

GRADE 11 STUDY GUIDE | 2024

Cell Structure and Cell Division

Life Sciences

1. Cell Structure Review

- Cell membrane: controls entry/exit of substances; phospholipid bilayer with embedded proteins
- Cell wall (plant/fungi/bacteria only): provides rigid support; made of cellulose (plants) or chitin (fungi)
- Nucleus: contains DNA; controls cell activities; surrounded by nuclear membrane with pores
- Mitochondria: site of cellular respiration; "powerhouse of the cell"; has its own DNA
- Chloroplasts (plant only): site of photosynthesis; contains chlorophyll
- Ribosomes: site of protein synthesis; found in cytoplasm and on rough ER
- Endoplasmic reticulum: rough ER (has ribosomes) transports proteins; smooth ER synthesises lipids
- Golgi apparatus: packages and modifies proteins for secretion
- Vacuole: large in plants (stores water, maintains turgor); small in animals
- Lysosomes: contain digestive enzymes; break down worn-out organelles and foreign material

KEY: Prokaryotic cells (bacteria): NO membrane-bound nucleus or organelles, no mitochondria. Eukaryotic cells (plants, animals, fungi): have nucleus and membrane-bound organelles.

2. Mitosis

Mitosis is nuclear division producing two GENETICALLY IDENTICAL daughter cells with the same chromosome number as the parent cell. Used for: growth, repair, asexual reproduction.

- INTERPHASE (not a mitotic phase): DNA replication, cell growth, organelle duplication
- PROPHASE: chromatin condenses into visible chromosomes; nuclear membrane disappears; spindle fibres form
- METAPHASE: chromosomes align along equatorial plate (middle); centromeres attached to spindle fibres
- ANAPHASE: centromeres split; sister chromatids pulled to opposite poles by spindle fibres
- TELOPHASE: nuclear membrane reforms around each set of chromosomes; chromosomes uncoil
- CYTOKINESIS: cytoplasm divides (cleavage furrow in animals; cell plate in plants)

Parent cell (2n) => [Mitosis] => 2 daughter cells (2n)

Humans: 2n = 46 chromosomes => 46 chromosomes in each daughter cell

3. Meiosis

Meiosis produces FOUR genetically diverse haploid (n) cells from one diploid (2n) parent. Only occurs in reproductive organs. Results in gametes (eggs and sperm in animals).

- MEIOSIS I: separates HOMOLOGOUS CHROMOSOMES (reduces chromosome number: 2n => n)

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MEIOSIS II: separates SISTER CHROMATIDS (like mitosis)

- Crossing over (prophase I): homologs exchange segments => genetic variation
- Independent assortment (metaphase I): random orientation of homologs => genetic variation

Parent cell (2n) => [Meiosis I + II] => 4 haploid cells (n)

Humans: 46 => 23 chromosomes in each gamete

KEY: Mitosis vs Meiosis: Mitosis = 1 division, 2 identical diploid cells, somatic cells. Meiosis = 2 divisions, 4 genetically varied haploid cells, sex organs only.