Standard: Students will evaluate the role of natural selection in the development of the theory of evolution.

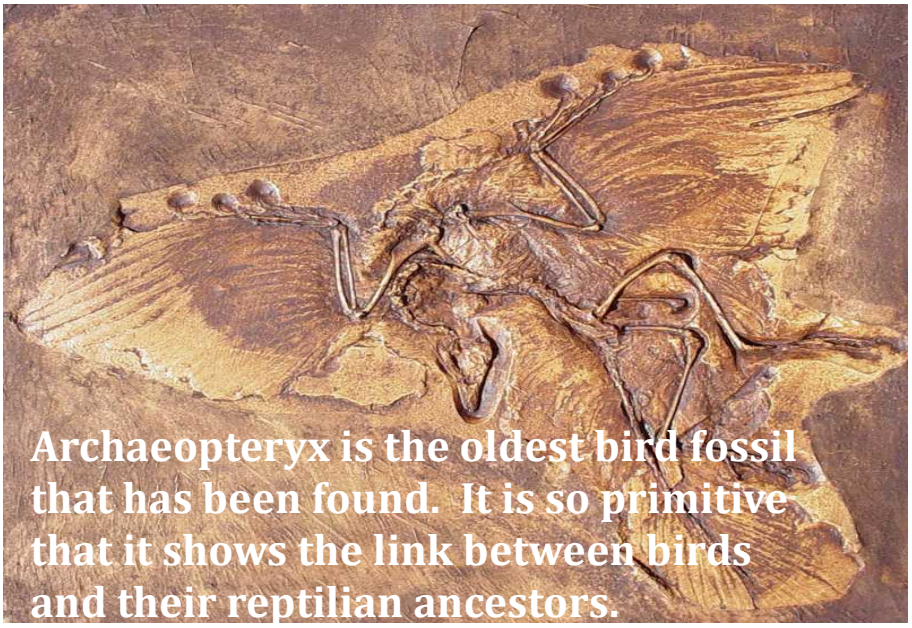
Element: Explain how fossil and biochemical evidence support the theory.

EQ: What kinds of evidence support the theory of evolution?

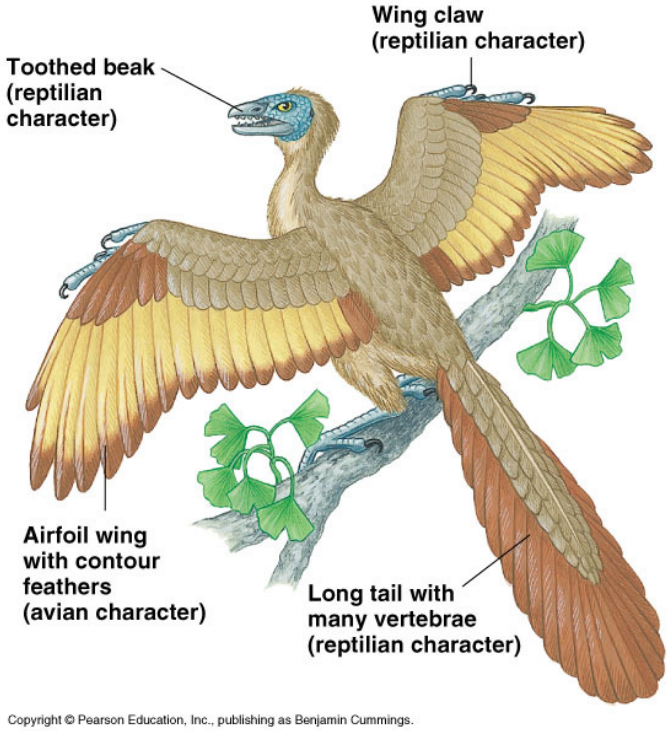
I) Fossil Evidence

A) Fossils show that different organisms existed in the past compared to organisms today.

