

Cells, tissues and organelles

State five features common to all cells.

Cells, tissues and organelles

Compare the DNA of eukaryotic and prokaryotic cells.

Cells, tissues and organelles

Define tissue, organ and organ system.

Cells, tissues and organelles

Give an example of a tissue, an organ and an organ system.

Cells, tissues and organelles

Function of the nucleolus?

Cells, tissues and organelles

Structure of a mitochondrion?

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Function of smooth ER?

Cells, tissues and organelles

Function of centrioles?

Eukaryotic: linear, in a nucleus, with histones. Prokaryotic: circular, free in the cytoplasm, no histones.

Cell surface membrane, cytoplasm, genetic material (DNA), ribosomes, and enzyme-controlled metabolic reactions.

Squamous epithelium (tissue), stomach (organ), digestive system (organ system).

Tissue: similar cells doing one function.
Organ: different tissues working together.
Organ system: organs working together for a major function.

Double membrane, inner membrane folded into cristae, fluid matrix. Site of aerobic respiration (ATP production).

Makes ribosomal RNA (rRNA) and assembles ribosome subunits.

Organise microtubules to form the spindle during nuclear division in animal cells.

Synthesis and transport of lipids and steroids.

Cells, tissues and organelles

What is a lysosome?

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Order of the pathway for a secreted protein.

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What happens to a protein in the Golgi apparatus?

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Function of the bacterial capsule?

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What is a plasmid?

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Function of pili and flagellum?

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Size of ribosomes in prokaryotes and eukaryotes?

Cells, tissues and organelles

How is rough ER recognised in an electron micrograph?

Ribosome on rER, lumen of rER, transport vesicle, Golgi apparatus, secretory vesicle, cell surface membrane, exocytosis.

A membrane-bound sac made by the Golgi apparatus, containing hydrolytic enzymes that digest worn organelles and engulfed material.

Protects against drying and the immune system and helps the cell stick to surfaces.

It is modified (for example carbohydrate added), sorted and packaged into secretory vesicles.

Pili attach to surfaces or other cells (and allow DNA transfer). The flagellum rotates to move the cell.

A small, circular piece of DNA separate from the main DNA, carrying extra genes such as antibiotic resistance.

Flattened sacs with many tiny black dots (ribosomes) on the surface.

Prokaryotes: 70S. Eukaryotes: 80S (larger).

Cells, tissues and organelles

How is a Golgi apparatus recognised in an electron micrograph?

Microscopy and measuring cells

Define magnification.

Microscopy and measuring cells

Define resolution.

Microscopy and measuring cells

Approximate resolution of a light microscope?

Microscopy and measuring cells

Why does an electron microscope have a higher resolution?

Microscopy and measuring cells

Difference between TEM and SEM?

Microscopy and measuring cells

What is an artefact?

Microscopy and measuring cells

Why are specimens stained?

How many times larger the image is than the real object. Magnification = image size ÷ actual size.

A stack of curved, flattened sacs with small vesicles at the ends.

About 200 nm (0.2 μm), limited by the wavelength of light.

The smallest distance between two points at which they can still be seen as two separate points.

TEM: electrons pass through a very thin section, showing internal structure. SEM: electrons scan the surface, giving a 3D image of the surface.

Electrons have a much shorter wavelength than light.

To increase contrast so that structures can be seen and distinguished from each other.

A structure seen in the image that is caused by the preparation of the specimen and is not present in the living cell.

Microscopy and measuring cells

What is used to stain specimens for electron microscopy?

Microscopy and measuring cells

Eyepiece graticule or stage micrometer: which has a fixed scale?

Microscopy and measuring cells

How do you calculate the size of one graticule division?

Microscopy and measuring cells

Rules for a biological drawing?

Chromosomes, meiosis and gametes

Define locus.

Chromosomes, meiosis and gametes

What is meant by linked genes?

Chromosomes, meiosis and gametes

How can linkage be broken?

Chromosomes, meiosis and gametes

Where and when does crossing over occur?

The stage micrometer (divisions of 10 μm).
The graticule units are arbitrary and must be calibrated.

Salts of heavy metals (for example lead or uranium), which scatter electrons.

Sharp pencil, continuous lines, no shading, ruled label lines, title, magnification or scale bar.

Known length of micrometer divisions $\div$ number of graticule divisions covering the same length.

Genes at different loci on the same chromosome, which tend to be inherited together.

The location of a gene on a chromosome.

Prophase I of meiosis, between non-sister chromatids of homologous chromosomes at chiasmata.

By crossing over during meiosis, which separates alleles on the same chromosome. Genes further apart are separated more often.

Chromosomes, meiosis and gametes

What is independent assortment?

Chromosomes, meiosis and gametes

**Formula for the number of
chromosome combinations in
gametes?**

Chromosomes, meiosis and gametes

Function of the acrosome?

Chromosomes, meiosis and gametes

What is the zona pellucida?

Chromosomes, meiosis and gametes

**Why does an egg cell have a large
cytoplasm?**

Chromosomes, meiosis and gametes

What is the acrosome reaction?

Chromosomes, meiosis and gametes

What is the cortical reaction?

Chromosomes, meiosis and gametes

What is polyspermy?

