Human Biology

The Microscope:

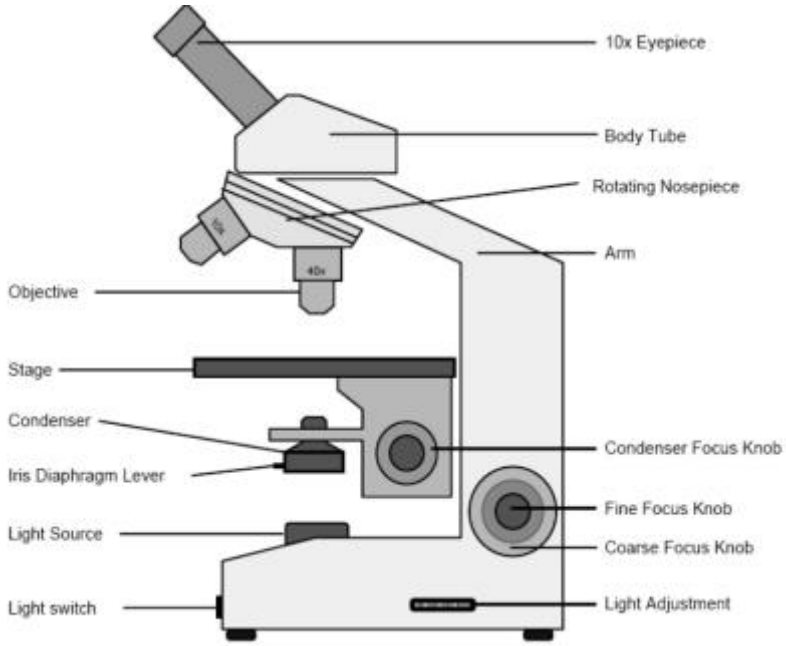
- **Operate the compound light microscope to examine specimens:**

Intro:

- Positioning and handline of microscope:
  - Handle the microscope by handling the arm in upright position
  - Position it 5cm away from the edge of the bench
  - Report and check for an defects before use, don't fix it

- Cleaning the microscope:
  - Use lens cleaning tissues and solutions (70% ethanol) to clean the lens
  - If no clear images are obtained, clean the eyepiece and objectives, moisten lens cleaning tissue with cleaning solutions and wipe the lens
  - Rotate the eye piece and if the image moves, then the eye piece must be dirty
  - Move the objectives, if the dirt disappears then it is the objective lens that are dirty

- Microscope skills needed:
  - Set up and use the microscope correctly
  - Make observations with the microscope
  - Accurately record observations, by drawing or writing descriptions
- Parts of the microscope:
  - Iris diaphragm – increase or decreases the light intensity
  - Adjustment knob – causes stage to move upward or downward
  - Stage – platform that supports slide
  - Objective lens system – after light passes through the specimen it next enters here
  - Condenser – concentrates light onto the specimen
  - Field of view – circular area seen through eyepiece
  - Nosepiece – part to which objective lens are attached
  - Stage clip – holds microscope slide in position
  - Eyepiece – contains a lens at the top of the body tube
  - Arm – serves as a handle for carrying microscope



Setting up the microscope:

- Focusing the light:
  1. Swing the objective into 10x and put the slide on the stage (with cover slip on)
  2. Turn on the light and adjust light intensity
  3. Use mechanical (coarse focus) knob to raise to stage 5mm away from slide
  4. Focus the specimen by bring down the stage
  5. Use fine focus knob to sharp focus the specimen
  6. Open the condenser and iris diaphragm fully

<u>Objective - Diameter</u>

4x - 5mm

10x - 2mm

40x - 0.5mm

- Maximise resolution:
  7. Look down on the eyepiece and close the iris diaphragm
  8. A white spot in grey circle can be seen
  9. Open the diaphragm until the white spot fills ¾ of the grey circle
  10. Place back the slide
  11. Refocus the specimen using the focus
  12. Focus as much as possible
  13. Turn into high power, adjust diaphragm and fine focus

Microscope theory:

- Uses a system of lens to produced enlarged image of an object
- It is both the magnification power and also resolution power that allows to see sharp images
- Minimum resolved distance = minimum distance two objects can be distinguished as distinct
- Magnification is the enlargement of the image

- How the condenser works:
  - Controls the focus of light by moving up and down
  - Iris diaphragm controls the amount of light reaching the objective
  - Condenser focuses light and control how much light enters the lends