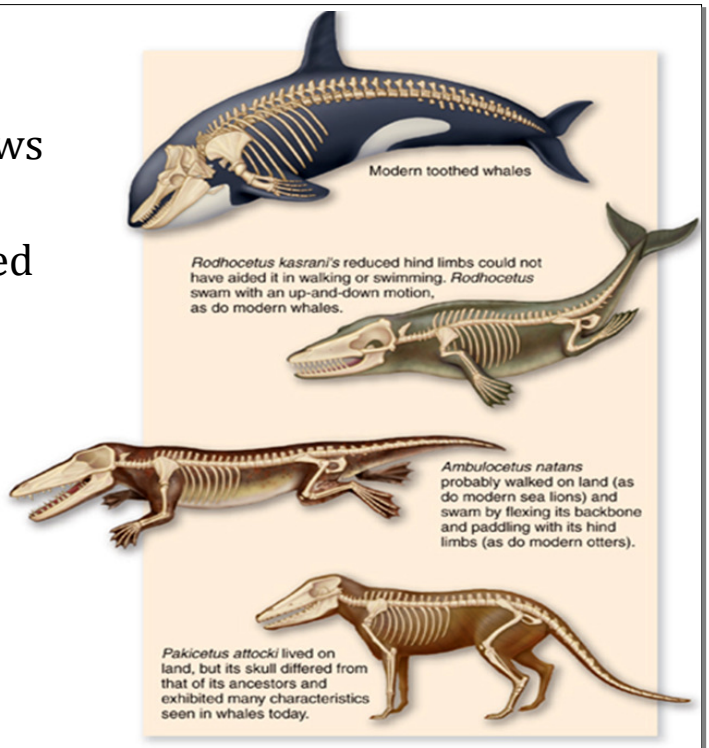
B) Fossils show changes in organisms over time.

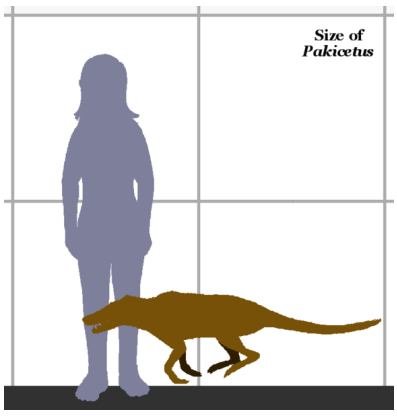


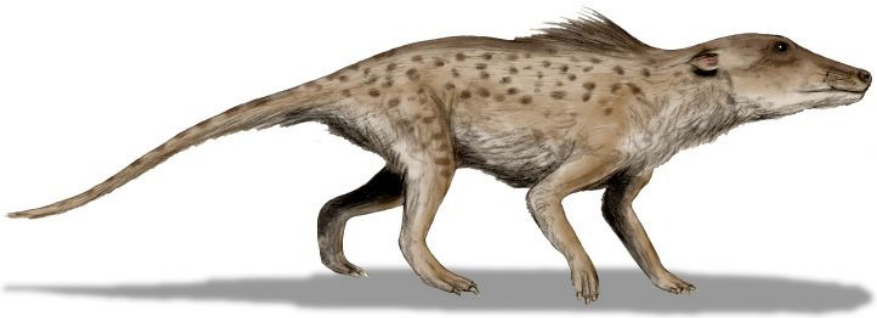
1) Archaeopteryx is the oldest bird fossil that has been found. It is so primitive that it shows the link between birds and their reptilian ancestors.



