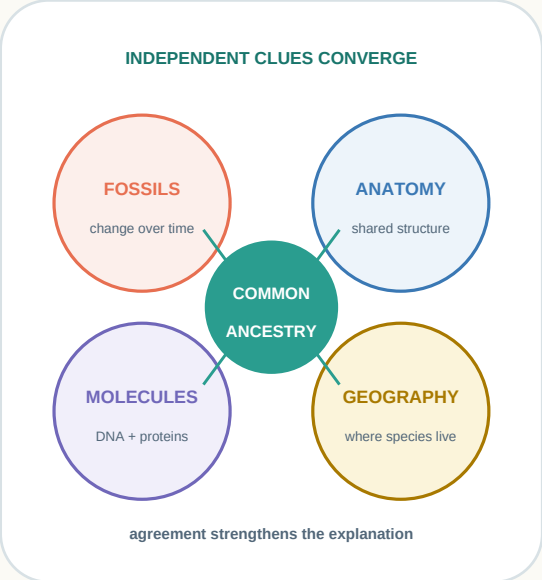
AP BIOLOGY | UNIT 7

TOPIC 7.6

Evidence of Evolution

Fossils, anatomy, biogeography, and molecular sequences independently record descent with modification through time.



THE CORE CAUSAL CHAIN

OBSERVE — collect patterns → **COMPARE** — identify similarity → **INFER** — test relatedness → **CONVERGE** — support ancestry

BY THE END, YOU SHOULD BE ABLE TO...

1. Connect fossil position in rock layers with change through time.
2. Distinguish homologous, analogous, and vestigial structures.
3. Use DNA or protein similarity to infer evolutionary relatedness.

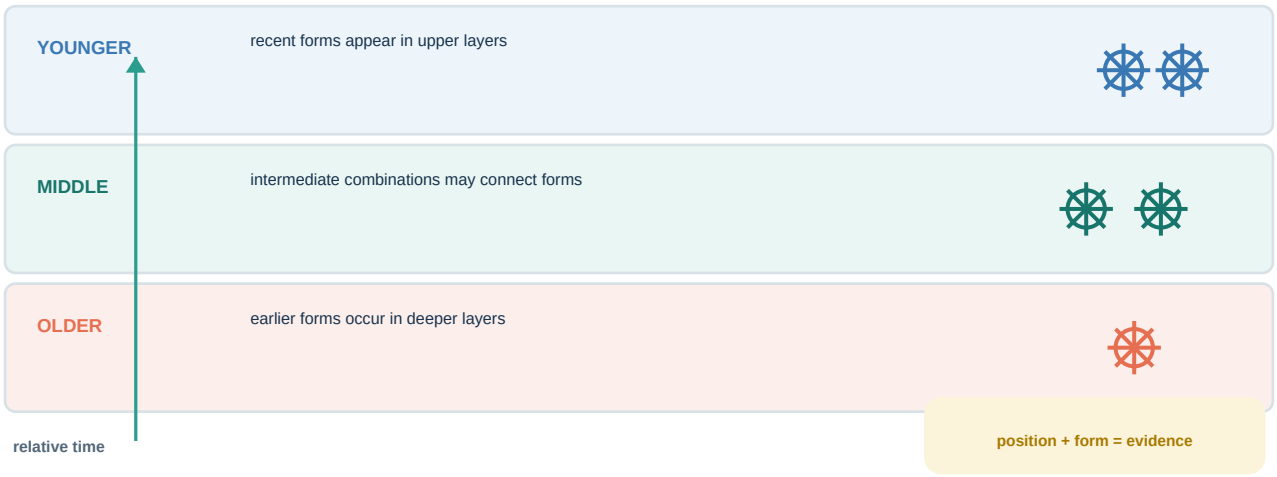
CENTRAL IDEA

The strongest evolutionary explanation is supported when independent evidence types reveal the same branching pattern of common ancestry.

1 Fossils and anatomy record descent with change

Rock layers provide a time sequence; inherited structural patterns connect extinct and living organisms to shared ancestors.

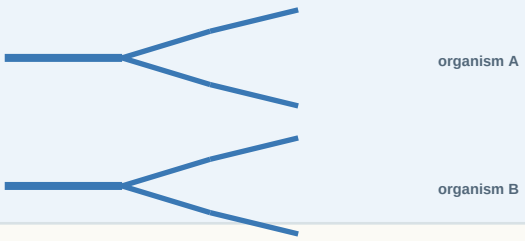
THE FOSSIL RECORD ADDS A TIMELINE



STRUCTURE: SAME ORIGIN OR SAME JOB?

HOMOLOGOUS STRUCTURES

Same underlying pattern; functions may differ. This supports common ancestry.



ANALOGOUS STRUCTURES

Similar function but different origin. This reflects convergent evolution.



VESTIGIAL STRUCTURES

A reduced inherited feature may have little or a different current function. Its structural connection to an ancestral feature supports descent with modification.

KEY DISTINCTION

Similarity supports common ancestry only when it reflects inherited structure, not merely a similar environmental challenge.

2 Molecules and geography reveal branching history

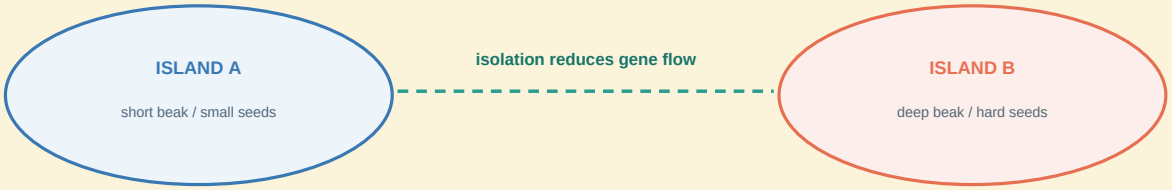
Sequence differences accumulate after lineages split, while geographic patterns show how isolation and movement shaped diversification.

MOLECULAR COMPARISON: FEWER DIFFERENCES, CLOSER RELATIONSHIP

SPECIES	DNA SEGMENT	DIFF.
Reference	ATGCCATGAA	0
Species B	ATGCCATGAG	1
Species C	ATACCCTGTT	4

Species B is inferred to share a more recent common ancestor with the reference than Species C does.

BIOGEOGRAPHY: LOCATION PREDICTS EVOLUTIONARY PATTERNS



Closely related species often cluster geographically, while isolation allows populations to diverge.

HOW TO INTERPRET THE EVIDENCE

USE MULTIPLE DATA SETS

Fossils, anatomy, sequences, and geography should be tested together.

DO NOT EQUATE SIMILARITY WITH PROOF

Convergence can create similar traits in distantly related lineages.

FINAL MAP

Fossils place change in time; homologies reveal inherited structure; molecules estimate relatedness; geography explains isolation. Agreement supports common ancestry.