

## Lab 1: Microscope and experimental design

**Microcosm:** miniature model-system

**Key principles of experimental design:**

1. Developing a hypothesis
2. Designing an experiment with controls
3. Designing an experiment with replication
4. Randomizing experiment

**Hypothesis:** Tentative (temporary) explanation for a well framed question

**Possible hypothesis:**

- a) Microcosm treated with nutrients will not show enhanced algal concentrations
- b) Microcosm treated with nutrients will show enhanced algal concentrations

**Control:** Untreated microcosm

**Micrometers:**  $1 \mu\text{m} = 10^{-6}\text{m}$ , this is the level that the microscope can see. We can see in millimeters.

**Zeiss compound microscope:** Microscope used in lab

**Scanning objective:** 3.2 x objective

**Eyepieces**

**Binocular Head**

**Dioptry adjustment collar:** To compensate for slight differences in left/right eye, located on the left side, below the eyepiece.

**Mechanical stage:** Where the specimen is secured

**Stage movement knobs:** Moves the mechanical stage around for viewing

**Body tube:** where magnified image of specimen is formed

**Objective:** Lens

**Coarse and fine focus two-in-one knobs:** focus the image by raise and lower the mechanical stage relative to the objectives

**Revolving nosepiece:** Where the 4 objectives are mounted

**Condenser:** Contains a lens system for converging (to come together) light rays coming from the bottom (There are two lenses)

**Illuminator:** Where the light rays come from

**Base**

**Main lens:** Large and located in the center of the condenser, captures most of the light from the illuminator. (Suitable for 3.2x )

**Front(top) lens:** Smaller and closest to the slide, condenses the light beam passing through the main lens into a narrower, more powerful cone suitable for use with 10x, 40x, 100x

**Condenser diaphragm:** controls amount of light passing through the condenser

**Illuminator knob:** controls variable light level

**Field diaphragm:** controls the amount of light coming from the illuminator, used to spare any unnecessary heat being transferred to the specimen

**Adjustment ring:** Thing on the field diaphragm that controls the size of the opening of the field diaphragm

**Blue filter:** Makes yellowish light from the bulb look more like natural light by giving it a slight blue color

**Centering screws:** Used to center light coming from the field diaphragm onto the slide

**Total magnification:** Magnification of eyepiece (10) x magnification of objective x magnification factor of binocular tube(1)

**Oil immersion:** 100x objective only, achieves 1000x total magnification. Use fine focus only

**Wet mount:**

- 1) add drop of water on the sample
- 2) rest one end of a coverslide on the slide, touching the edge of the drop of water
- 3) gently lower the other end of the coverslide until it rests on the slide-with care, no bubbles will form

**Optical section:** A single plane of focus in an object

**Cells:** Fundamental basic building blocks of life

**Tissues:** Occurs only in multicellular organisms. Cells are organized into groups that function together. This group is called tissue. (i.e. xylem, phloem, epidermis)

**Organ:** Multicellular organism only, an organ is several tissues grouped together to form a structural and functional unit. (In plants, the organs are roots, stems, and roots, the protists, the antheridium and the oogonium are both sexually reproduction organs)

**Organ system:** A group of organs working together

**Elodea:** freshwater plant, important role in ecosystem as it provides refuge for aquatic organisms

**Chloroplasts:** Green sacs

**Thorn cells:** cells on the extreme edge that project outwards. Do not contain as much as chloroplasts, thus nucleus and the nucleolus are visible.

**Nucleolus:** Inside nucleus, the site where ribosomes are synthesized from proteins and RNA

**Cytoplasmic streaming:** Movement of the cytoplasm within the cell, this moves the nutrients, enzymes, etc. around the cell and plays a crucial role in the locomotion of amoeba.

**Selective staining:** A process that kills the cells but make some structures more visible (due to different materials that absorb different dyes). If one wants to observe cellular functions (rather than structures) this process would not be used

**Pyrenoids:** Starch containing bodies inside the chloroplasts, usually purple in color when dyed.

**Histological sections:** Thin slices of tissues used for microscope slides, usually stained.

**Cross section:** section cut perpendicular to the main axis

**Longitudinal section:** section cut parallel to the main axis

**Safranin:** Red dye

**Fast green:** green

**Crystal violet:** purple

**Lignified cell walls:** red, thick-walled supportive cells

**Cellulose:** cells walls, green

**Starch grains:** pyrenoids, purple

**Difference between animal and plant cells:** animals have no cell walls, no chloroplast, and no large vacuoles. Biggest visible difference is that all plants have a thick, cellulose cell wall.

