take God into account and that evolution is just a theory rather than a fact.

Science requires that a hypothesis or theory must be maintained by physical indication, whereas religion involves acceptance of a doctrine without analysis.

DNA testing has prove that humans and chimpanzees have a 98-percent genetic similarity, having an devastating indication that apes and humans have a shared ancestry. Scientists are willing to take these outcomes as indication that man is a specific type of ape, but this is what creationists find most revolting since they believe that "God created man in his image," as stated in Genesis 1:27.

For this reason, struggles between evolution and creationism have never been resolved.

Guide Questions:

1. Based on the statement given above, give your insight into how science influences man's traditional origin.

2. Do you think science 'disproves' the Law of Bible which refers to the Creation of the man based on God's image? Why?

3. In what ways are scientific concepts about creation different from these creation myths? How are creation myths similar to scientific theories?

*Great job! You have understood the lesson.
Are you now ready to summarize?*



What I Have Learned

What are the things that you have learned from this module?

1. _____ is the idea that a divine being creates living things and remains unchanged since the beginning.
2. _____ is the idea that forceful and sudden natural disasters have give rise to extinction due to death of organisms. After each disaster, God created new sets of life forms.
3. _____ is the person who believed that the environment could bring about inherited change.
4. _____ proposed the theory of evolution through natural selection. He believed that all organisms originate from a common ancestor.
5. Evidence for evolution come from many sources. Evidence is classified as direct and indirect. _____ evidence means something that can be obviously observed or seen. Fossils provide direct evidence for evolution. _____ evidence is something that does not include actual observation of evolution but for which we can infer that evolution has taken place.
6. Similar structures in different species irrespective of their functions are called _____ structures. _____ structures are those that has the same function though possibly in very different ways. _____ structures are structural features present in organism but have no function.
7. _____ is not the only driving force for evolution to occur, other mechanisms include non-random mating, gene flow, genetic drift, and mutations.
8. Two types of speciation are identified: allopatric and sympatric. _____ speciation happens when a population is divided into two by a geographic barrier. In _____ speciation, a population is split into two or more in the absence of physical barriers.



What I Can Do

Self-Test

A friend says to you, “Man Originated from Apes” because many physical and biochemical resemblances are found between them. How would you react to this?



Assessment

Multiple Choice. Write the **letter** of the best answer on your sheet of paper.

1. An adaptation promotes _____.
 - A. chance to survive
 - B. chance to reproduce
 - C. chance to survive and reproduce
 - D. None of the above
2. The criterion used to determine if an organism is a new species is based on _____.
 - A. time
 - B. geography
 - C. reproduction
 - D. physical traits
3. Where can most fossils be found?
 - A. Black soil
 - B. Lava flows
 - C. Granite rock
 - D. Sedimentary rock
4. Vertebrate forelimbs are most likely to be discussed in _____.
 - A. Ecology
 - B. Embryology
 - C. Biogeography
 - D. Comparative anatomy
5. Which of the following statements does NOT describe Darwin's theory of natural selection?
 - A. The members of a population of the organisms will strive.
 - B. Populations tend to replicate in minimal numbers.
 - C. Members of a population have genetic differences.
 - D. Some members of a inhabitants have adaptive behaviors.
6. The following statements describe evolution EXCEPT
 - A. Evolution is continuous
 - B. Evolution refers to a change
 - C. The world is stable and unchanging
 - D. The mutation causes evolution only when it becomes heritable
7. All of these are true about fossils EXCEPT?
 - A. They specify that life has a history.
 - B. They are evidence of the ancient life.
 - C. The older fossils may look like less than the modern day species.
 - D. They look precisely like modern-day species, regardless of their age.

