Grade 8 Science

Cells

Class 1

Big Ideas

Understanding Life Systems: Cells

- Cells are the basis of life
- Cells organize into tissues, organs, organ systems, and organisms
- Healthy cells contribute to healthy organisms
- Systems are interdependent

Which one is living?

Characteristics of Living Things

- Living things grow in size, reproduce and are able to repair themselves
- Living things require energy
- Living things respond to changes in their environment

- Living things have a lifespan

- Living things produce waste

All living things possess these characteristics!

Does the animatronic shark possess these characteristics?

Checkpoint

- Identify the characteristic(s) of living things illustrated by each of the following statements. Explain your choice for each.
  a) Flowers eventually die
  b) Plants obtain energy from the sun
  c) A zebra runs away from a lioness
  d) A broken bone heals over time
  e) Plant roots grow towards moist soil

Cells

- Cell – the basic structural and functional unit of life; some are single-cellular and some are multi-cellular

Cell Theory

Cell Theory states:

- All living things are composed of one or more cells
- The cell is the basic unit of life
- All cells come from preexisting cells

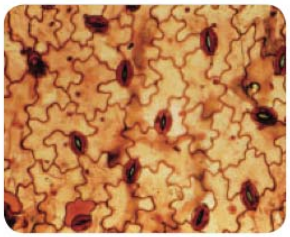


Figure 1 Two types of plant cells: the dark kidney bean–shaped cells are used for gas exchange and the puzzle piece–shaped cells are epithelial cells.

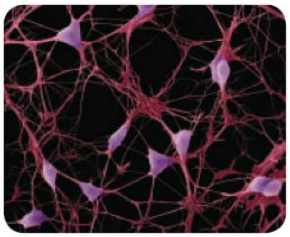
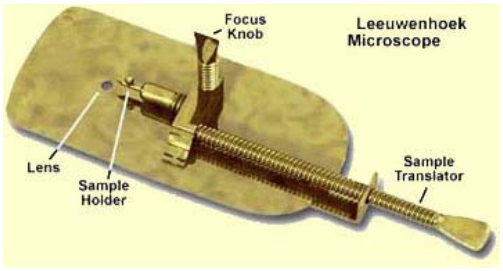


Figure 2 Nerve cells allow animals, including humans, to respond to changes in their environment.

Figure 3 Smooth muscle cells line the organs of the digestive system and help move food through the digestive tract.