**Cells without nuclei:** Dead cells like the xylem and the sclerenchyma

**Villi:** folding of the lining of the intestine, forming finge-like projections called villi. They exist to increase the surface area for absorption.

**Epithelial cells:** inner most layer of the intestine

**Blood capillary:** looks like a nuclei but it is pink in color

**Small intestine:** stain used is haematoxulin-eosin. Nuclei is purple (dark pink), cytoplasm is pink, plasma membrane is transparent.

**Lumen:** hallow space

**Kidney:** consists of large collection of tiny tubules(tubes) called nephrons (Basic structural and functional unit of kidney).

**Tubules:** function in regulation of water, nutrients, wastes, and production of urine.

**Brassica Rapa:** Field mustard

**Order of entry:** This is for the greenhouse, enter clean areas first before you enter the infected areas. This is done to minimize the spread of pests and diseases within the facilities.

**Slides that we will go over:**

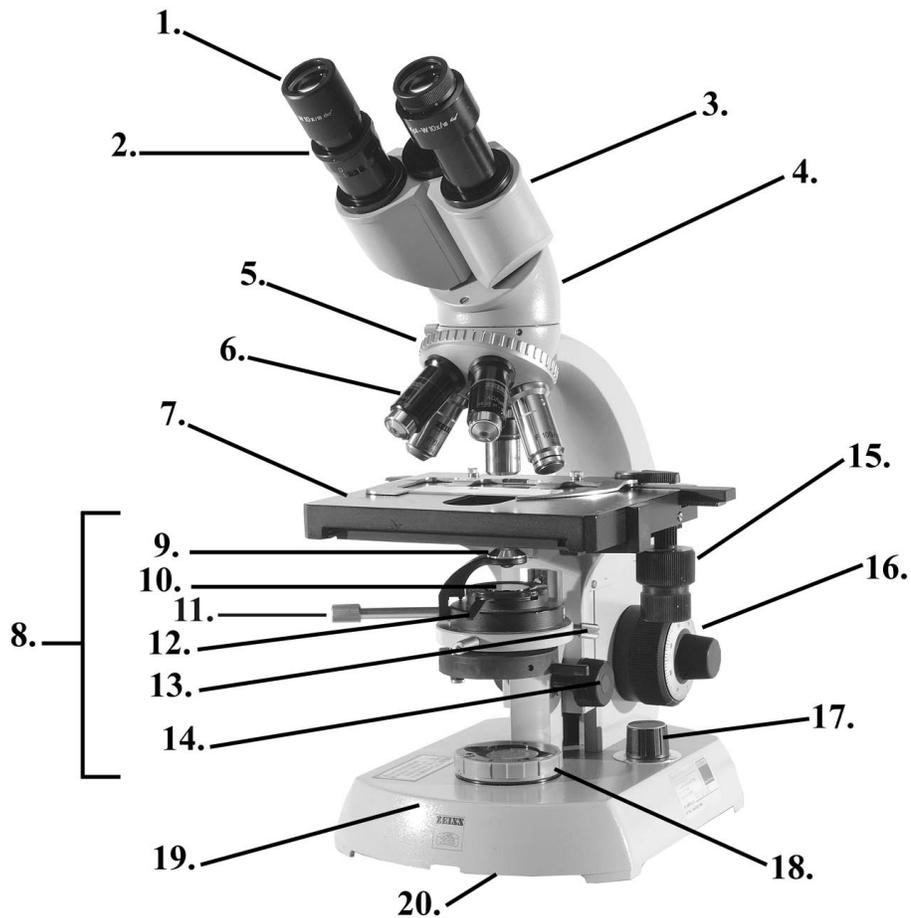
Prepared small intestine of amphiuma

Prepared kidney of amphiuma, (just 1 tubule)

Elodea Leaf

**Pictures that we will go over:**

Microscope



## The Zeiss compound microscope

- |                              |   |
|------------------------------|---|
| 1. eyepiece (ocular)         | 12. lever to condenser diaphragm                                  |
| 2. dioptre adjustment collar | 13. centering screws  |
| 3. binocular head            | 14. condenser focus knob  |
| 4. body tube                 | 15. stage movement knobs  |
| 5. revolving nosepiece       | 16. coarse and fine focus knobs                                   |
| 6. objectives                | 17. illuminator brightness control knob                           |
| 7. mechanical stage          | 18. adjustment ring for field diaphragm (with blue filter on top) |
| 8. condenser                 | 19. illuminator (in base)   |
| 9. condenser front lens      | 20. base of microscope  |
| 10. condenser main lens      |   |
| 11. lever for front lens     |   |