

Key Concept 5: Cell Growth and Division

Learning Objectives

Students will be able to ...

Essential Knowledge

Students need to know that ...

Cell Cycle

CELLS 5.1(a) Describe the importance of the growth phases in the cell cycle.

CELLS 5.1(b) Explain how the cell cycle is regulated.

CELLS 5.1.1 Generally, the cell spends 90 percent of its time in interphase.

- During the growth phases (G1 and G2) the cell is producing new organelles and proteins. There are cell division checkpoints at the end of both of these phases.
- During the synthesis phase, DNA uncoils to replicate itself. Afterward, each chromosome consists of two double-stranded copies of identical DNA.

Mitosis

CELLS 5.2(a) Explain why chromosome duplication must occur prior to mitotic division.

CELLS 5.2(b) Create and/or use models to explain the phases of mitosis.

CELLS 5.2(c) Predict consequences for biological systems if the cell cycle regulation is altered.

CELLS 5.2.1 Multicellular organisms use mitotic cell division in order to replace dying or damaged cells.

- Mitosis, the fourth phase of the cell cycle, consists of a series of sub-phases (prophase, metaphase, anaphase, and telophase) whereby the parent nucleus produces two genetically identical daughter nuclei.
- There is a cell division checkpoint during metaphase.
- Cancer cells form when cellular division continues without regulation.

Viruses

CELLS 5.3(a) Describe the structural differences between viruses and cells.

CELLS 5.3(b) Explain how viruses affect functions in biological systems.

CELLS 5.3.1 Viruses must utilize cellular machinery in biological systems in order to replicate their genetic material.

- Viruses lack the ability to perform reactions that require energy, such as replicating their own genetic material.
- Viruses bind to and release their genetic material into host cells, which allows the cellular machinery to be hijacked to produce viral proteins and genomes.
- Viral infection may disrupt biological systems by manipulating cell cycle regulation and altering the normal synthesis of proteins, causing disease or cell death in organisms.

Content Boundary: The *focus* here is not on memorizing phases in the appropriate order, but rather how those individual phases support other vital functions that sustain biological systems. Students should see the need for cells to grow in size and increase the number of organelles prior to cellular division. They should also understand why regulating cell size through mitotic division is necessary. This keeps cell sizes small in order to support diffusion rates and improve efficiency of cellular processes.