Module 8: Evolution and Natural Selection
Topic 2 Content: Evidence for Evolution Notes

Evidence for Evolution

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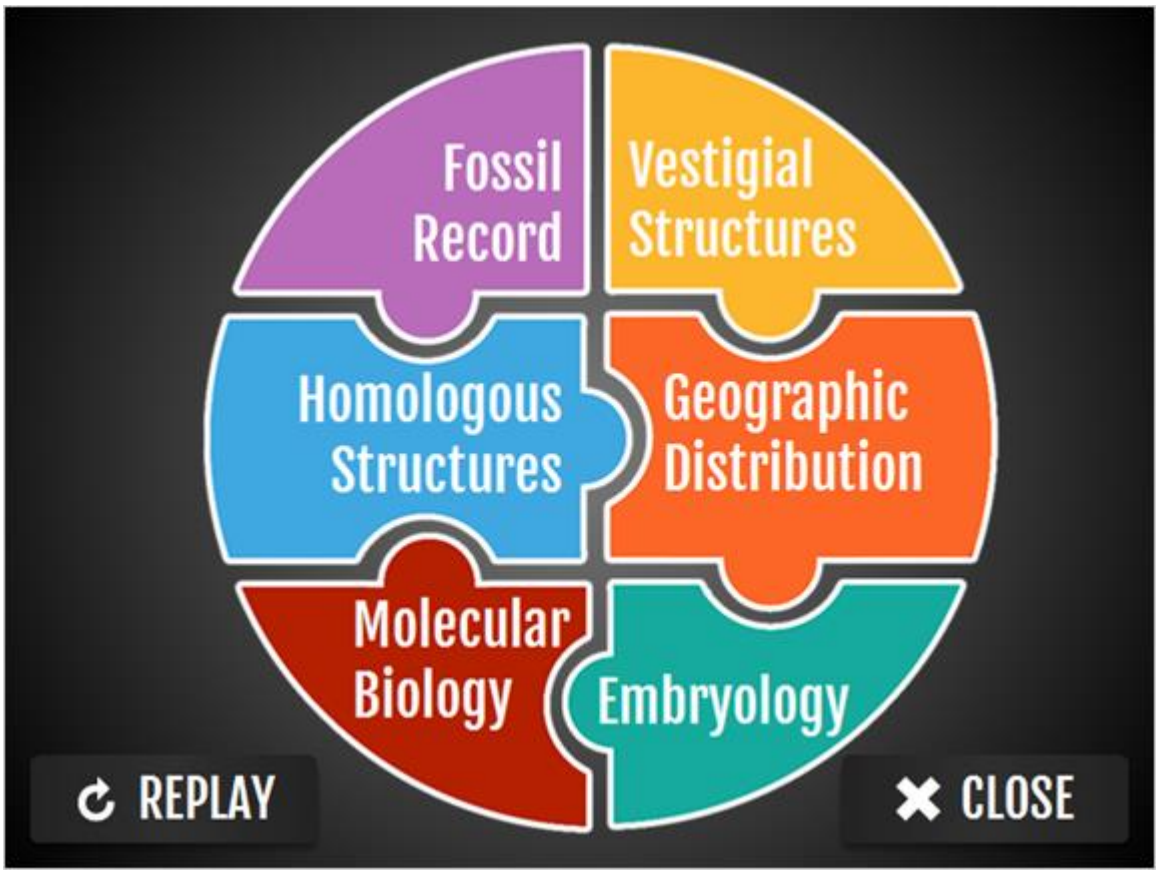
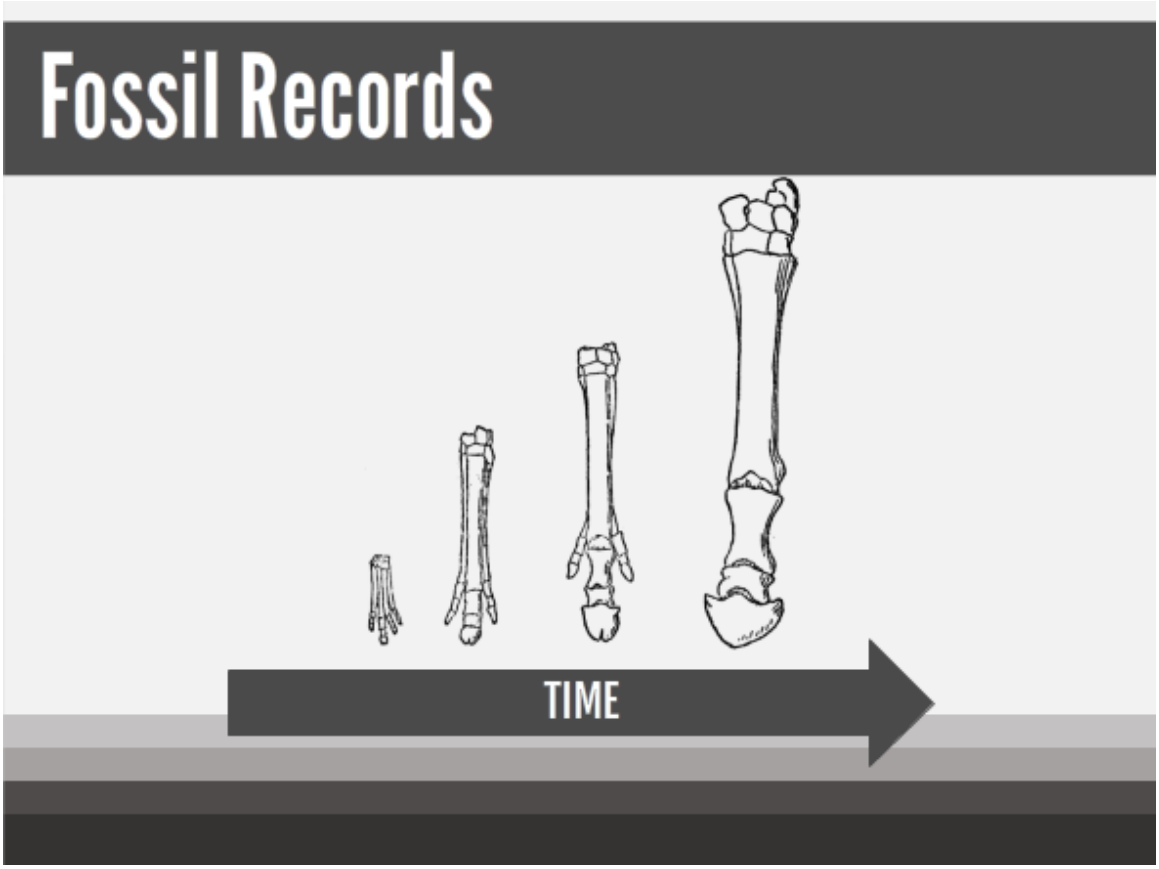


