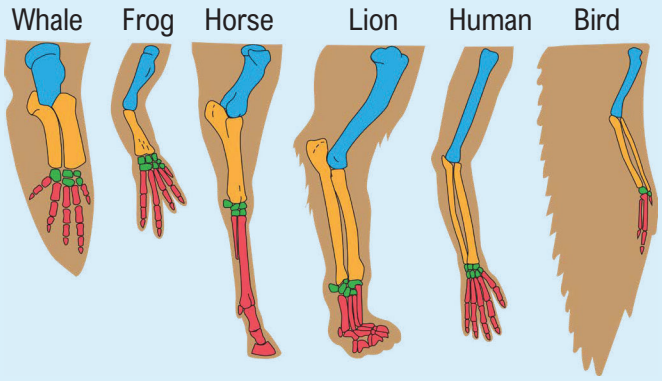
TOPIC: EVIDENCE OF EVOLUTION

Homology and Analogy

◆ *Recall*: Common descent: species share common _____.

◆ **Homology:** traits with similar _____ structure suggest common ancestry.

- E.g., upper limb bones in tetrapods.



Homo: Greek = same

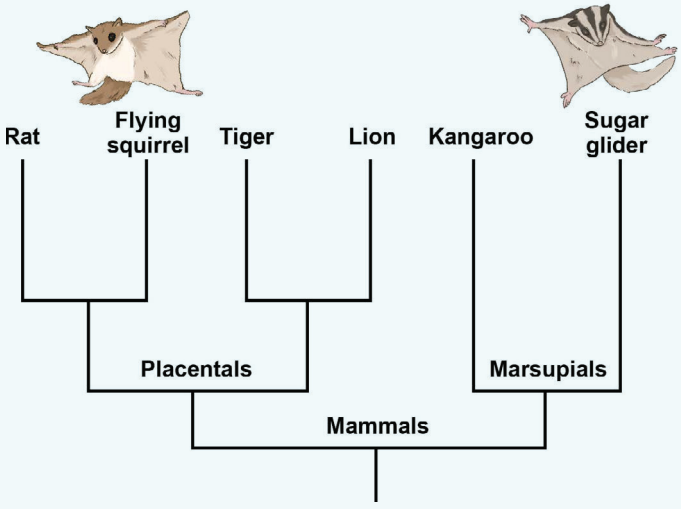
◆ **Analogy:** functionally similar traits with different _____ origins.

- E.g., wings in bees, birds, and bats.

Ana: Greek = again

EXAMPLE

Given the evolutionary tree below, do you expect the ability to glide using skin flaps in the North American flying squirrel and the Australian sugar glider to be an example of homology or analogy? Explain your reasoning.



Homology or Analogy: _____

Reasoning: _____

_____

PRACTICE

A similar arrangement of internal organs is observed in birds, rodents, and frogs. This is likely an example of:

a) Analogy. b) Use and Disuse. c) Homology. d) Uniformitarianism.

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PRACTICE

The potato (*Solanum tuberosum*) and the sweet potato (*Ipomoea batatas*) are both plants that form starchy tubers. A tuber is an underground part of plant used for nutrient storage and is the part of the potato and sweet potato that we eat. Most other plants of both the genus *Solanum*, which includes the tomato and the eggplant, and the genus *Ipomoea*, which includes the morning glory, do not form tubers. As described do you think the tubers found in potatoes and sweet potatoes are more likely an example of analogy or homology and why?

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a) Homology, because the tuber phenotype is extremely similar in both plants.

b) Homology, because potatoes and sweet potatoes likely share a common ancestor.

c) Analogy, because the tuber is a structure that likely first evolved in the common ancestor of these plants.

d) Analogy, because the presence of a tuber in these plants likely arose separately in each population.

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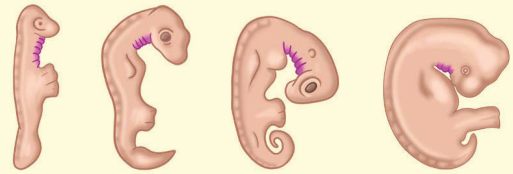
Types of Homologies

Vestigial Structures:

- Traits that have lost most or all of their _____ function.
  - e.g., pelvic girdle and femur in snakes, wings on an ostrich, human goosebumps.

Embryologic Homology:

- Organisms share traits as embryos that are not shared in _____.
  - e.g., pharyngeal arches and -anal tail.



Molecular Homology:

- _____ and Protein sequences are more similar in related organisms.

Lion: TAGTTCTATCCATCTTAATCTTAGCAATTA
Tiger: TAGTCTTATCCATCTTAATCTTAGCCATTA
House Cat: TAGTACTCTCCATCCTAGTACTAGCAATCA

EXAMPLE

Below are the DNA and amino acid sequences for three different but related species. Use the sequences to answer the following questions.

a) Based on the DNA sequence, which of the two organisms do you expect to be more closely related?

_____

b) Based only on these data, do you expect to see differences in the traits of these organisms? Why or why not?