8. Which of the following describes indirect evidence for evolution?
- A. It is observed or seen
 - B. It involves actual observations
 - C. It is something that does not involve actual observation of evolution but for which we can infer that evolution has taken place
 - D. None of the above.
9. In what era do the oldest fossils locate?
- A. Mesozoic
 - B. Cenozoic
 - C. Paleozoic
 - D. Pre Cambrian
10. What best defines homologous structures?
- A. Structures are similar in origin and structure. They evolve to fit the animal's way of life.
 - B. Structure in different organisms that serve the same function. They show no evolutionary relationship between organisms
 - C. Structure that functions and later on disappear
 - D. All of the above
11. Natural selection states that
- A. nature selects the variations within a species that are most useful for survival.
 - B. fitness gives organisms the ability to survive but not to produce fertile offspring.
 - C. a change in a species occurs over time
 - D. all of the above
12. Which of the following statements **best** describes the Theory of Natural Selection?
- A. Developed characteristics of parents can be passed on to offspring.
 - B. Organisms develop necessary structures to survive in a given environment.
 - C. Organs that are not used may fade, while organs that are constantly utilized may develop.
 - D. In nature, the organism with necessary characteristics may survive, while those with weaker traits may not.
13. The most obvious evidence for evolution from a common ancestor is _____
- A. similar embryological structures.
 - B. similar DNA sequences.
 - C. similar body structures.
 - D. similar fossils
14. What does it mean by direct indication or evidence for evolution?
- A. It consists of observations of actual evolution
 - B. It does not involve direct observation of the evolution
 - C. It is something that is not observed or seen
 - D. None of the above.
15. Which idea best describes the theory of evolution?
- A. Earth is comparatively young.
 - B. Each organism is specially shaped
 - C. Species are related by common ancestry.
 - D. A mix of fossils indicates that a local catastrophe occurred.

Great job! You are almost done with this module.



Additional Activities

Activity 1 - KNOW ME

Fill up the missing letters to identify a term related to evolution.

		Definition
1	S_EC_A_ION	the formation of new and distinct species in the course of evolution
2	BI_GEO_RA_HY	study of the distributions of organisms
3	EM_RY__OGY	The study of the prenatal development of the gametes, fertilization, and development of embryos and fetuses
4	V_ST_GI_L	an anatomical feature or behavior that no longer seem to have a purpose in the current form of an organism of the given species.
5	O_GA_IS_	Refers to an individual creatures such as a, animal, plant or a single-celled life form.
6	A_ALO_O_S	are structures that are different in appearance but have the same function
7	H_MOL_GO_S	alike structures in different species irrespective of their functions
8	A_AP_AT_ON	set of genetically developed traits that make the organism better suited to its environment.
9	S_E_I_S	creatures that can replicate with one another in nature and produce fertile offspring
10	O_FS_RI_G	young born of living organisms that produced either by a single organism or, in the case of sexual reproduction, two organisms.



Answer Key

Assessment	1. C 2. C 3. D 4. D 5. B 6. C 7. D 8. C 9. D 10. A 11. A 12. D 13. B 14. A 15. C
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What I Know	1. D 2. C 3. D 4. D 5. C 6. C 7. D 8. D 9. C 10. A 11. C 12. B 13. C 14. B 15. A
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What's In (Activity 1)	1. MYTH 2. CREATIONISM 3. FOSSILS 4. CATASTROPHISM 5. UNIFORMITARIANISM
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What's In (Activity 2)	1. C 2. D 3. A 4. B 5. D
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What's New
 Activity 1
 Guide Questions
 1. The skulls all have a similar ridge that protrudes from the top. The overall shape is the same. Each skull has a set of flattened teeth. Each skull has a large diastema, or gap between the front and back teeth.
 2. The size of the skull is dramatically larger in the modern horse.
 3. The modern horse, in addition to having longer legs, has developed hooves in place of hand/foot bones.

What's More	Assessment 1
Animal	Primary Functions
Human	Using tools, picking up and holding objects
Whale	Swimming.
Cat	Running, jumping, pouncing, climbing, catching prey.
Bat	Flying, gliding.
Bird	Flying, gliding.
Crocodile	Swimming, walking.

B.

