

These notes explain the **why** behind every concept, not just the what. They include **analogies**, **real-life examples**, and explanations of **common mistakes**. Use these alongside your revision notes for full understanding.

B1a Cell Structures — Understanding What Each Part Does and Why

Every organelle in a cell exists for a reason. Evolution has refined cells over billions of years — structures that served no purpose disappeared. Understanding why each part exists helps you remember what it does.

■ **Think of it like this:** *A cell is like a factory. The nucleus is the management office (gives instructions). Mitochondria are the power generators. Ribosomes are the production line (making proteins). The cell membrane is the security gate (controlling entry and exit). The cell wall (in plants) is the building's walls — structural support.*

Prokaryotic cells (bacteria) are much simpler — no nucleus, no membrane-bound organelles. They are believed to have evolved first. Eukaryotic cells may have originated when one prokaryote engulfed another — the inner cell became the mitochondrion (the endosymbiotic theory, supported by the fact that mitochondria have their own DNA and divide independently).

Cell Division — Growth and Reproduction

Mitosis produces genetically identical cells. It is used for growth, repair, and asexual reproduction. The parent cell's DNA is replicated first, then both copies are separated into two new cells.

Meiosis produces genetically different cells. It is used to produce gametes (sex cells). It involves two rounds of division, producing four haploid cells, each with a unique combination of alleles.

"Meiosis is just mitosis done twice."

✓ **Actually:**
chromosomes

Respiration and Photosynthesis — Opposite Reactions

Aerobic respiration: glucose + oxygen → CO₂ + water (releases energy). Photosynthesis: CO₂ + water → glucose + oxygen (stores energy). These two reactions are essentially the reverse of each other. Plants do both simultaneously during the day.

■ **Why does this happen?** In bright daylight, photosynthesis in a plant produces far more oxygen than respiration uses. At night, photosynthesis stops but respiration continues — so plants release CO₂ at night. This is why hospitals used to remove flowers from wards at night (though the CO₂ released by a few plants is negligible).

Eukaryotic	Cell with membrane-bound nucleus — animals, plants, fungi
Prokaryotic	Cell without a nucleus — bacteria
Mitosis	Cell division producing 2 genetically identical diploid cells — for growth and repair
Meiosis	Cell division producing 4 genetically different haploid cells — for sexual reproduction

Aerobic respiration

Releases energy from glucose using oxygen — produces CO₂ and water

Fermentation

Anaerobic respiration in yeast — produces ethanol and CO₂