AQA Biology A-level

2.2 - All cells arise from other cells

Flashcards

State what the cell cycle is and outline its stages.

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cycle of division with intermediate growth periods

1. interphase
2. mitosis or meiosis (nuclear division)
3. cytokinesis (cytoplasmic division)

Explain why the cell cycle does not occur in some cells.

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After differentiation, some types of cell in multicellular organisms (e.g. neurons) no longer have the ability to divide.

What is the difference between the cell cycle and mitosis?

What is the difference between the cell cycle and mitosis?

Cell cycle includes growth period between divisions; mitosis is only 10% of the cycle & refers only to nuclear division.

Outline what happens during interphase.

Outline what happens during interphase.

G1: cell synthesises proteins for replication e.g. tubulin for spindle fibres & **cell size doubles**

S: DNA replicates = chromosomes consist of 2 sister chromatids joined at a centromere

G2: organelles divide

State the purpose of mitosis.

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produces 2 genetically identical daughter cells for:

- Growth
- Cell replacement/ tissue repair
- Asexual reproduction

Name the stages of mitosis.

Name the stages of mitosis.

1. **P**rophase
2. **M**etaphase
3. **A**naphase
4. **T**elophase

Outline what happens during prophase.

Outline what happens during prophase.

1. **Chromosomes condense**, becoming **visible**. (X-shaped: 2 sister chromatids joined at centromere)
2. **Centrioles** move to opposite poles of cell (animal cells) & **mitotic spindle** fibres form.
3. **Nuclear envelope & nucleolus** break down = chromosomes free in cytoplasm.

Outline what happens during metaphase.

Outline what happens during metaphase.

Sister chromatids line up at **cell equator**, attached to the mitotic spindle by their centromeres.

Outline what happens during anaphase.

Outline what happens during anaphase.

requires energy from ATP hydrolysis

1. Spindle fibres contract = **centromeres divide**.
2. Sister chromatids separate into 2 distinct chromosomes & are pulled to opposite poles of cell (looks like ‘V’ shapes facing each other).
3. Spindle fibres break down.

Outline what happens during telophase.

Outline what happens during telophase.

1. Chromosomes **decondense**, becoming **invisible** again.
2. New nuclear envelopes form around each set of chromosomes = **2 new nuclei**, each with 1 copy of each chromosome.

Explain the procedure for a root tip squash experiment.

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1. Prepare a temporary mount of root tissue.
2. Focus an optical microscope on the slide. Count total number of cells in the field of view and number of cells in a stage of mitosis.
3. Calculate **mitotic index** (proportion of cells undergoing mitosis).

Outline how to prepare a temporary mount of root tissue.

Explain how to prepare a temporary root tip mount.

1. Place root in hydrochloric acid to **halt cell division** & hydrolyse middle lamella.
2. **Stain** root tip with a dye that binds to chromosomes.
3. **Macerate** tissue in water using mounted needle.
4. Use mounted needle at 45° to press down **coverslip** & obtain a single layer of cells. Avoid trapping air bubbles.

Name 2 dyes that bind to chromosomes.

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- toluidine blue (blue)
- acetic orcein (purple-red)

Why is only the root tip used when calculating a mitotic index?

Why is only the root tip used when calculating a mitotic index?

- **Meristematic cells** at root tip are actively undergoing mitosis.
- Cells further from root tip are elongating rather than dividing.

What are tumour suppressor genes & proto-oncogenes?

What are tumour suppressor genes?

Genes that code for proteins to trigger apoptosis (programmed death of damaged cells)/ slow cell cycle (e.g. p53 acts between G1 & S in interphase so damaged DNA cannot replicate).

What are proto-oncogenes?

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Genes that code for proteins to stimulate cell cycle to progress from one stage to the next.

How can mutation to tumour suppressor genes & proto-oncogenes cause cancer?

How can mutation to tumour suppressor genes & proto-oncogenes cause cancer?

- **Tumour suppressor**: no production of a protein needed to slow the cell cycle.
- **Proto-oncogenes**: form **permanently-activated** oncogenes.
- Disruption to cell cycle → uncontrolled cell division → tumour.

Suggest how cancer treatments control the rate of cell division.

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Disrupt the cell cycle:

- prevent DNA replication
- disrupt spindle formation = inhibit metaphase / anaphase

NB: can also damage healthy cells

How do prokaryotic cells replicate?

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Binary fission:

1. DNA loop replicates. Both copies stay attached to cell membrane. Plasmids replicate in cytoplasm.
2. Cell elongates, separating the 2 DNA loops.
3. Cell membrane contracts & septum forms.
4. Cell splits into 2 identical progeny cells, each with 1 copy of the DNA loop but a variable number of plasmids.

Estimate the exponential growth of bacteria within 8 hours. Assume binary fission occurs once every 20 minutes & there is 1 bacterium at the start.

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$8 \times 60 = 480$ mins

$480 / 20 = 24$ divisions

2^{24}

Why are viruses classified as non-living?

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They are acellular: no cytoplasm, no metabolism & cannot self-replicate.

Outline how viruses replicate.

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1. **Attachment proteins** attach to receptors on host cell membrane.
2. Enveloped viruses fuse with cell membrane or move in via endocytosis & release **DNA/ RNA into cytoplasm** OR viruses inject DNA/ RNA.
3. Host cell uses viral genetic information to synthesise n**ew viral proteins/ nucleic acid**.
4. **Components of new viral particle assemble**.

How do new viral particles leave the host cell?

How do new viral particles leave the host cell?

a) Bud off & use cell membrane to form envelope.
b) Cause lysis of host cell.

Why is it so difficult to develop effective treatments against viruses?

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Replicate inside living cells = difficult to kill them without killing host cells.