2^n , where n is the haploid number.

The random orientation of homologous pairs at the equator in metaphase I, giving random combinations of maternal and paternal chromosomes in gametes.

A jelly-like layer of glycoproteins around the egg cell, with sperm receptors; it hardens after fertilisation.

A modified lysosome containing hydrolytic enzymes that digest the zona pellucida.

Release of enzymes from the acrosome by exocytosis when the sperm contacts the zona pellucida; they digest a path through it.

It contains food stores to supply the early embryo.

Fertilisation of an egg by more than one sperm; it gives an abnormal number of chromosomes.

Cortical granules release enzymes that harden the zona pellucida, preventing polyspermy.

Chromosomes, meiosis and gametes

What guides the pollen tube?

Chromosomes, meiosis and gametes

What is double fertilisation?

Mitosis and the cell cycle

Name the phases of interphase and what happens in each.

Mitosis and the cell cycle

What happens in prophase?

Mitosis and the cell cycle

What happens in metaphase?

Mitosis and the cell cycle

What happens in anaphase?

Mitosis and the cell cycle

What happens in telophase?

Mitosis and the cell cycle

Give three roles of mitosis.

One male nucleus fuses with the egg nucleus (diploid zygote) and the other with the polar nuclei (triploid endosperm).

Chemicals released by the ovule; the tube grows down the style to the micropyle.

Chromosomes condense (two sister chromatids), nuclear envelope breaks down, spindle forms (organised by centrioles in animal cells).

G1: growth and protein synthesis. S: DNA replication. G2: growth and preparation for division.

Centromeres divide and spindle fibres pull sister chromatids to opposite poles.

Chromosomes line up on the equator, attached to spindle fibres by centromeres.

Growth, replacement and repair of cells, and asexual reproduction.

Chromosomes uncoil, nuclear envelopes and nucleolus re-form, spindle breaks down.

Mitosis and the cell cycle

Why is a root tip used in the squash practical?

Mitosis and the cell cycle

Why is the root tip warmed in hydrochloric acid?

Mitosis and the cell cycle

Name a stain used in the root tip squash.

Mitosis and the cell cycle

Why is the root tip squashed?

Mitosis and the cell cycle

Formula for the mitotic index?

Mitosis and the cell cycle

What does a high mitotic index suggest?

Stem cells, gene expression and phenotype

Define stem cell.

Stem cells, gene expression and phenotype

Totipotent vs pluripotent?

To break down the middle lamella so cells separate, and to fix (kill) the cells.

The meristem just behind the tip has cells dividing rapidly by mitosis.

To make a layer one cell thick so light can pass through and the cells can be seen clearly.

Acetic orcein (or toluidine blue), which binds to chromosomes.

A large proportion of the cells are dividing, as in a meristem or growing tissue.

Number of cells in mitosis $\div$ total number of cells observed ($\times 100$ for a percentage).

Totipotent: any cell type including placenta, can form a whole organism. Pluripotent: any body cell type, but not placenta.

An undifferentiated cell that can divide by mitosis and differentiate into specialised cells.

Stem cells, gene expression and phenotype

What is a morula?

Stem cells, gene expression and phenotype

What is a blastocyst?

Stem cells, gene expression and phenotype

Give two ethical objections to embryonic stem cell use.

Stem cells, gene expression and phenotype

What is differential gene expression?

Stem cells, gene expression and phenotype

How do proteins make a cell specialised?

Stem cells, gene expression and phenotype

Exon vs intron?

Stem cells, gene expression and phenotype

What is alternative splicing?

Stem cells, gene expression and phenotype

Phenotype depends on?

A hollow ball of cells with a cavity, an outer layer forming the placenta and an inner cell mass of pluripotent cells.

A solid ball of about 16 cells formed by early divisions of the zygote.

Different genes are transcribed in different cell types, giving different active mRNA and proteins, so cells specialise.

Embryos are destroyed, and some believe an embryo has a right to life or object on religious grounds.

Exons are coding sections that are kept in mature mRNA; introns are non-coding sections removed by splicing.

They control cell processes (as enzymes) or determine cell structure.

An interaction between genotype and the environment.

Joining exons of pre-mRNA in different combinations, so one gene gives several different mRNAs and proteins.

Stem cells, gene expression and phenotype

Effect of DNA methylation?

Stem cells, gene expression and phenotype

Effect of histone acetylation?

Stem cells, gene expression and phenotype

How are epigenetic changes passed to daughter cells?

Stem cells, gene expression and phenotype

What are multiple alleles?

Stem cells, gene expression and phenotype

What is polygenic inheritance?

Stem cells, gene expression and phenotype

Continuous vs discontinuous variation?

Loosens the DNA from histones so the gene can be transcribed (activated).

Methyl groups added to cytosine usually switch the gene off (prevent transcription).

More than two alleles of a gene in a population (for example I^A , I^B and I^O for ABO blood groups).

The pattern of methylation is copied onto the new DNA after replication, so daughter cells inherit it.

Continuous: a range of values (polygenic and environment), bell-shaped, for example height. Discontinuous: distinct categories, for example blood groups.

A characteristic controlled by many genes at different loci, each with a small additive effect.