

## LAB EXAMS

## 1. Microscope part functions

**Eyeiece Lens:** the lens at the top that you look through.

**Tube:** Connects the eyepiece to the objective lenses

**Arm:** Supports the tube and connects it to the base

**Illuminator:** A steady light source (110 volts) used in place of a mirror.

**Stage:** The flat platform where you place your slides. Stage clips hold the slides in place.

**Fine adjustment:** Fine tunes the focus and increases the detail of the specimen.

**Course adjustment-** the stage height

**Working distance:** the distance between the lens of a microscope and the top of the sample being observed.

**Depth of field:** the distance between the nearest and the furthest objects that give an image judged to be in focus in a camera.

**Depth of field (depth of focus)** Lenses have a depth of field. It is the number of planes in which an object appears to be in focus.

**Reflected light** is directed unto opaque specimens from above and is reflected to the viewer. **Transmitted light** is used with translucent specimens and passes through the specimen from beneath the stage and into the viewer's eyes.

plasma (cell) membrane, cell wall, protoplast, cytoplasm, vacuoles, nucleus, nucleolus and chloroplasts. !!!

Protoplast- the protoplasm of a living plant or bacterial cell whose cell wall has been removed. The cell minus the cell wall.

Cell membrane- membrane of lipids and proteins that forms the external boundary of the cytoplasm of a cell

Cell wall- a rigid layer of polysaccharides lying outside the plasma membrane of the cells of plants, fungi, and bacteria.

Cytoplasm- the material in a cell excluding the nucleus.

Vacuoles- storage bubbles found in cells.

Nucleus- dna, genetic info

Chloroplast- mitochondria of plant cells

Nucleolus- small structure in the nucleus during interphase.

**+Plasmolysis-** contraction of the protoplast of a plant cell as a result of loss of water from the cell. NaCl contributes to plasmolysis.

Osmosis- water from a low concentration gradient to a high concentration gradient.

Similarly, if there is a higher concentration of dissolved salt outside of the cell (a **hypertonic** environment), then H<sub>2</sub>O will diffuse "out" from the cell and the cell will dehydrate and shrink and cellular metabolism will cease. This phenomenon is called **plasmolysis** and it is the reason why foods can be preserved with high concentrations of salt and sugar.

The size ratio between 2 objects do not vary on screen and in real world:

$$\underline{A1} = \underline{B1}$$

$$A2 \quad B2$$

$$\frac{40 \text{ cm}}{0.180 \text{ mm}} = \frac{9 \text{ cm}}{x}$$

$$x = 0.180 * 9 / 40 = 0.0405 \text{ mm}$$

$$40.5 \text{ } \mu\text{m}$$

### **LAB 2- Blood Permeability**

**Hemolysis-** Rupturing of the blood cell. This process describes the destruction of red blood cells that occurs when too much water flows inside the cell and causes the rupture of the plasma membrane.

**Electrolyte:** compound that dissociates into ions (charged entity) when put in solution.

**Diffusion:** movement of substances from a region of higher concentration to a region of lower concentration ([fig. 1](#))

**Osmosis:** Movement of water from a region of lower solute concentration to a region of higher solute concentration, usually across a semipermeable membrane ([fig. 2](#))

**Osmolarity:** concentration of all solutes present in a solution.

**Tonicity:** Globally, tonicity depicts the ability of a solution to cause a cell to absorb or reject water.

Tonicity depends on how well solutes can cross the cell membrane, as well as their concentration.

**Hypotonic:** A solution which causes water to enter the cell. For a non-penetrating solute, it means its concentration is lower outside the cell compared to inside the cell. (antonym: hypertonic).

Hypertonic- From the blood cell outside.

Why does diffusion cause hemolysis?

1- A cell is placed in an isotonic solution= The concentration of solutes is the same inside and outside the cell (so is the water concentration). No osmosis occurs.

2- After a moment purple molecules start to diffuse through the membrane and reach the inside of the cell (spontaneous diffusion following their own gradient). The solute concentration becomes higher inside the cell than outside and creates osmotic imbalance. Water molecules start to move toward the inside of the cell due to the osmotic gradient.

3- As more purple molecules diffuse, more water is pulled inside the cell, causing the cell to swell.

4- After a while the volume of the cell increases and exceeds the resistance of the membrane, and the cell undergoes lysis.

aquaporins

Goes to the lower concentration gradient

What factors affect diffusion?

The size of the solute as well as the polarity.

Size- The bigger the size, the harder it is to cross the membrane.

Hemolysis can also be reached by placing the cells into an isotonic solution of a penetrating substance (e.g. ethylene glycol). Slower.

However, when 75 % of the cell population has undergone hemolysis, the suspension of red blood cells becomes suddenly transparent.

Systole- the part in the contractile vacuole that releases the water.

### Lab 3- Amoeba

Amoeba proteus is a protist that belongs to the Amoebozoa group

p. It is a single-celled eukaryotic organism. . It extends its pseudopodia (extension of long polymers of actin.) as a way to move, and to catch food (including preys) that will then be digested in food vacuoles.

