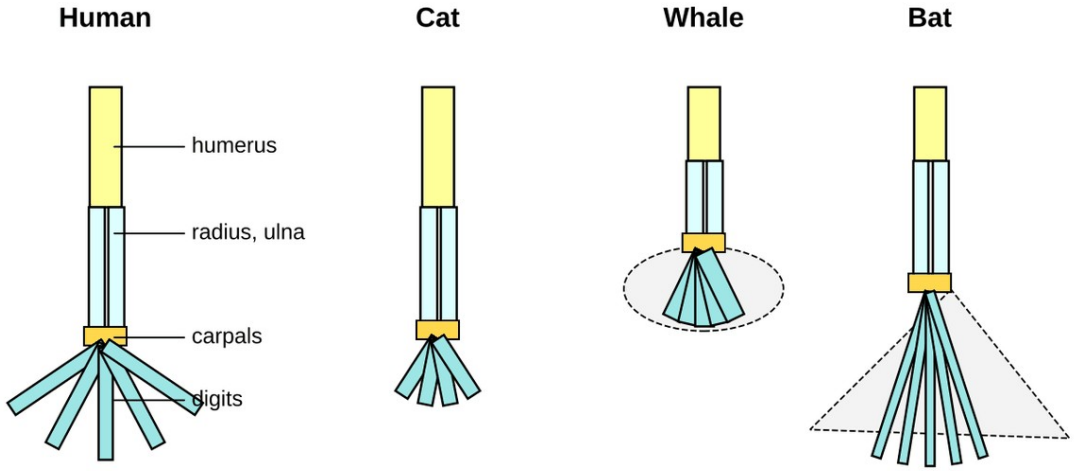
Essential Question

How do shared body structures and DNA point to common ancestors?

Homologous Structures

- Homologous structures: same basic design, different jobs
- Inherited from a common ancestor
- The forelimbs of mammals have the same bones
- Different uses come from changes in shape and size



Simplified drawings. Whale and bat shading shows the paddle and the wing membrane.

Homologous, Analogous, and Vestigial Structures

- Analogous: similar job, but different structure and origin
- Analogous structures do not show common ancestry
- Vestigial: reduced structures with little or no use
- Vestigial structures are remnants from ancestors

Type	What it is	Example	Shows common ancestry?
Homologous	Similar structure from a common ancestor, often with different functions	Human arm and whale flipper	Yes
Analogous	Similar function but different structure and origin	Wing of a bat and wing of an insect	No. They evolved separately in similar environments.
Vestigial	Reduced structure with little or no function	Tiny hip bones in whales, tailbone in humans	Yes. They are remnants of structures in ancestors.

