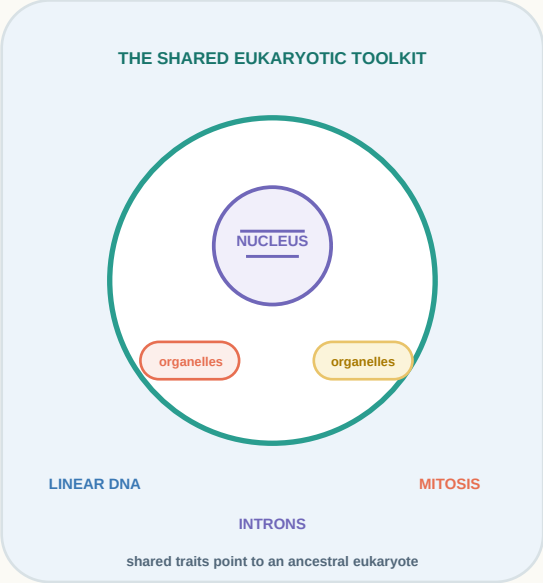
AP BIOLOGY | UNIT 7

TOPIC 7.7

Common Ancestry

Shared cellular architecture and molecular processes indicate that modern eukaryotes descended from a common ancestral lineage.



THE CORE CAUSAL CHAIN

SHARED TRAITS → across eukaryotes

INHERITANCE → traits are conserved

BRANCHING → lineages diverge

ANCESTRY → one source lineage

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

1. Identify cellular structures shared by eukaryotes.
2. Connect linear chromosomes and introns with shared ancestry.
3. Explain why conserved traits support a branching history.

CENTRAL IDEA

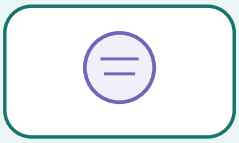
Complex shared traits are best explained as inherited features from a common ancestor, especially when their structure and function agree.

1 Eukaryotes share a cellular blueprint

Plants, animals, fungi, and protists differ greatly, yet their cells preserve a common compartmentalized organization and chromosome system.

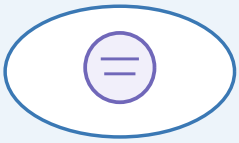
DIFFERENT LINEAGES, SHARED CELL PLAN

PLANT



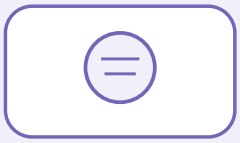
nucleus + organelles

ANIMAL



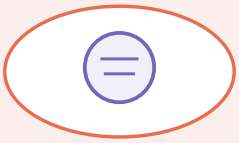
nucleus + organelles

FUNGUS



nucleus + organelles

PROTIST



nucleus + organelles

STRUCTURAL AND FUNCTIONAL EVIDENCE

MEMBRANE-BOUND ORGANELLES

Internal compartments separate processes and coordinate complex cell functions.

CYTOSKELETON + CELL DIVISION

Related proteins organize cells and move chromosomes during mitosis or meiosis.

TRANSCRIPTION + RNA PROCESSING

Eukaryotic cells make pre-mRNA and remove introns before translation.

ENERGY TRANSFORMATION

Mitochondria and related pathways conserve energy in a shared cellular framework.

LINEAR CHROMOSOMES HAVE ENDS



Shared chromosome organization suggests inheritance from an ancestral eukaryotic cell.

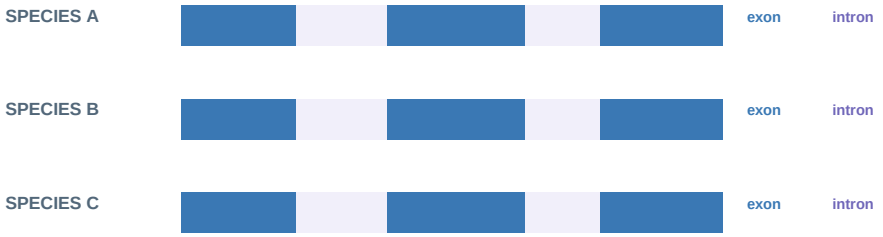
WHY THIS SUPPORTS ANCESTRY

The same integrated cell plan across diverse lineages is unlikely to be a collection of unrelated coincidences; inheritance explains the pattern parsimoniously.

2 Molecular patterns preserve shared history

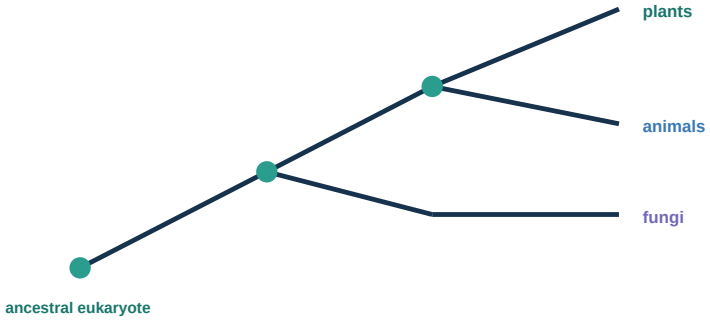
Conserved genes, shared intron positions, and related protein systems can be inherited across branches after an ancestral lineage divides.

INTRON-EXON ORGANIZATION IS A MOLECULAR CLUE



matching positions are inherited clues

SHARED TRAITS MAP ONTO A BRANCHING HISTORY



A trait shared by every branch likely arose before their split. A trait shared by fewer branches may have arisen later.

INTERPRET THE PATTERN, NOT JUST THE LIST

CONSERVED COMPLEXITY

Shared, coordinated systems are unlikely to arise independently in exactly the same form.

NESTED SIMILARITY

Traits shared by subsets of lineages support successive branch points.

IMPORTANT SCALE

Universal features such as DNA and ribosomes support ancient common ancestry of all life. Eukaryote-specific features support a later common eukaryotic ancestor.

FINAL MAP

Shared cell architecture + linear chromosomes + intron-containing genes + conserved processes = evidence for eukaryotic common ancestry.