_____

_____

DNA

Species 1:	TCG	GCC	TCT	TTG	CGA	GAA
Species 2:	TCA	GCT	TCC	TTA	CGC	GAG
Species 3:	TCG	GCC	TCT	TTA	CGA	GAA

Amino Acid

Species 1:	Ser	Arg	Arg	Asn	Ala	Leu
Species 2:	Ser	Arg	Arg	Asn	Ala	Leu
Species 3:	Ser	Arg	Arg	Asn	Ala	Leu

c) Circle the regions of the DNA & amino acid sequences that show homology in all three organisms.

d) Did you circle the same regions for both sets of sequences? Explain why or why not.

_____

_____

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PRACTICE

Different alleles of the *MC1R* gene have been associated with hair/coat color variation in many different mammals, including mice, jaguars, cows, and humans. In humans, specific mutations of the *MC1R* gene are associated with red hair. Using the concept of homology, explain why the same gene would affect similar traits in multiple organisms.

a) Because the *MC1R* gene affects hair/fur color variation, you can expect that the gene will change often as organisms adapt to different environments.

b) Since hair color is not a trait that confers a survival or reproductive advantage in humans, the *MC1R* gene can be considered an example of a vestigial trait.

c) The *MC1R* gene was likely involved in coat color determination in the common ancestor of these organisms and maintains that role in each of these lineages.

d) It is likely that the *MC1R* gene evolved to control hair/fur color separately in each lineage, as the presence of hair/fur is a homologous trait in mammals.

PRACTICE

Which of the following statements describes a vestigial structure?

a) While cats have much better balance than humans, the inner ear structures responsible for balance are largely the same in both cats and humans.

b) Owls' arteries are located much closer to the spine than in other birds, allowing for extreme neck flexibility without diminished blood flow.

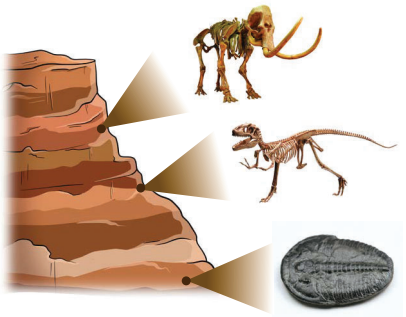
c) A peacock's tail is large and brightly ornamented to advertise its fitness to females.

d) Cave salamanders live in complete darkness but still develop eyes with limited functionality.

TOPIC: EVIDENCE OF EVOLUTION

Fossils

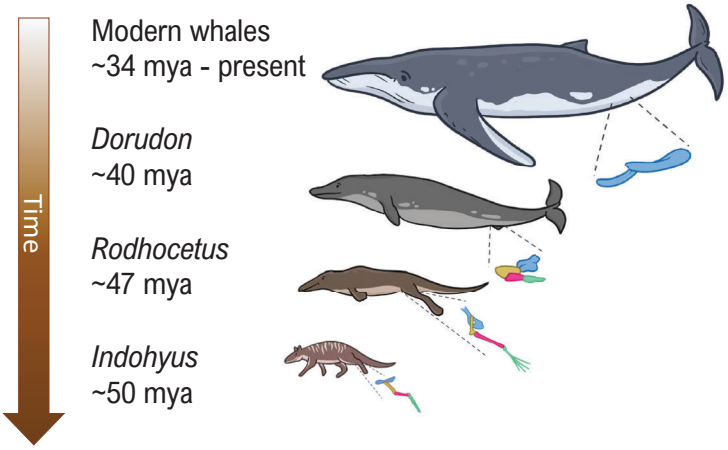
- Geologic layers provide evidence for broad patterns in evolution:
  - Create a _____ for Earth. (deeper = _____).
  - _____ layers have very _____ organisms than today.
    - Demonstrates both extinctions & _____ change.



- Fossils demonstrate specific evolutionary histories and _____.

Hypothesis: Whales evolved from 4-legged _____ ancestors.

Expectation: We should find whale-like fossils with _____ leg structures.



PRACTICE

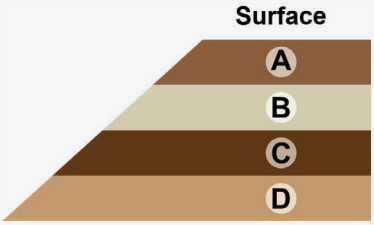
Sedimentary rock creates distinct layers that paleontologists can use to help interpret their findings. Use the image below to determine which of the following statements is true about fossils and sedimentary rock.

a) The fossils found in layer B will be older than the fossils in layer A.

b) More fossils are likely found in layer C than in layer B.

c) Fossils are most likely to be found in the transitions between layers.

d) Fossils in layer C are likely to be the ancestors of fossils in layer D.



TOPIC: EVIDENCE OF EVOLUTION

PRACTICE

Dinosaurs went extinct approximately 65 million years ago (mya). Fossils of the organism *Archaeopteryx* have been found in strata dating to approximately 150 mya. These fossils show a dinosaur-like skeleton with a bony tail, teeth, and claws, as well as clear impressions of feathers similar to those found in flying birds. It is thought that *Archaeopteryx* belongs to a group of dinosaurs from which birds evolved. Which statement below is consistent with the evidence presented above?

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a) Because *Archaeopteryx* had more dinosaur-like traits than bird-like traits, it should not be considered a transitional form.

b) Flight is an analogous trait found in both dinosaurs and birds.

c) *Archaeopteryx* should be considered a bird and not a dinosaur due to the presence of feathers.

d) At least some traits common in modern birds evolved long before dinosaurs went extinct.