

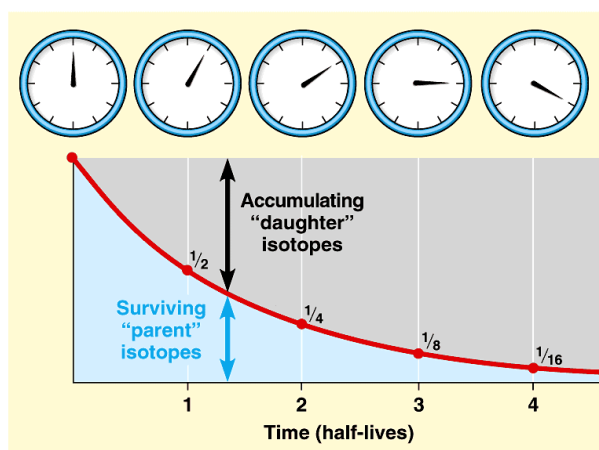
Tracing Phylogeny

A. Fossils:

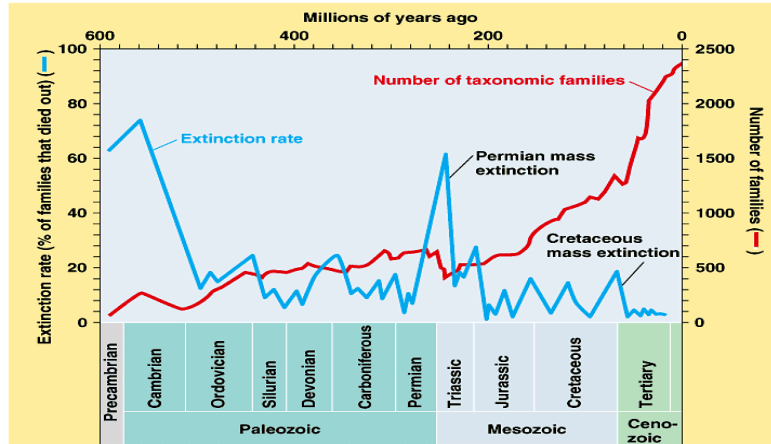
•Some fossils form as _____ is weathered and eroded from the land and carried by rivers to seas and _____ where the particles settle to the bottom. Deposits pile up and _____ the older sediments below into rock. It is usually just the _____ of the organism that get preserved as a fossil, while soft tissue decays. And sometimes _____ seep into the tissues and replace its organic material as is done with _____.

•Other fossils form by leaving an empty _____ that becomes filled with minerals. Some _____ fossils leave behind _____ or burrows that show the animal's _____. And sometimes an entire preserved organism gets found in _____-fossilized tree sap, or frozen in ice, or in _____ where decomposition is slowed down.

•There are 2 methods to date fossils: _____ dating and _____ dating. Relative dating relies on the position of fossils in _____. The deeper a fossil is in the rock layers, the _____ it is. This tells us the _____ in which groups of species existed but not the _____ of a fossil. Absolute dating does not tell us the “absolute”/ errorless age of a fossil, but gives us a close number. Absolute dating is done with the aid of _____ dating. This method relies on the fact that all fossils contained _____ when they were alive and these isotopes _____ at a fixed rate. For example, _____ has a _____ of 5,600 years. This means, it takes that long for 50% of the original sample to decay because isotopes are _____. C-14 is used to date relatively _____ fossils, while radioactive isotopes with longer half-lives like _____ with a half-life of 4.5 billion years is used to date older rocks.