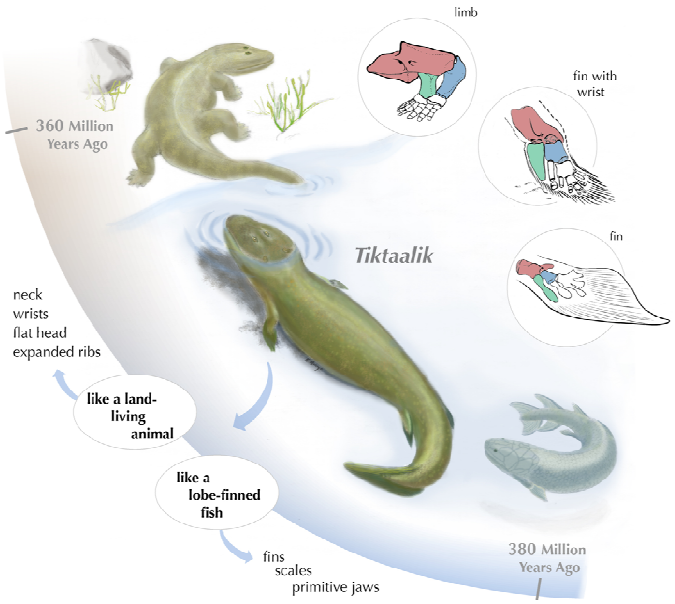
2) Fossil evidence shows that modern whales evolved from land-dwelling organisms.



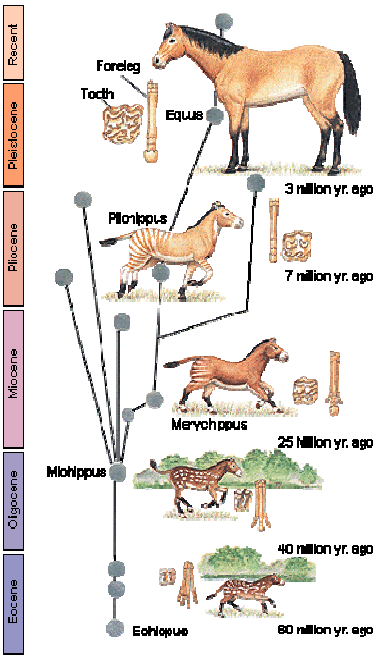


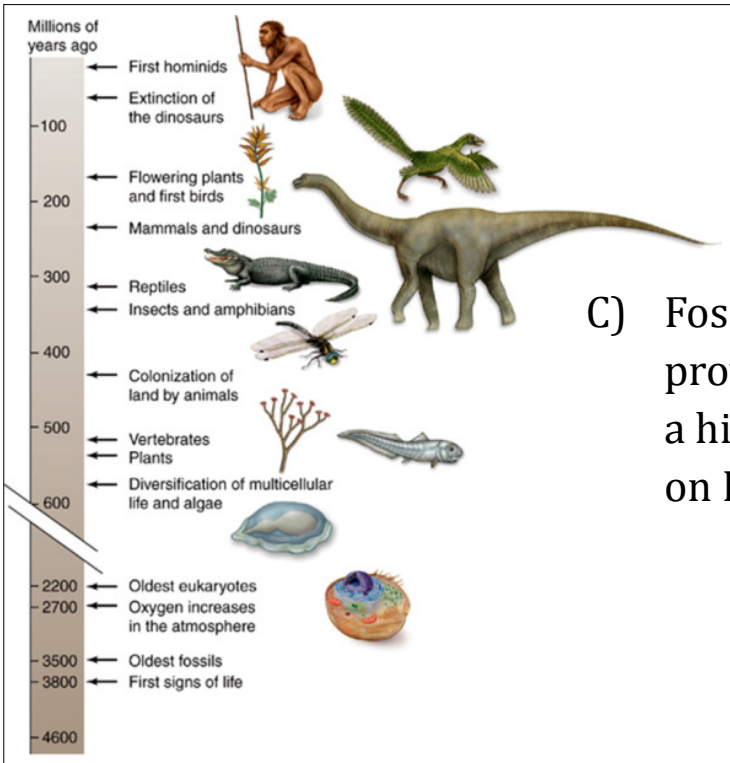


3) Tiktaalik is a transitional form between fish and amphibians.



4) Fossils of horse and their ancestors show that the size of the horse has increased as well as a change in foot from four toes to one hoof.