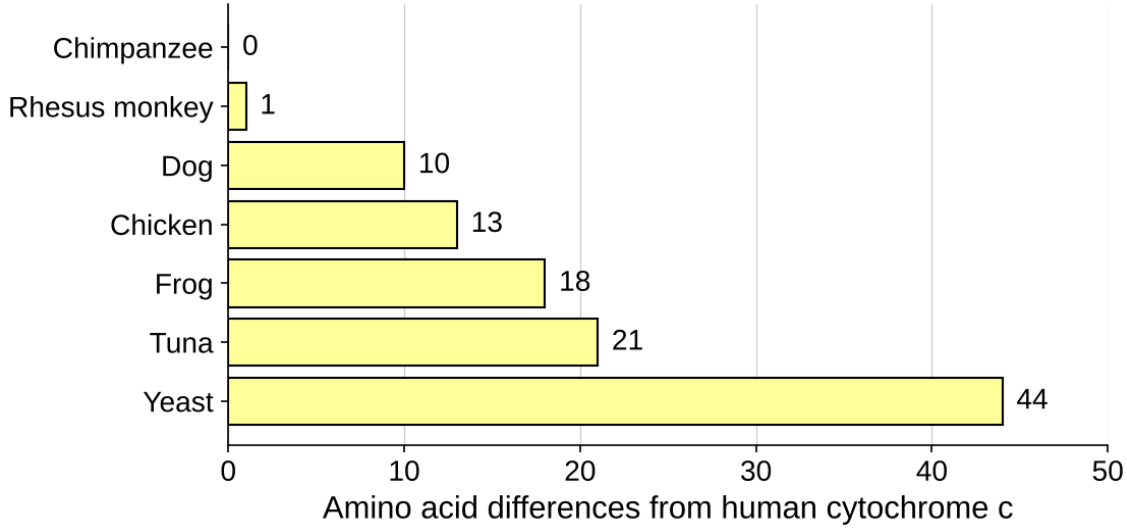
Embryos Show Shared Ancestry

- Early vertebrate embryos look alike
- All have pharyngeal pouches and a tail
- Features develop into different adult structures
- Similar development points to shared ancestors

Embryo feature	Present in embryos of	What it becomes
Pharyngeal pouches	Fish, reptiles, birds, mammals (including humans)	Gills in fish; parts of the ear and throat in humans
Tail	Fish, reptiles, birds, mammals (including humans)	Tail in many animals; the tailbone in humans

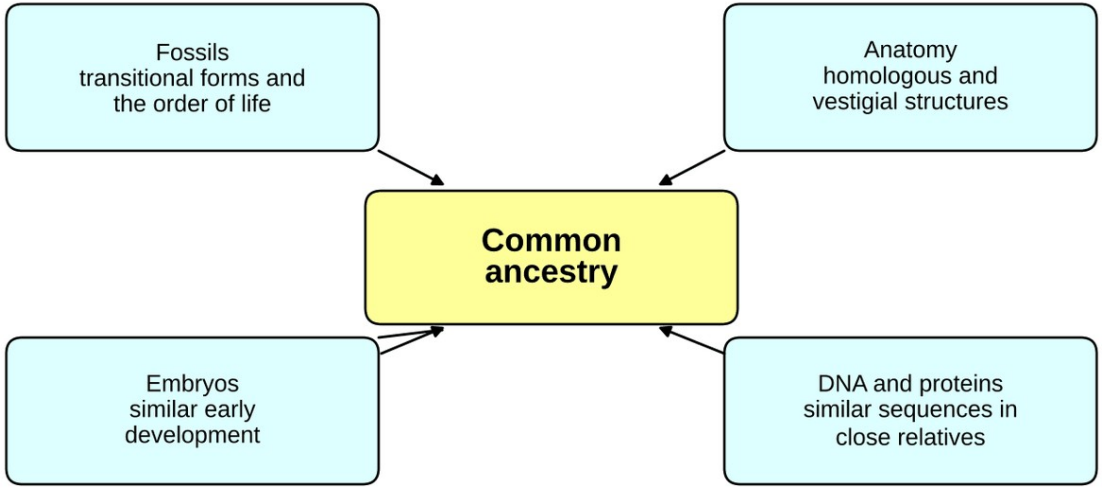
DNA and Protein Evidence

- All life uses DNA and the same genetic code
- Related species have more similar DNA and proteins
- Fewer differences mean a more recent common ancestor
- Cytochrome c is a protein found in many species



Lines of Evidence Agree

- Fossils, anatomy, embryos, and DNA are independent
- They point to the same family tree
- Agreement from many sources makes the evidence strong