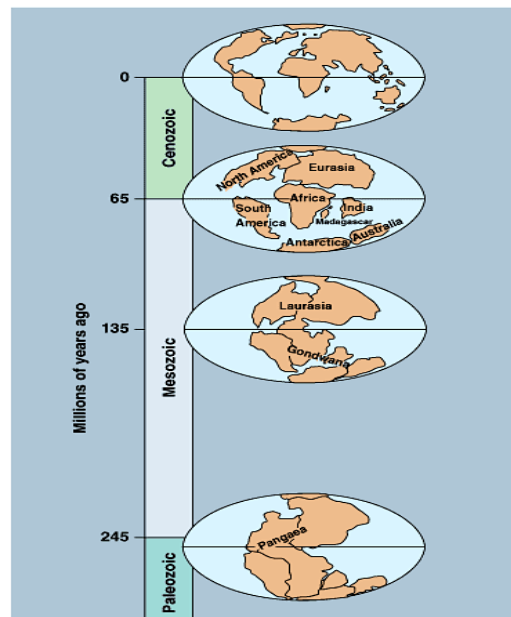
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•The _____ scale can be divided into 4 _____, many _____, and many _____. The 4 eras starting with the oldest are the _____, paleozoic, mesozoic, and _____. The geological time scale is not divided arbitrarily, but corresponds to times of great change.

•The continents are not _____, but are drifting on _____ above a hot mantle. The movement of plates leads to _____ building, _____, and _____. About _____ plate movements brought the land masses on earth together into a “supercontinent” called _____. Species that had evolved in isolation were now together, shorelines _____, causing a _____ continental interior. This also led to a mass _____.



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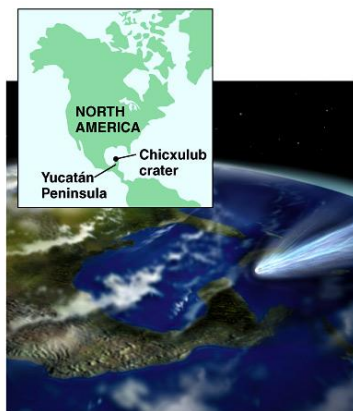
•The fossil record reveals an episodic history with long periods punctuated by a turnover in species composition. These episodes include _____ and _____. One adaptive radiation that was particularly impressive was the _____ between the Precambrian and Paleozoic eras.

This marked a drastic change in _____ life. The Cambrian animals were the first to have _____ body parts like _____, skeletons and claws. This allowed for many new complex body designs and altered many _____ relationships. In fact, many believe that all animal _____ that exist today evolved during this time.



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•Adaptive radiation most often follows mass extinctions. There have been many extinctions in earth’s history, but 2 are most noted. The one we already spoke of 250 million years ago (the Permian extinction) when pangea came together. _____ of life was destroyed allowing then for mammals and _____ to flourish. The other extinction occurred _____ in the _____ period. This marked the end of the _____ and furthered the evolution of _____ -flowering plants. Many theories exist to what caused this mass extinction. Volcanic eruptions in what is now India blocking out the sun, an _____ colliding in the Yucatan Peninsula sending a great cloud of dust into the air and also blocking out the sun for possibly years and setting off a _____ across the N.A. continent killing most life there upon impact. The species that managed to survive the crisis adaptively radiated to fill the vacant zones caused by the extinction.



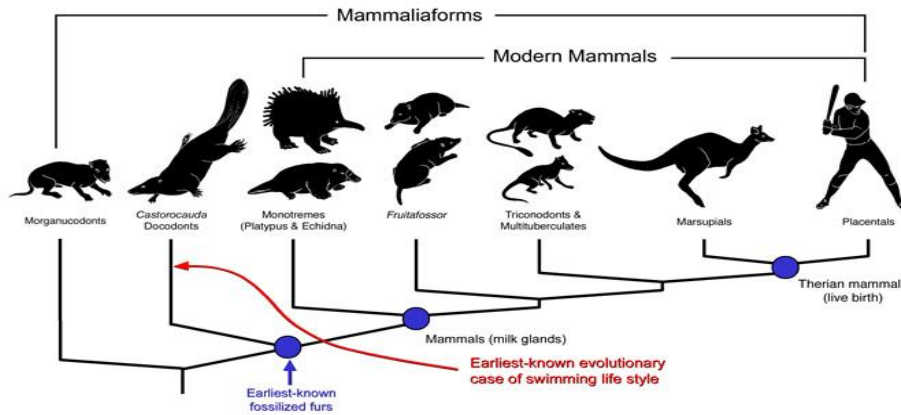
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B. Phylogeny and Systematics:

• _____ is the evolutionary history of a species . Reconstructing phylogeny is done with the aid of _____-the study of biological _____ in an _____ context. Biologists represent the genealogies of organisms with _____ trees -diagrams that trace evolutionary relationships as best that can be determined. Systematists use _____, the identification and classification of species, in their attempts to arrange organisms in categories that reflect their _____ history/ phylogeny.