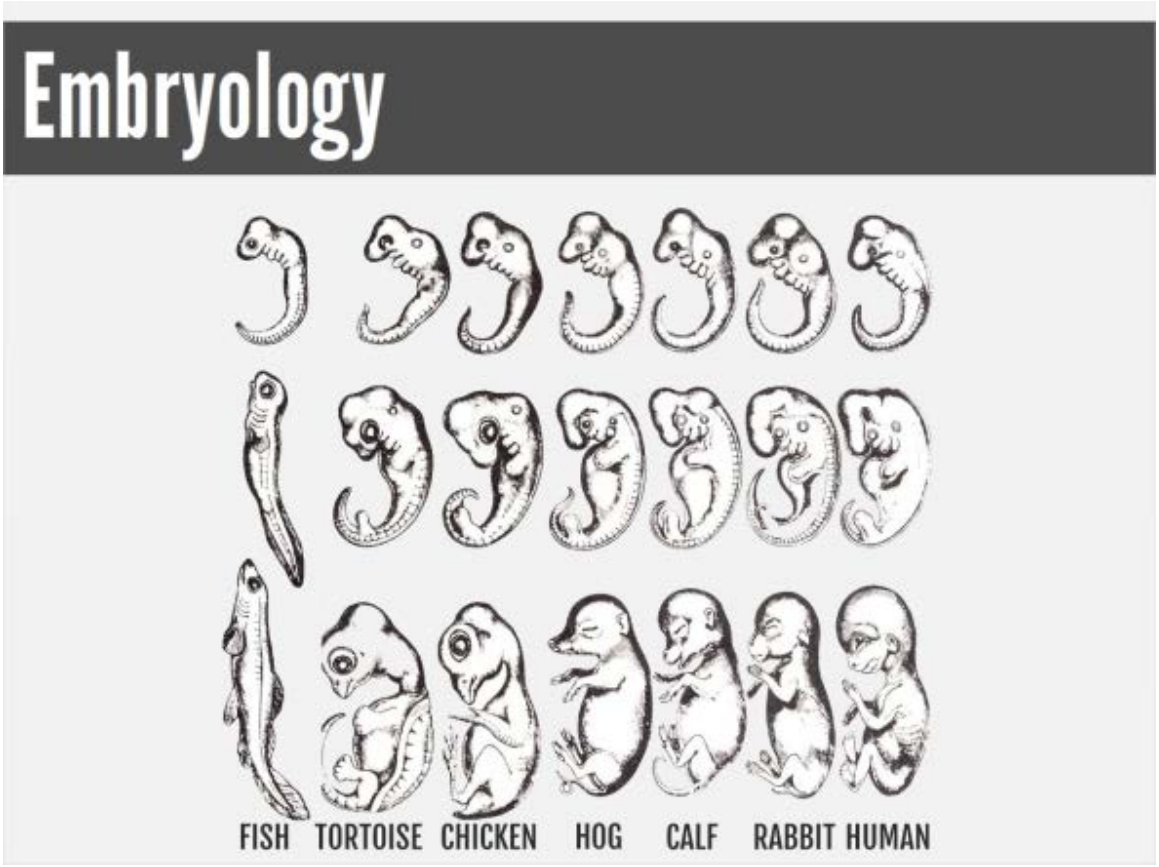
Like pieces of a large puzzle, the evidence supporting evolution fits together to create a picture showing the amazing development of species over time. There are six main types of evidence supporting evolution, including:

- Fossil Records,
- Geographic Distribution of Related Species,
- Homologous Structures,
- Vestigial Structures,
- Similarities in Embryology, and
- Molecular Biology.

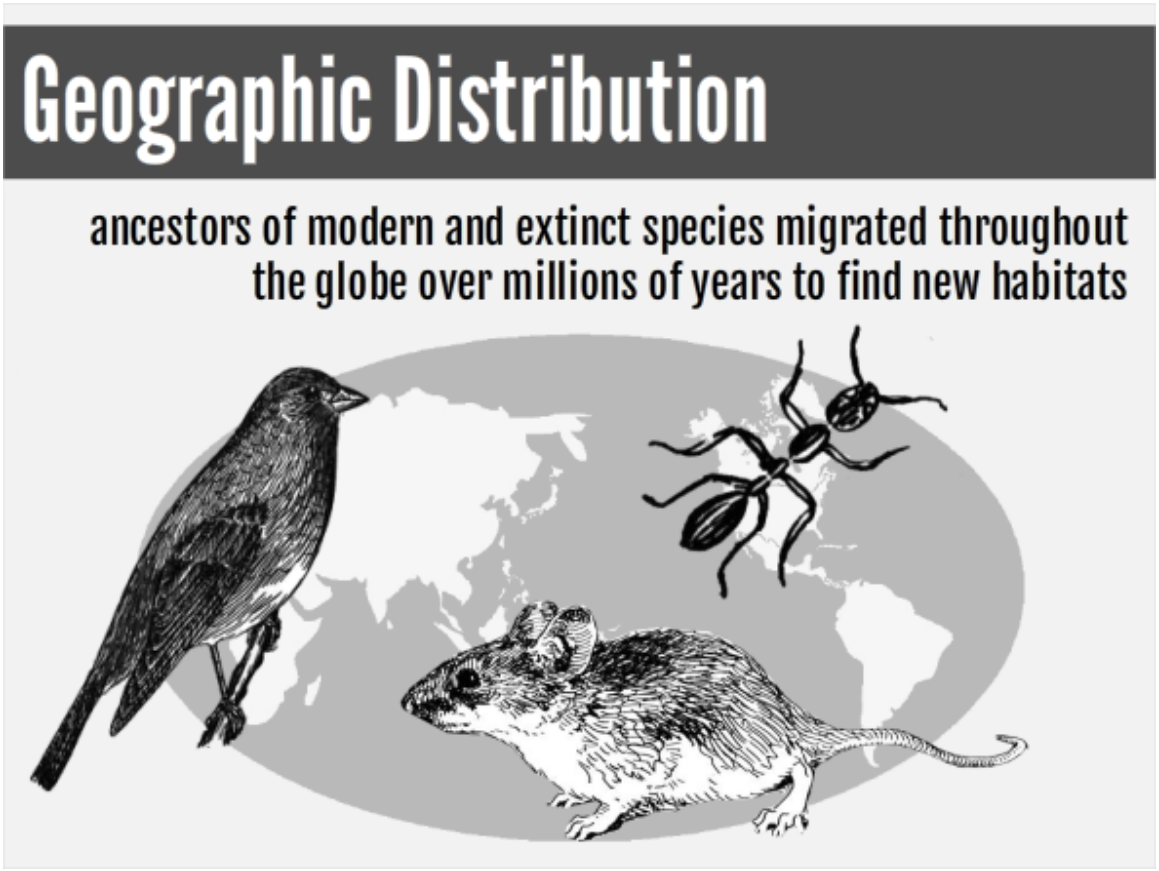
Click on each of the puzzle pieces to learn more.