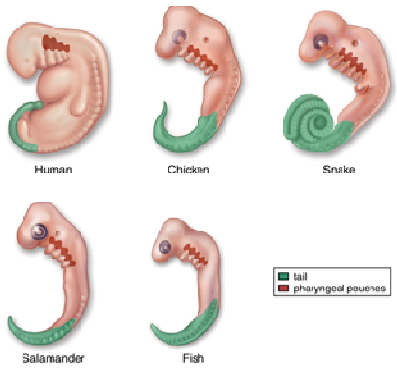
C) Fossil record provides us with a history of life on Earth.

II) Comparative Anatomy

A) Embryology: study of developing embryos

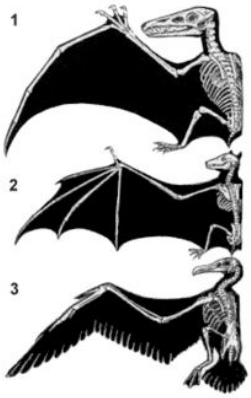
1) Provides strong evidence for a common ancestor because developing embryos of very different species start out having very similar structures

2) Example: Embryos start out with **pharyngeal pouches** that go on to develop into different structures depending on the type of organism: gills in fish, glands and ducts in humans



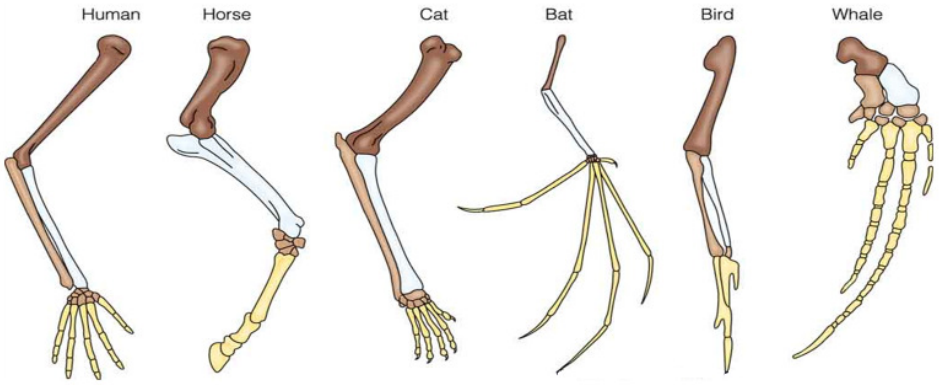
B) Homologous Structures: body structures that have the same basic *form*, but may not necessarily have a similar *function*

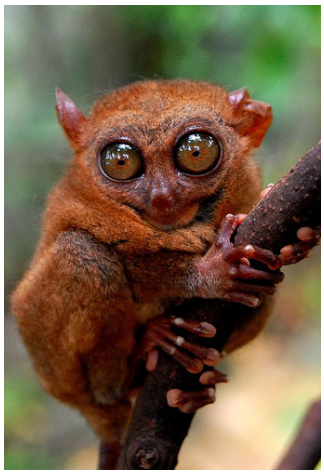
1) Homologous structures suggest a common ancestor.