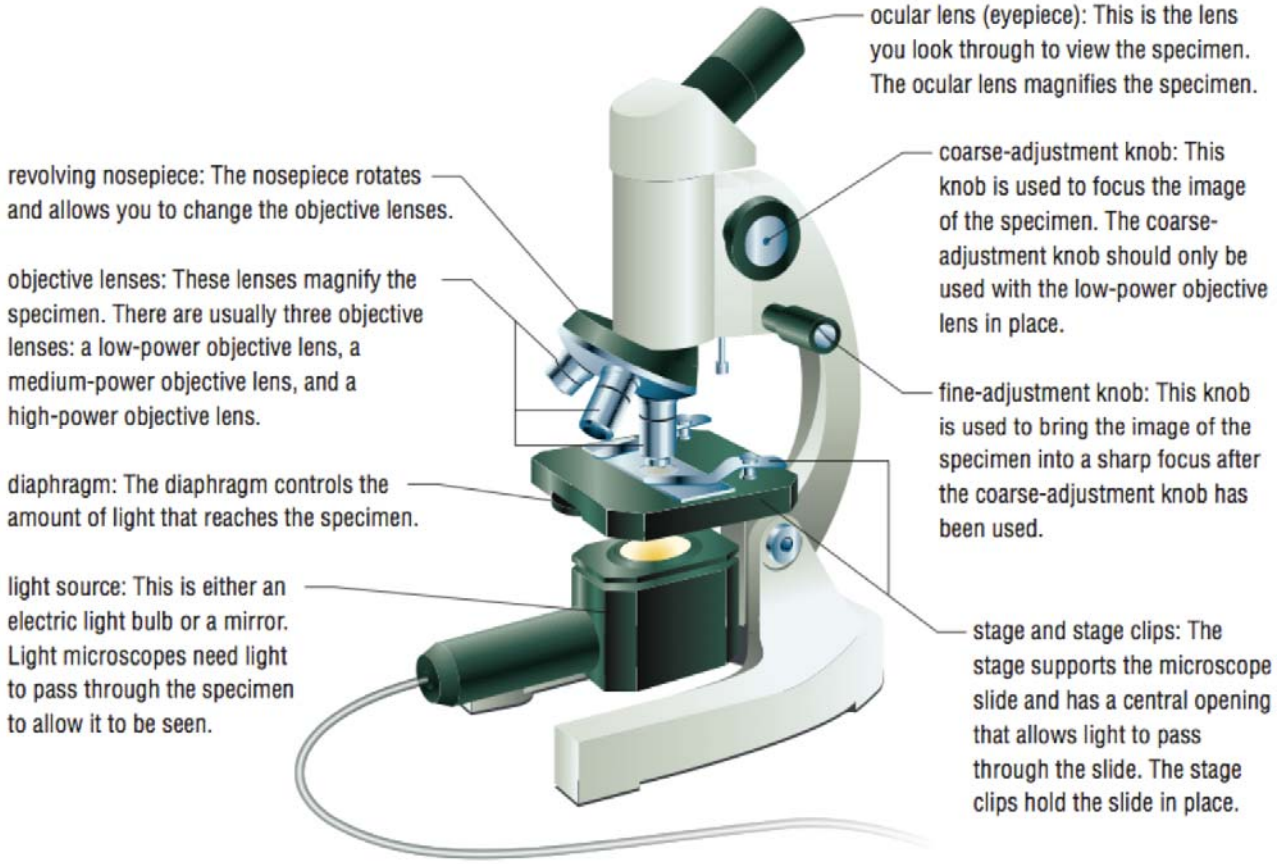
First Microscope



- Anton van Leeuwenhoek (1632-1723) built the first light microscope
  - Built small lenses that could magnify an object 270 times
  - Observed bacteria cells, yeast cells, blood cells and life in pond water

Compound Microscope

- Also called the compound light microscope because it uses two lenses and a light source to magnify the specimen
- Easy-to-use and relatively inexpensive



Magnification

- The degree to which the appearance of a specimen is enlarged
- Achieved using a lens system
- Ex: Magnification of 2X = two times larger than actual size

Ocular Lens	Objective Lens	Total Magnification
10X	4X	40X
10X	10X	100X
10X	40X	400X

The total magnification is determined by multiplying the ocular lens by the objective lens

Safety Procedures

- Use two hands to carry the microscope – one under the base and one on the arm
- Use both eyes to observe the specimen
- Always store the microscope with the lower-power objective lens in place and the stage lowered to prevent the lens from being accidentally scratched
- Only use the course-adjustment knob with lower-power objective; fine adjustment knob at higher powers

Field of View

- Field of View – The visible area of the specimen seen through the eyepiece of a compound microscope
- As magnification increases, the diameter of the field decreases

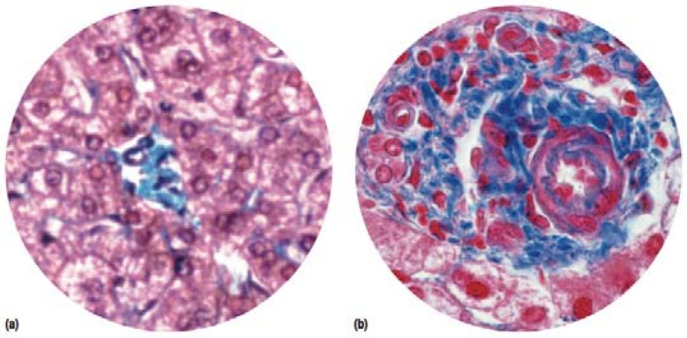


Figure 3 (a) Human liver cells magnified 50× (b) Human liver cells magnified 600×

Biological Drawings

- To accurately record observations, scientists draw a circle to represent the field of view
- Draw what they see through the microscope in the circle
- Label the total magnification and use straight, horizontal lines to label any visible structures
- Drawings are drawn with firm, short strokes and are “stippled” instead of shaded