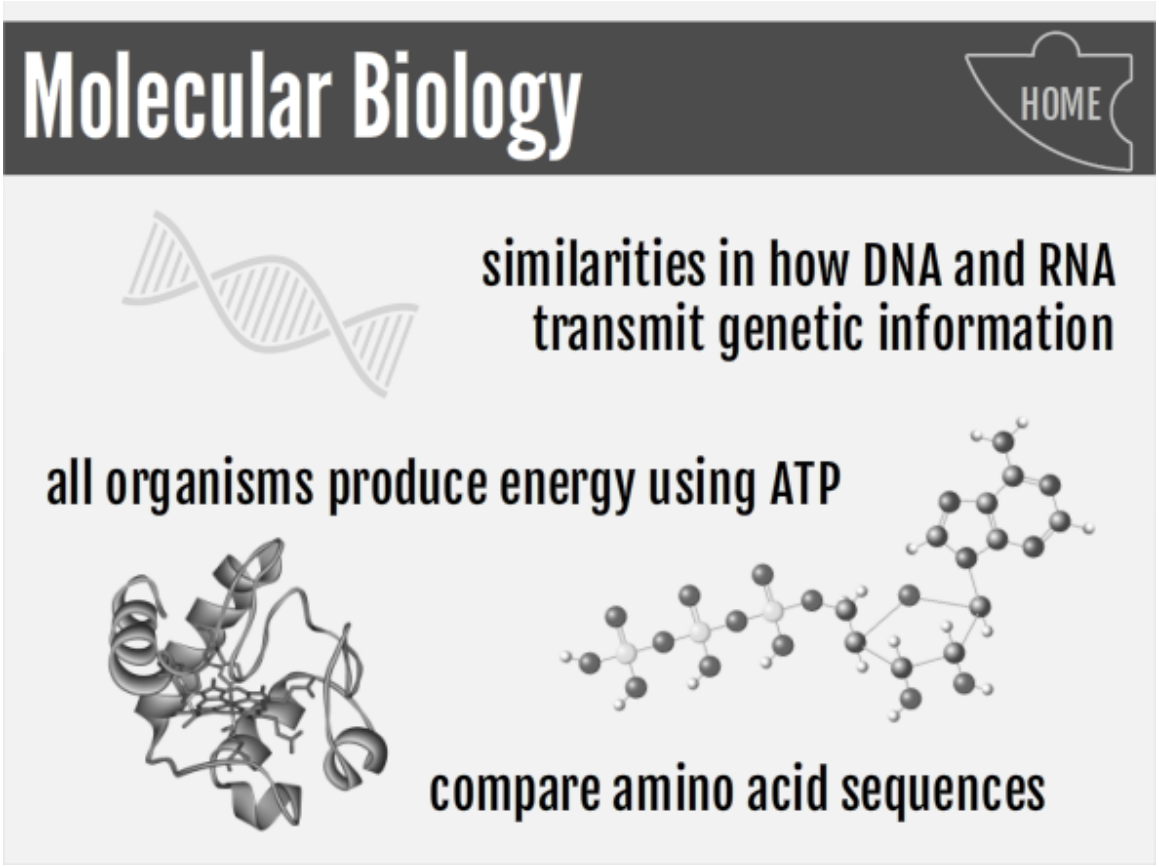
By comparing fossils from older rock layers with fossils from younger rock layers, scientists can see how life on Earth has changed over time. Geologists have found hundreds of transitional fossils, which show intermediate stages of evolution of modern species from species now extinct. A good example of fossil records shedding light on how a species has changed over time is the modern horse, pictured here with the limb on the right, with evolutionary fossils shown over time from the left. Notice how the individual bones of the forelimb of the horse's ancient ancestor changed over time to become the large, thick hoof of the modern horse.