- Iris diaphragm:
  - Varies the angle which light passes the specimen (contrast and resolution)
  - If too wide, then light scatters and not focus
  - If not too narrow, it will be too dark with poor resolution and high contrast

- Trouble shooting of microscope:
  1. Can't see an image? – microscope plugged in, light on/off, objective lens in position
  2. Can't find specimen? – centre specimen over the light source, use lower objectives
  3. Dirt obscuring specimen? – is the dirt on the lens or specimen

4. Can't focus? – specimen too thick, coverslip on top, iris diaphragm opened/ closed too far
5. Too dark or bright? – check light intensity and opening or iris diaphragm
6. Poor contrast? – close down iris diaphragm
7. Poor resolution? – adjust condenser, open up diaphragm

- **Apply a scale to your drawings**

Producing a scale bar drawing (relate to the size of the object)

- A scale bar is the representation of the ratio between the size of the object in reality and the drawn size of the same object

A = actual size of the object in real life (eg. pencil in real life is 18cm long)

D = drawn size of the object (eg. Pencil is drawn 7.5cm on paper

a = length the scale bar is representing (eg. Xcm on scale bar =5cm in real life)

d = actual size of the scale bar (eg. scale bar is measured at 5cm)

Therefore

$$\frac{D}{A} = \frac{d}{a}$$

Once we have D, A and a, we can calculate d (the length we have to draw the scale bar).

i.e. $$d = \frac{D \times a}{A}$$

Eg: Producing a scale bar of 18cm long pencil

Actual length (A) = 18.0cm

Length of drawing (D) = 7.5cm

Theoretical bar length (a) = 5cm

Scale bar length (d) = 7.5 x 5 / 18.0 = 2.1cm

Hint* = scale bar units should be in whole numbers and the bar should represent 1/3 or ¼ the drawn length (eg. 2.1cm is roughly ¼ the drawn length of 7.5cm)

- Estimating the size of the objects using a microscope:
  - Place a grid under low power with 0.1mm each
  - Count how many 0.1mm side squares fit across the field of view
  - If 10 fits, then 0.1mm x 10 = 1mm diameter of the field of view

- Count how many times an object can fit across the field of view (eg. if 4 can fit under, then the size of object is 1mm / 4 or 1000microns/4 = 250micronsper object)

➢ Biological drawings:
  - Include a title of the drawings
  - All drawing must be done on unlined paper with lead pencil
  - Do not colour in or shade in the drawing
  - Drawing should be simple, done in clear, definite lines that join other lines
  - Animal drawing should include the anterior or dorsal towards top of the page
  - Plants should be drawn the way they are oriented
  - Label in pencil without arrow heads, must be parallel and not cross with each other
  - All drawing should include scale bars

Cell Structure:

- **Describe the structures and functions of a cell**

  - It is a basic living unit of all organisms, they determine the shape and functions of an organisms, and many diseases are from cellular basis.
  - Each cell contains highly specialised structures called organelles to perform specific functions, surrounded by cytoplasm. The cytoplasm is enclosed by the cell membrane.
  - Activity of an organism depends on both the individual and the collective activities of its cells
  - According to the principle of complementarity of structure and function, the biochemical activities of cells are dictated by the relative number of their specific subcellular structures
  - Continuity of life from one generation to another has a cellular basis (sperm + egg)

➢ Function of the cell:
  - *Cell metabolism and energy use*. The chemical reactions that occur within cells are collectively called cell metabolism. Energy released during metabolism is used for cell activities such as the synthesis of new molecules, muscle contraction and heat production, which helps maintain body temperatures.

  - *Synthesis of molecules.* Cells synthesise various types of molecules, including proteins, nuclei acids, and lipids. The different cells of the body do not all produce the same molecules. Therefore, the structural and functional characteristics of cells are determined by the types of molecules they produce.

  - *Communication*. Cells produce and receive chemical and electrical signals that allow them to communicate with one another and with muscle cells, causing muscle cells to contract.

  - *Reproduction and inheritance*. Each cell contains a copy of the genetic information of the individual. Specialised cells (sperms cells and oocytes) transmit that genetic information to the next generation.

Organelles and their functions:

- Eukaryotic – membrane bound nucleus and membrane bound organelles
- Prokaryotic – do not have a membrane bound nucleus