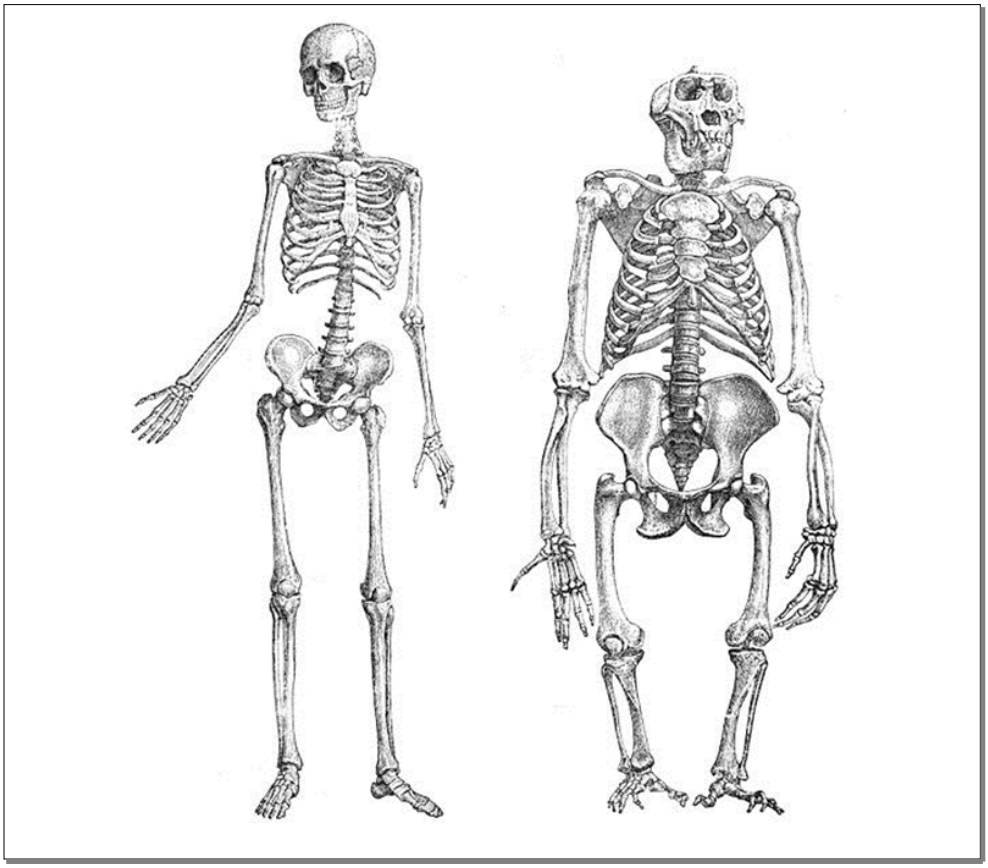


1- pterodactyl
2-bat
3-bird

2) Example: all of these organisms have the same basic bone structure, even though the shape of the bones are different depending on how the limb is used.







C) Vestigial Structures: structure that serves no apparent function, or no longer serves its original function

1) Vestigial structures provide some of the strongest anatomical evidence for evolution because they show ancestral traits that are no longer necessary.