•Phylogenetic trees are _____ of past history based on available data. They are based upon _____ evidence, comparative anatomy, embryology, and comparing _____ and proteins. Comparing DNA and/or proteins is the most precise method in constructing evolutionary relationships if the DNA / proteins are available. Then DNA can be analyzed by use of _____ or _____-comparing the actual nucleotide sequences of DNA segments. To measure the differences between two species, one can then identify nucleotides found in both species and determine if they have common ancestry.



Where does *Castorocauda* fit on the mammalian family tree?

Graphics: Mark A. Klingler / CMNH

•Recall that likeness attributed to shared ancestry is called _____ - the forelimbs of mammals for example, having a common ancestor. But not all likeness is inherited from a *common* ancestor. Species from different evolutionary branches may come to resemble one another if they have similar _____ roles and natural selection has shaped similar _____. This is called _____ evolution and similarity due to convergence is called _____, not homology. For example, the _____ of insects and birds are _____ for flight that evolved independently and are built from entirely different structures. With developing phylogenetic trees and classify organisms we must use _____ similarities only! The greater the number of homologous parts between 2 species, the _____ closely related they are. And the more complex 2 similar structures are, the _____ the chance that they evolved from one common ancestor. For example, the _____ of humans and chimpanzees are made of many bones and

the two skulls match almost perfectly, bone for bone. It is highly unlikely that chimpanzees and humans have _____ origins.



Q: How does this image display convergent evolution?

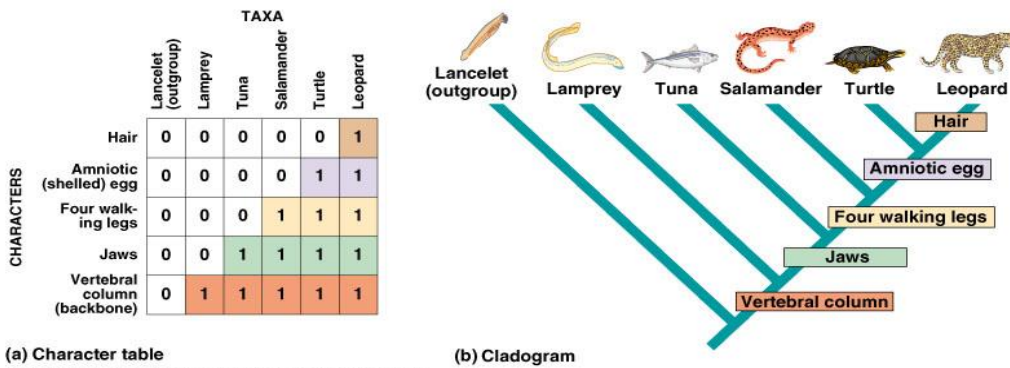
C. Search for Fossilized DNA:

•Even when a frozen or dried fossil is recovered, it is rare that the DNA is intact. Often the DNA is contaminated from _____ or _____ or it has changed shape/ broken down. Pieces of DNA mined from any fossil represent only fractions of an organism’s whole genome. This is the case with the _____, the DNA found is in pieces and this makes it difficult to clone an entire extinct organism.

D. Phylogenetic Trees Versus Cladograms:

•Phylogenetic trees have 2 significant features: 1) the location of branch points along the tree symbolize the relative _____ of origin of different organisms 2) the extent of divergence between branches represents how different 2 organisms have become since branching from a common ancestor.

•With a _____, the actual organisms are treated as terminal _____, and the branching structure is determined solely by _____ characteristics- _____ structures that evolved in an ancestor that are common to all species on _____ branch of a fork in the tree, but not common on the other branch.



•So basically a cladogram is a _____ of phylogenetic tree. And the *main* difference between phylogenetic trees and cladograms is with phylogenetic trees, the _____ of the branch is proportional to _____ / divergence from a branch point. With cladograms, the length of branches is _____ and only _____ is significant.