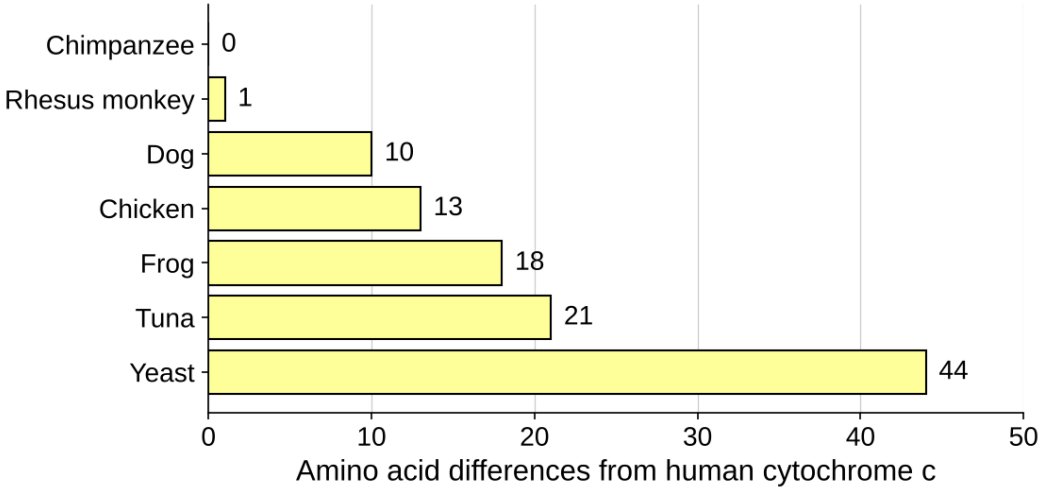
Example: Comparing DNA Sequences

The table shows a 20-base section of the same gene in three species. Find the percent of bases that are identical between Species A and Species B, and between Species A and Species C. Which species is more closely related to A?

Species	DNA sequence (20 bases)
A	ATGGCTAAGCTTGACCATGA
B	ATGGCTAAGCTCGACCGTGA
C	ATAGCCAATCTAGATCACGA

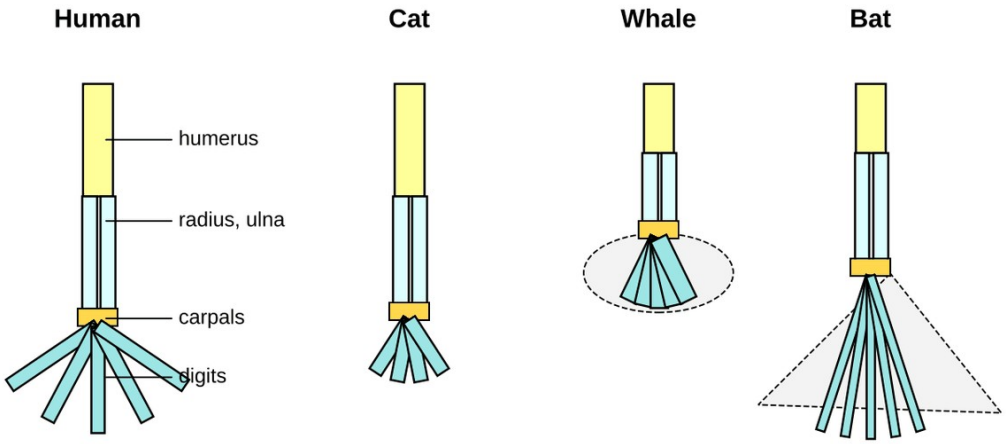
Example: Cytochrome c Data

Use the graph of cytochrome c differences from humans. (a) Which species has the most similar protein to humans? (b) Which is more closely related to humans, a dog or a chicken? (c) How many more differences does yeast have than tuna?



Example: Homologous or Analogous?

(a) Compare the bones of a human arm and a whale flipper. Are they homologous or analogous? (b) A bat's wing and an insect's wing are both used for flight. Are they homologous or analogous? Explain each answer.



Simplified drawings. Whale and bat shading shows the paddle and the wing membrane.

Anatomical and Molecular Evidence

Big Ideas

- Homologous structures: same design from a common ancestor
- Analogous structures: similar job, separate origin
- Vestigial structures are remnants from ancestors
- More similar DNA and proteins mean closer relatives
- Many independent lines of evidence agree