A) Pelvic bones of a whale

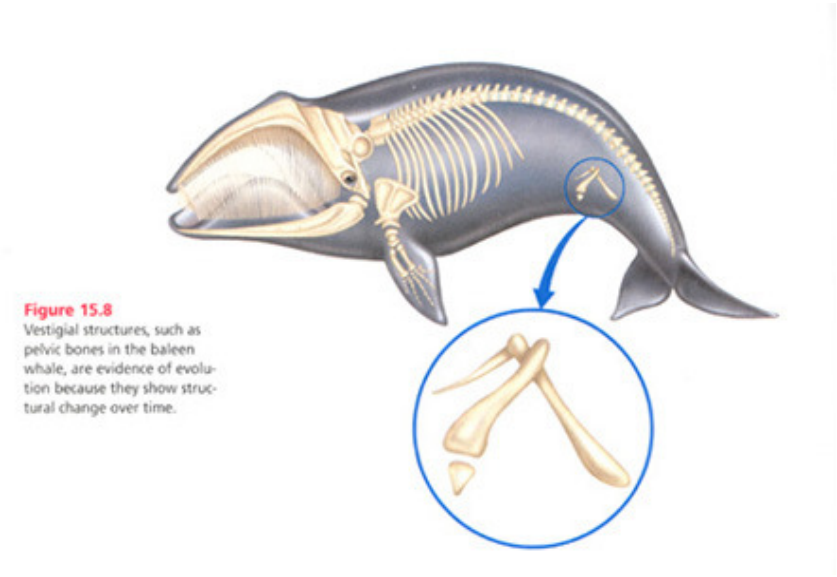
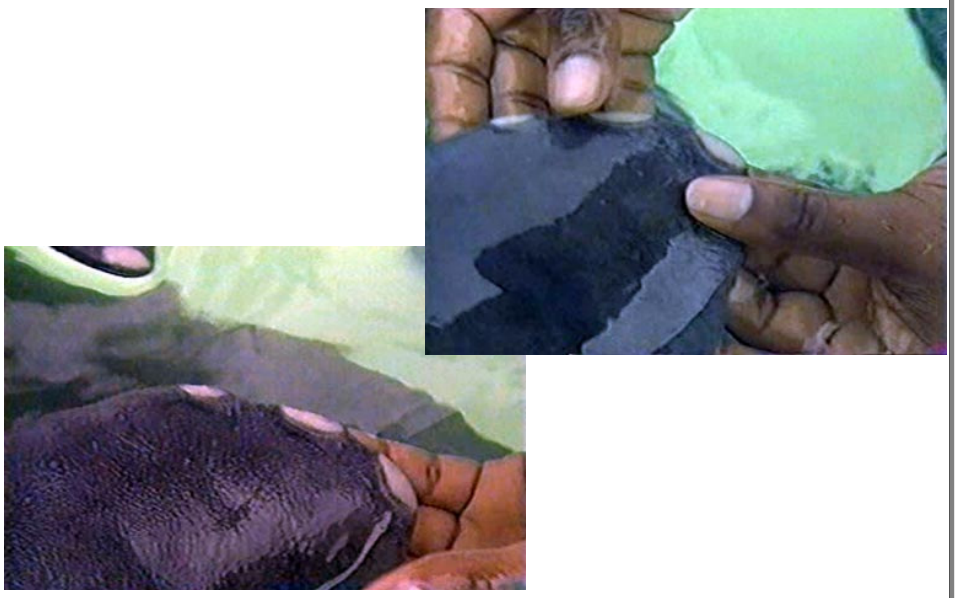


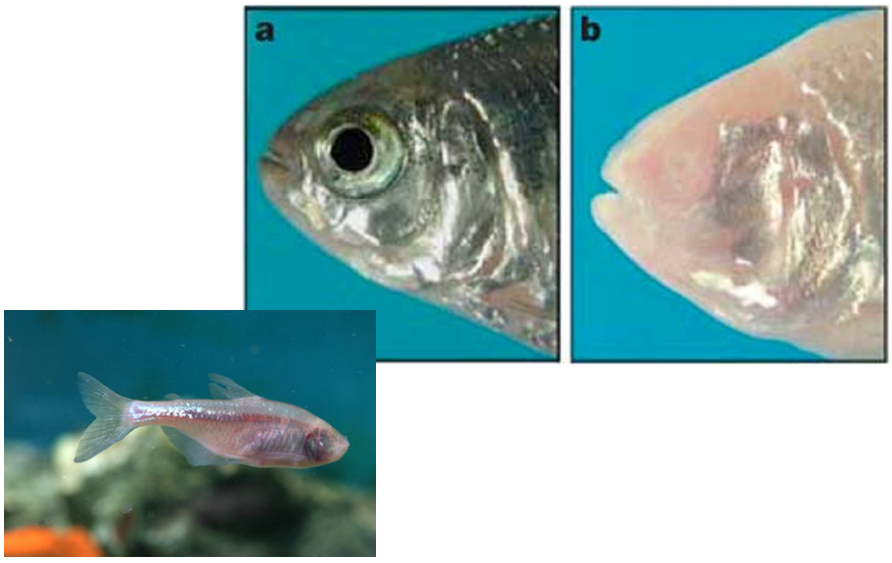
Figure 15.8
Vestigial structures, such as pelvic bones in the baleen whale, are evidence of evolution because they show structural change over time.