Species	Anatomical Changes from Early to Late Stages
Human	Developed limbs, external ears, a large head, and a nose.
Chicken	Developed a beak, larger eyes, four limbs including wings, and a short tail.
Rabbit	Developed four limbs, external ears, a mouth, nose, and a tail.
Tortoise	Developed a shell, long tail, larger eyes, and a beak.
Salamander	Developed external gills, four limbs, and a long tail.
Fish	Developed internal gills and a full set of fins for swimming.

Guide Questions:

- Each of the embryos has the same basic shape, including a tail. They all have external segmentation where the backbone will eventually develop. They also all have gill slits, even the animals that will eventually develop lungs.
- The similarities between these embryos, especially at their early stages, are striking. While each of these animals has a unique adult body structure, they all seem to have emerged from the same early blueprint. These observations are probably not random coincidence – this suggests a common ancestor between all these vertebrates.

A.

Species	Embryo
Human	F
Chicken	D
Rabbit	E
Tortoise	C
Salamander	B
Fish	A

Species	Embryo
Human	F
Chicken	D
Rabbit	E
Tortoise	C
Salamander	B
Fish	A

Activity 4

Activity 2

- Flight.
- The bird's wing is constructed of bone, muscle, skin, and feathers. The butterfly's wing is a thin membrane of exoskeleton inflated by blood.

Activity 3

- The cave fish does not have any eyes.
- As the name suggests, cave fish lives in caves that are completely devoid of sunlight. In this environment, developing eyes would not grant any evolutionary advantage.
- The cave fish has special sense organs on its body surface that respond to the presence of different chemicals in the water. This would be analogous to our sense of smell.

1. ANSWERS MAY VARY

2. The answer depends on how a person defines “mental gymnastics” as well as how literally a person takes the Genesis creation account. If a person takes Genesis completely literally, then science is not compatible. Science refutes that the world was formed in six days. Genesis states that explicitly. If one is willing to view each with a grain of salt, however, one could fit science and Genesis together rather easily for the most part.

3. If viewed purely as the story of Earth, Genesis still fits with science if taken with a grain of salt. Before Earth could be something other than a “void,” there needed to be light, in this case the Sun. The Earth would also have begun rotating as soon as it sprung into existence, hence the separation of night and day. One could also argue that the earth mentioned was not actually Earth specifically, much as how modern people do not always mean the entire universe when they say “the universe” or may use “the world” to refer to all of existence, not just the little sliver that exists on Earth. In this case, “earth” could potentially stand in for the Cosmic Egg which would make Genesis match science more closely.

Activity 5

- What I Have Learned**
1. Creationism
 2. Catastrophism
 3. Jean Baptist Lamarck
 4. Charles Darwin
 5. Direct, Indirect
 6. Homologous, Analogous
 7. Natural Selection
 8. Allopatric, Sympatric

- Additional Activities**
1. SPECIATION
 2. BIOGEOGRAPHY
 3. EMBRYOLOGY
 4. VESTIGIAL
 5. ORGANISM
 6. ANALOGOUS
 7. HOMOLOGOUS
 8. ADAPTATION
 9. SPECIES
 10. OFFSPRING

	2 points	1 point	0 point
Claim <i>An assertion that is something true</i>	Makes a claim that is sufficient to answer the question and is coherent	Makes a claim that is sufficient to answer the question of coherent	Does not make a claim or makes an incoherent claim
Explanation <i>Describes how and why a phenomenon occurs</i>	Provides an explanation that addresses how and why a phenomenon occurs	Provides an answer that addresses how or why a phenomenon occurs	It does not offer an explanation
Reasoning <i>Provides reason the reader should accept your claim or explanation</i>	Includes all of the following: <ul style="list-style-type: none"> ✓ Cites sufficient and relevant evidence to support the claim and explanations ✓ Describe how the cited evidence defends the claim/explanation. 	Includes one of the following <ul style="list-style-type: none"> ✓ Cites sufficient and relevant evidence to support the claim and explanations ✓ Describe how the cited evidence defends the claim/explanation. 	Includes none of the following <ul style="list-style-type: none"> ✓ Cites sufficient and relevant evidence to support the claim and explanations ✓ Describe how the cited evidence defends the claim/explanation.

REASONING RUBRICS

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