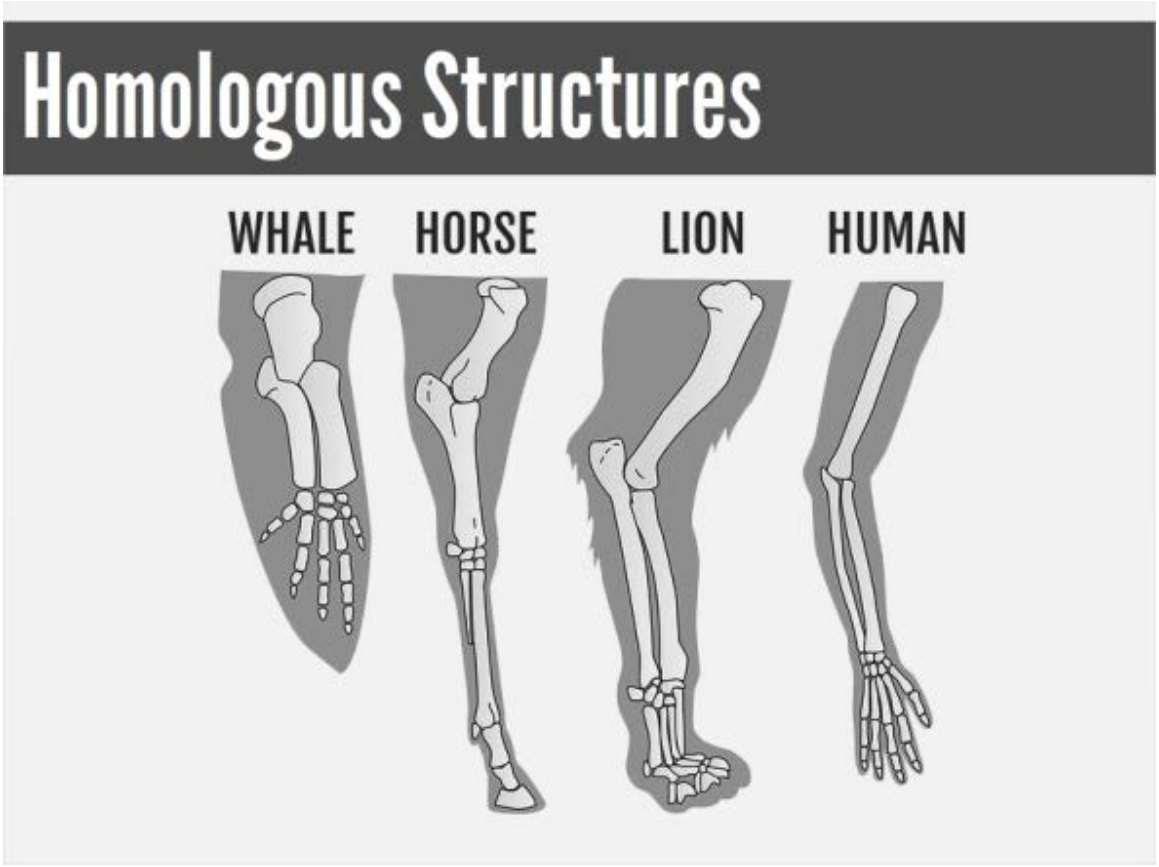
Similarities in embryology are another piece of the evolutionary puzzle. All embryos develop similarly because there are related genes that define their basic body plans. You may be surprised to know that all mammals, including humans, have tails as embryos. In fact, the embryos of all vertebrates share many similarities. In the case of humans, the embryonic tail disappears almost completely during gestation, with a small part, called the coccyx, or tailbone, remaining.