B) Rudimentary hip bones of snakes

C) Fingernails on a manatee



D) Nonfunctional eyes on a cave fish



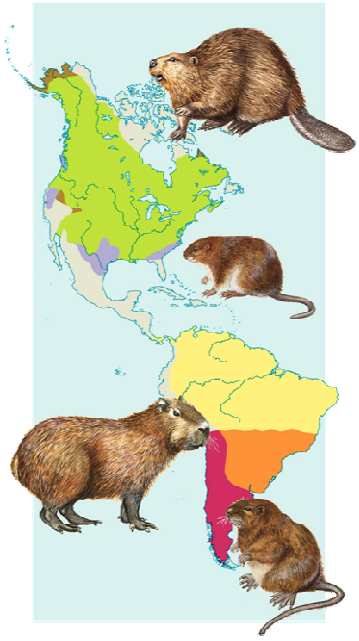
III) Biogeography

A) Convergent Evolution: development of similar traits in organisms that do not share a recent ancestor but live in similar habitats

Rhea

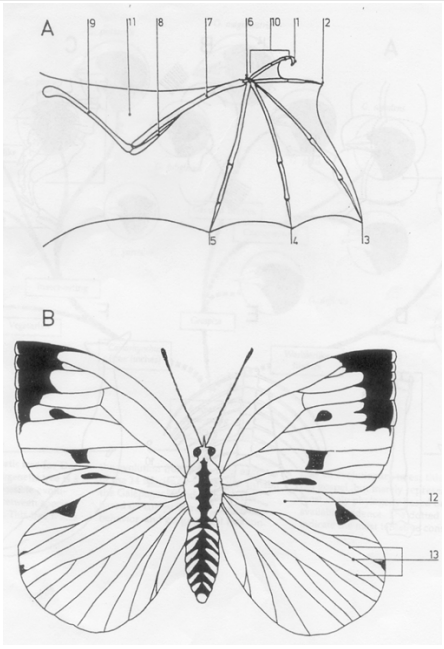
Ostrich

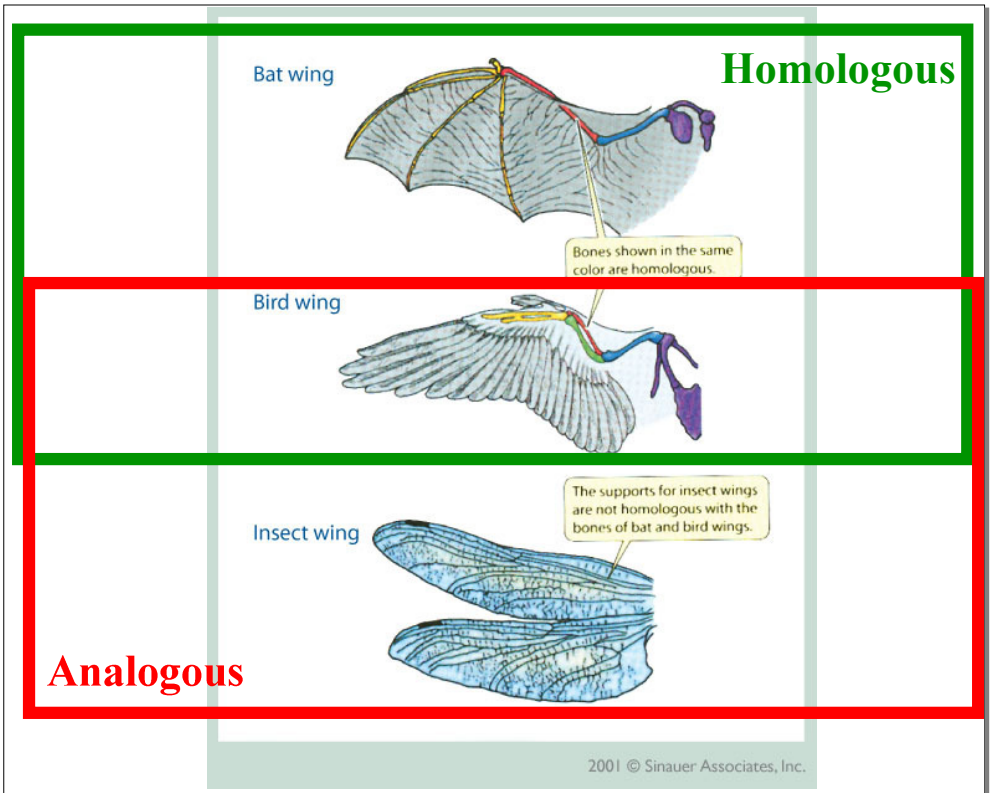
Emu



The beaver and muskrat are closely related to each other, but not the coypu and capybara of South America. Their similarities result from convergent evolution.

B) Analogous Structures: body structures that serve the same *function* but do not have the same *form*





IV) Biochemical Evidence

A) Chemistry of Life

1) All living things are made of the same building blocks, the four macromolecules: proteins, carbohydrates, lipids, and nucleic acids.

2) ATP is used universally among living things as a source of chemical energy.

B) Genetic Information

