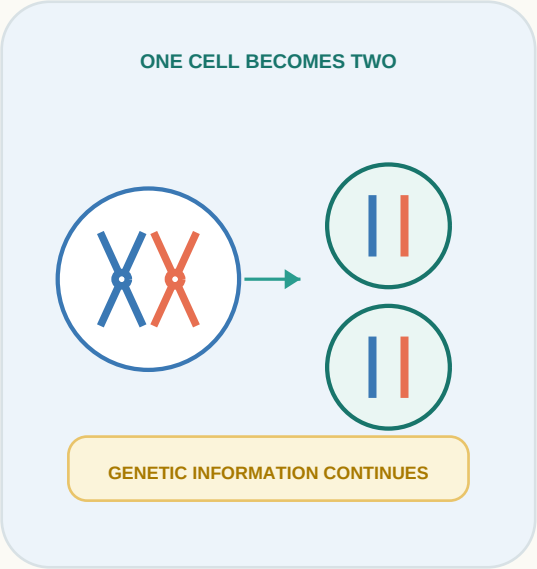
AP BIOLOGY | UNIT 4

TOPIC 4.5

Cell Cycle

The eukaryotic cell cycle coordinates growth, DNA replication, nuclear division, and cytoplasmic division to produce two daughter cells.



THE CORE CAUSAL CHAIN

G1
growth and function

→

S
DNA replicates

→

G2
division preparation

→

M + CYTOKINESIS
cell divides

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

1. Sequence G1, S, G2, mitosis, and cytokinesis.
2. Track DNA and chromosomes through the cycle.
3. Explain why organisms use controlled cell division.

CENTRAL IDEA

DNA is copied once during S phase, then duplicated chromosomes are separated during mitosis so each daughter cell receives the same chromosome set.

1

Interphase grows the cell and copies DNA

G1, S, and G2 make up interphase; the cell performs normal functions, duplicates its DNA, and prepares for nuclear division.

THREE PARTS OF INTERPHASE

G1

GROWTH AND ACTIVITY

Cell grows, makes proteins, and performs its specialized functions.

S

DNA SYNTHESIS

Each DNA molecule is replicated to create sister chromatids.

G2

PREPARATION

Cell continues growth and prepares structures needed for division.

WHAT CHANGES DURING S PHASE?

BEFORE S PHASE



DNA amount: 1x

chromosomes are unreplicated

AFTER S PHASE



DNA amount: 2x

same chromosome number; duplicated

DNA REPLICATES ONCE BEFORE MITOSIS

S PHASE DOUBLES DNA AMOUNT, NOT CHROMOSOME NUMBER

COMMON ERROR

Interphase is not a resting stage. The cell is highly active, and S phase performs the DNA replication required before division.

2

Mitosis and cytokinesis complete division

Mitosis separates duplicated chromosomes into two nuclei; cytokinesis then divides the cytoplasm to form two daughter cells.

A SIMPLIFIED MITOSIS SEQUENCE



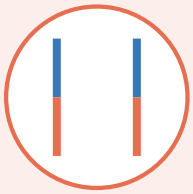
PROPHASE

chromosomes condense



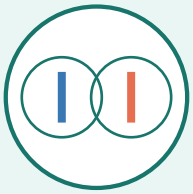
METAPHASE

chromosomes align



ANAPHASE

sister chromatids separate



TELOPHASE

two nuclei form

CYTOKINESIS DIVIDES THE CYTOPLASM -> TWO DAUGHTER CELLS

WHAT THE CYCLE ACCOMPLISHES

GROWTH

increases the number of cells in an organism

TISSUE REPAIR

replaces damaged or lost cells

CELL REPLACEMENT

renews cells with limited lifespans

ASEXUAL REPRODUCTION

produces offspring from one parent

ONE DNA REPLICATION -> ONE NUCLEAR DIVISION -> TWO CELLS

COMMON ERROR

DNA replicates during S phase, not during mitosis. Mitosis divides the nucleus; cytokinesis divides the cytoplasm.