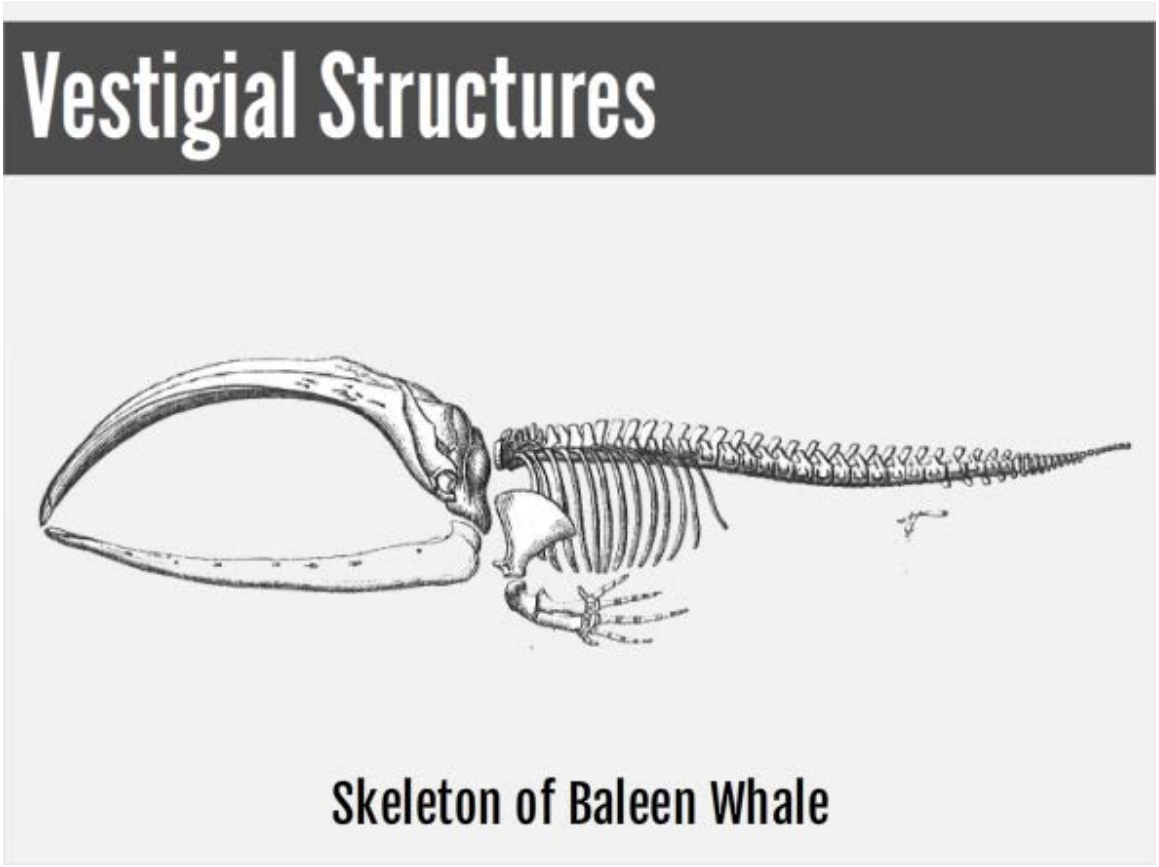
The geographic distribution of related species is an important piece of the evolutionary puzzle. Many ancestors of modern and extinct species migrated throughout the globe over millions of years to find new habitats. Birds, such as finches, mammals, such as mice, and insects, like ants, are found in nearly every part of the world, although all with slightly different adaptations structured for their particular environments. Bears are an example of geographic distribution of related species; bears of varying types live on all continents, except for Africa and Australia.



Many organisms show similarities in their molecular biology. Scientists in the field of molecular biology study the role of DNA and RNA in transmitting genetic information. In addition, molecular biologists examine how all organisms produce energy using ATP. Finally, scientists can compare amino acid sequences, or proteins, in organisms to speculate how closely these organisms are related.



Homologous structures provide an interesting piece of the evolutionary puzzle. Homologous structures are those that derive from a common ancestor and develop from the same part of the embryo of different species, but that have different forms and functions when fully grown. One example of a homologous structure is the forelimbs in the mammalian embryo. These forelimbs develop into the structures shown here in each animal.



Did you know that the human embryos have a tail? Or, that whale embryos have hind limbs like those on a cow? Shown here is the skeleton of a baleen whale. On the left, you can see the whale's huge jaw bones, as well as large forelimbs that adapted to become flippers, both outcomes of natural selection. On the right, are the relatively small structures of the whale's hind limbs, which you might never notice on a living whale. Because whales are marine mammals, they retained the hind limbs of the common land-dwelling ancestor from which they evolved millions of years ago, as did cows and hippos.

Vestigial structures are those that, over time, have so reduced in size or function that they no longer perform to the extent of the homologous structures in related species. Scientists believe that the presence of the structure does not affect an organism's ability to survive and reproduce, so there is no need for natural selection to eliminate the structure completely.