Contractile vacuoles- release water build up.

Endocytosis and Phagocytosis.

Phagocytosis- food, Pinocytosis- water.

Systole-

### Lab 4- Mitosis

the G1 (first gap) stage is a period of growth and active synthesis of all groups of macromolecules (including RNAs and proteins). It is also during G1 that cytoplasmic organelles (like mitochondria, ribosomes, etc...) are duplicated.

. The S (synthesis) phase follows with precise replication of all DNA and synthesis of DNA-associated proteins (such as histones in eukaryotic cells) or microtubule-associated proteins (such as the centrioles in animal cells).

. The G2 (gap 2) stage involves protein synthesis and production of structures needed for mitosis, like spindle fibres

Interphase: This is the stage that the cell is in between mitotic divisions. Growth, synthesis of macromolecules and assembly of organelles, as well as DNA replication occur during this phase.

Prophase- Chromosomes shorten and thicken and each one can now be seen to consist of two chromatids attached at the centromere region. During prophase the microtubules of the cytoskeleton disassemble into tubulin subunits that begin to reassemble, forming the mitotic spindle. The nucleoli gradually disappear. The centrosome (including its two centrioles) duplicates just before the S phase of interphase. During prophase in animal cells, the two centrosomes separate and migrate towards the opposite poles of the cell. Centrosomes are also the site where microtubules of the mitotic spindle are produced.

Promet

+aphase: The fragmentation or breakdown of the nuclear membrane marks the beginning of prometaphase. The centrosomes will eventually be found at opposite poles of the cell (spindle poles). A protein complex forms on the centromere of each chromatid: the kinetochore. The kinetochore of one sister chromatid attaches to microtubules from one pole (polar microtubules) while the kinetochore of the other sister chromatid attaches to polar microtubules of the opposite pole. As chromosomes are being pulled toward opposite poles simultaneously, they slowly migrate toward the metaphase (equatorial) plate, an imaginary plane located midway between each pole of the cell.

Metaphase- Mitotic spindle microtubules are fully formed between the poles. The centromeres of all chromosomes are located at the metaphase plate. Cohesin complexes are cleaved by an

enzyme called separase, which releases the junctions between sister chromatids. Then, centromeres start to separate.

**Anaphase:** Each chromatid (now called a daughter chromosome) moves to opposite poles of the cell. The movement of chromatids towards the pole is driven by the shortening of microtubules, which occurs by depolymerisation at the level of kinetochores

**Telophase:** Chromosomes now located at the poles decondense and become longer and thinner. Nuclear membrane reappears and the nucleolus reforms. Spindle disappears. Cytokinesis usually occurs during this phase. In plant cells, the phragmoplast guides the formation of the new cell wall across the centre of the cell, while in animal cells a cleavage furrow pinches the cell in two

Feulgen stain, which give a strong and specific staining. will react specifically with aldehyde groups to form a coloured reaction product.

the root tip with its square cells many of which are undergoing mitosis

Around the end of the root tip is a mass of irregular dead cells with thicker walls. These are the root cap which protects the apical meristem of the root tip as it is pushed into the soil.

region of the apical meristem. It is a zone of cell division or the site of apical growth of the root. At the base of the apical meristem is the quiescent centre. It is a relatively inactive region where the cells are arrested in G1 of interphase.

Above the region of cell division, but not sharply delimited from it, is the region of elongation. The elongation of cells in this region results in most of the increase in length of the root. Following the region of elongation is the region of maturation in which most of the cells of the primary tissues mature. Root hairs are also produced in this region.

. The xylem cells of these bundles transport water and salts from the soil to the rest of the plant. The phloem cells transport carbohydrates from the

photosynthetic portions of the plant to the roots. The roots do not have chloroplasts and cannot make their own food.

In animal cells there is an aster, a semicircle of fibrils around each end of the spindle. There are no asters in plant cells.

Feulgen stain process

1. Wash- rinse once in 95% alcohol
2. Hydrolysis- Add HCl and put it in a 60 degrees celcius for 10 mins. Discard hcl and add cold water
3. Stain- Discard water and leave it to stain for 30-40 mins.

All lab4 samples are exam material (= you must be able to recognize a mitosis phase on a picture)

kinetochores

### Lab 5- Meiosis

. In meiosis, there is also DNA duplication, but it is followed by 2 divisions. The net result of meiosis is 4, not 2 cells, and because of events that occur during meiosis, the 4 daughter cells are not identical to each other nor to the mother cell.

The diploid individual produces haploid gametes by meiosis (gametogenesis). Male and female gametes fuse to form a diploid zygote. The zygote then divides mitotically to become a multicellular diploid organism. This type of meiosis is called gametic meiosis.

Meiosis- goes from diploid cells to haploid cells.

Diploid- diploid- haploid- fertilized- diploid baby

Leptotene- condensation

Zygotene- synapse

Pachytene- crossing over

Diploleptene- lol

Diakinesis- final modifications

(spermatogenesis- male gametes

Oogenesis- female- egg and polar bodies

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