**Guided Notes: Walking and Swimming Whales**

**Big Idea:** The fossil record and analysis of similar anatomical structures provide evidence that modern whales evolved from land-dwelling mammalian ancestors over millions of years, demonstrating the process of evolution from common ancestors.

**Key Concepts:**

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an organism from which two or more different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ have descended.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are preserved remains, impressions, or traces of organisms that lived in the past, allowing scientists to study life forms that existed millions of years ago.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ study the structure, development, and chemical composition of fossils to determine their origins and evolutionary relationships.

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a branching, tree-like diagram that represents hypotheses about the evolutionary ancestry of different groups of organisms based on similarities and differences among them.

• Organisms with more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are considered more closely related and therefore have shared a more recent \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

• Comparing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, such as bone structure, is one way scientists can infer evolutionary relationships and trace back to common ancestors.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in genes between different organisms also provide clues about how closely or distantly they are related through evolution.

**Real-World Examples:**

1. The fossil species \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which lived around 50 million years ago, had four legs and was likely a land-dwelling mammal, providing evidence that it was an ancient \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of modern whales.

2. The skeletal structures of mammals like humans, dogs, and whales all share key \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ features like a backbone and limbs with finger-like bones, indicating they share a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in their evolutionary past.

**Guided Notes: Are Dinosaurs Still With Us?**

**Big Idea:** The fossil record provides evidence that birds evolved from a group of dinosaurs over millions of years, demonstrating the process of evolution through natural selection.

**Key Concepts:**

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the gradual process by which biological traits in a population change over successive generations.

• The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ consists of all the fossils discovered on Earth that have been identified and organized based on their estimated age and the type of organism they represent.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the theory proposed by Charles Darwin that explains how evolution occurs, by natural variation and differential reproduction of organisms with advantageous traits that allow them to better adapt to their environment.

• In natural selection, organisms with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that aid survival and reproduction will tend to leave more offspring, passing those beneficial traits on to subsequent generations.

• Over long periods of time, this process leads to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of advantageous traits and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of less beneficial traits in a population.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ traits are physical features, behaviors, or other characteristics that enhance an organism's ability to survive and reproduce in its environment.

**Real-World Examples:**

1. The fossil of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, an animal that lived millions of years ago, had features of both dinosaurs and modern birds, linking the two groups through evolution.

2. Having favorable traits like \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_can help an animal survive and pass those advantageous traits to offspring through natural selection.

**Guided Notes: Understanding Human Evolution**

**Big Idea:** Fossil evidence and analysis of anatomical similarities demonstrate that humans evolved from ancient primates and share common ancestors with other great apes through the process of evolution over millions of years.

**Key Concepts:**

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are a group of mammals that includes lemurs, monkeys, apes, and humans.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are a group within primates that includes the great apes like gorillas as well as humans.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are a specific group of hominids that includes humans and our extinct relatives.

• Being \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ means walking upright on two legs, a key trait of hominins.

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an organism from which two or more different organisms have descended.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the gradual process by which biological traits in a population change over successive generations.

**Real-World Examples:**

1. Fossil evidence shows the ancient hominin species \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, nicknamed "Lucy", was likely the first bipedal hominin but had a relatively small brain compared to modern humans.

2. Comparing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ features like skeletal structures allows scientists to determine how closely related different organisms are, such as the similarities between human and chimpanzee skeletons indicating a common ancestor.

**Guided Notes: Are Whales and Hippos Related?**

**Big Idea:** Anatomical and fossil evidence reveals that whales and the land-dwelling hippopotamus share a common ancestor from which they diverged and evolved very different structures and traits suited to their respective aquatic and terrestrial environments over millions of years.

**Key Concepts:**

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an organism from which two or more different organisms have descended and share ancestral traits.

• To \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ means for two or more groups to evolve differently and develop divergent structures and traits by adapting to different environments after splitting from a common ancestor.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the gradual process of change in the heritable characteristics of biological populations over successive generations.

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a diminished or impaired bodily structure inherited from an ancestor but no longer serves its primary function in the descendant organism.

• Comparing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ among modern organisms can reveal ancestral relationships and traits shared by common descent.

• The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ provides physical evidence of past life forms and can show the gradual changes in ancestral species over vast timescales.

**Real-World Examples:**

1. While modern whales have no visible leg bones, their ancestors like the amphibious Ambulocetus had small \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that were vestiges of when their ancestors lived on land, similar to how the human tailbone is a vestigial remnant of a tail in our ancestors.

2. Your own \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ contains many of the same bones arranged similarly as other mammals like bats, horses, and even whale flippers, indicating you share a common ancestor with hooved and winged creatures.

**Guided Notes: Evolution of the Horse**

**Big Idea:** The fossil record provides evidence of how the modern horse evolved gradual anatomical changes from smaller, primitive ancestors over millions of years.

**Key Concepts:**

• To \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ means to change over long periods of time.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are scientists who study fossils to learn about prehistoric life.

• An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an early organism from which later organisms descended and evolved.

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a fossil that displays transitional features between an ancestor and a descendant organism.

**Real-World Examples:**

1. Your own \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are evidence that you share a common ancestor with other mammals, as the bones are arranged similarly to horse, bat, and whale limbs.

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ devices like video game controllers have evolved over time from having just a few simple buttons to incorporating more complex designs with joysticks, shoulder buttons, and other features to enhancing the user's experience.

**Guided Notes: Comparing Vertebrate Embryos**

**Big Idea:** The shared anatomical features present in vertebrate embryos, despite differences in adult forms, provide evidence that all vertebrates evolved from a common ancestor.

**Key Concepts:**

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an animal that has a skeleton with a backbone.

• An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an unborn or unhatched offspring in the process of development.

• \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the process by which an organism changes over time.

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an organism that evolves into two or more other organisms.

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a relationship where a change in one value consistently changes another value.

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a relationship where a change in one value does not consistently change another value.

**Real-World Examples:**

1. Career paths can demonstrate a linear relationship if one person's earnings increase steadily with years of experience, while a nonlinear path could occur if someone changes careers and has fluctuations in their earnings over time.

2. Smartphone technology has evolved in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ way, with new models displaying linear increases in processing power and memory capacity, but \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ advances like folding screens and in-display fingerprint sensors.

**Guided Notes: Stages of Development**

**Big Idea:** Similarities in the embryonic stages of different vertebrates provide evidence that they evolved from a common ancestor.

**Key Concepts:**

• An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an unborn or unhatched animal that is early in its development.

• A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an animal that has a backbone.

• An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an animal from which a different animal evolved.

• Vertebrate embryos go through similar stages of development, sharing structures like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ early on, before diverging into their specialized adult forms.

• These shared features in embryonic development suggest vertebrates evolved from the same \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organism.

**Real-World Examples:**

1. Early stages of human embryonic development share similarities with other vertebrates, like initially developing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that later become part of other structures or disappear.

2. Video games often release new versions that start out very similar but then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into different forms with unique features tailored to different audiences, similar to how embryos develop along divergent paths.