1) DNA sequences are highly similar between organisms that are closely related.

Phylogeny of 8 species based on DNA sequencing

```
                1   2   3       4           5     6 7
Species A  ACCAGCCTGTGCATCGATGACGACTAAGTGATACCATAAAGACT
Species B  ACCAGCCTGTGCATCGATGACGACTAAGTGATACCATAAAGACT
Species C  ACGAGCATGTGCATCGATGCCGACTAAGTGATACCATAATGACT
Species D  ACGAGCATGTGCATCGATGCCGACTAAGTGATACCATAATGACT
Species E  ACCAGCATGTGTATCGATGCCGACTAAGTGATACCAAAATGACT
Species F  ACCAGCATGTGTATCGATGCCGACTAAGTGATACCAAAATGACT
Species G  ACCAGCATGTGTATCGATGCCGACTAAGTGCTACCATAATGACT
Species H  ACCAGCATGTGTATCGATGCCGACTAAGTGCTACCATAATGACT
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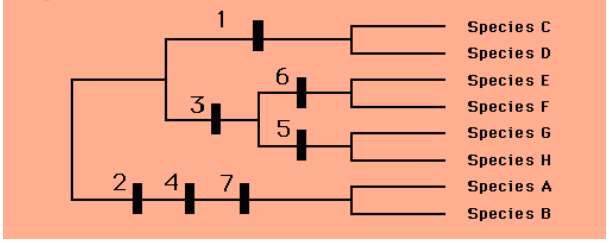
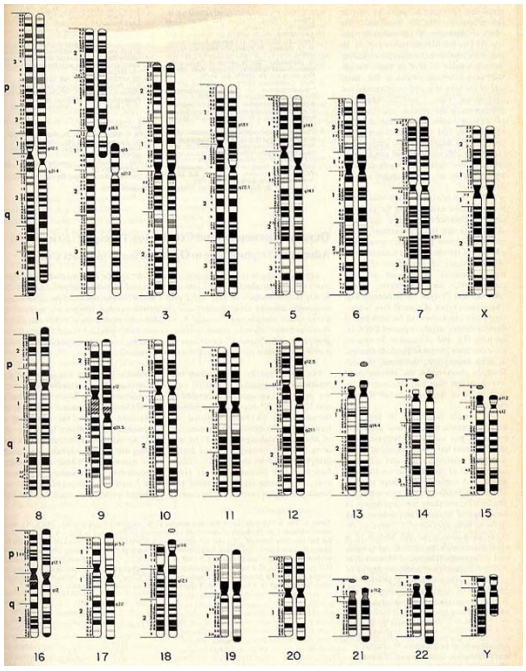


2) Because DNA is used to store the information for a cell to make proteins, sometimes amino acid sequences are used to determine relationships instead of DNA.



3) Example: humans share over 98% of their DNA with chimpanzees, yet only about 85% with mice