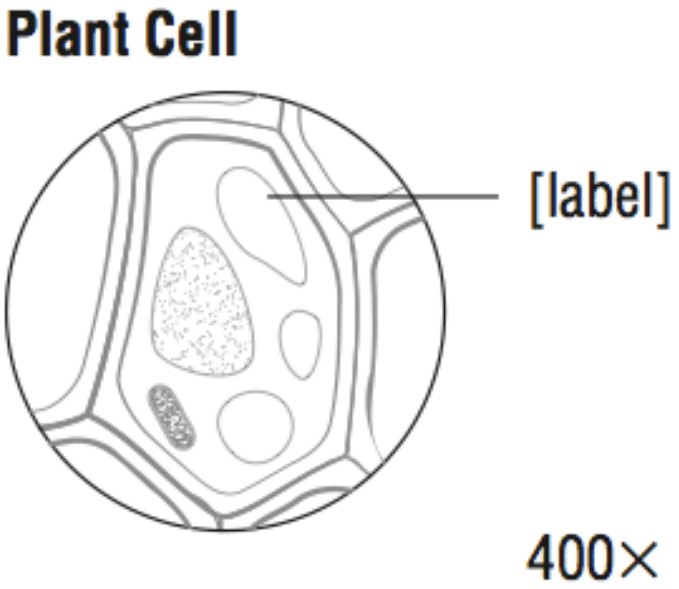
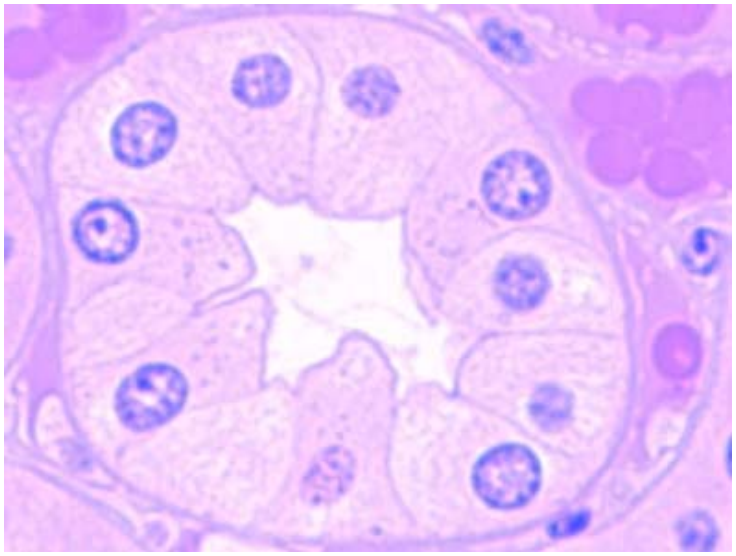


Figure 4 Scientists use lines and stipple for the details of their drawings.

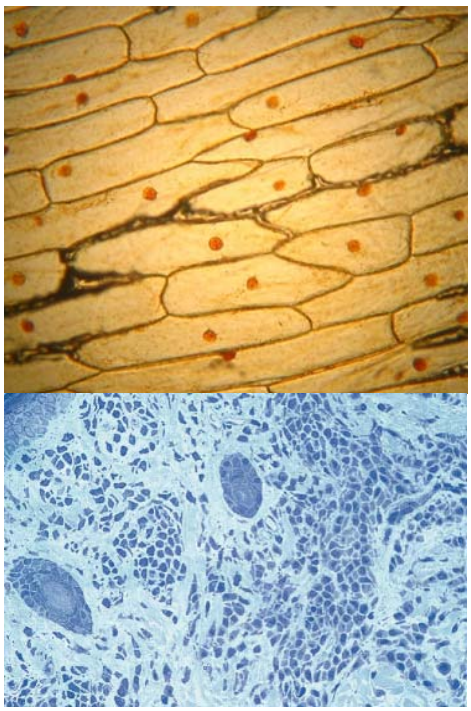
Checkpoint

Sketch the following capillary cross-section. Assume you used a 40X objective lens.



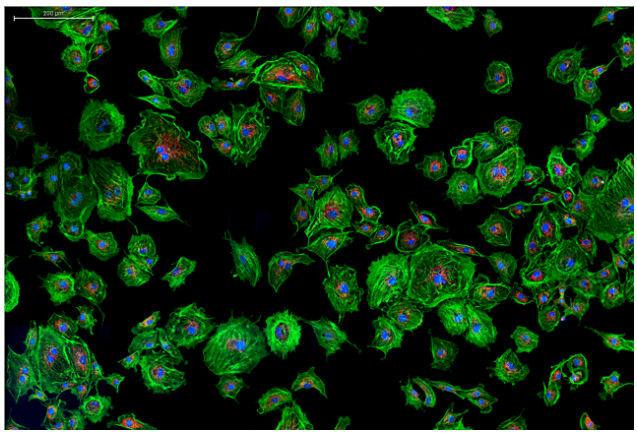
Preparing Slides

1) Cut a thin slice of the specimen
2) Mount on the slide:
   - **Dry Mount** – dry sample is placed on a slide directly
   - **Wet Mount** – sample is covered with a fluid solution
3) Stain the slides
   - Food colouring (non-toxic)
   - Iodine – detects presence of starch; best for plant cells
   - Methylene blue – to visualize the nucleus; best for animal cells



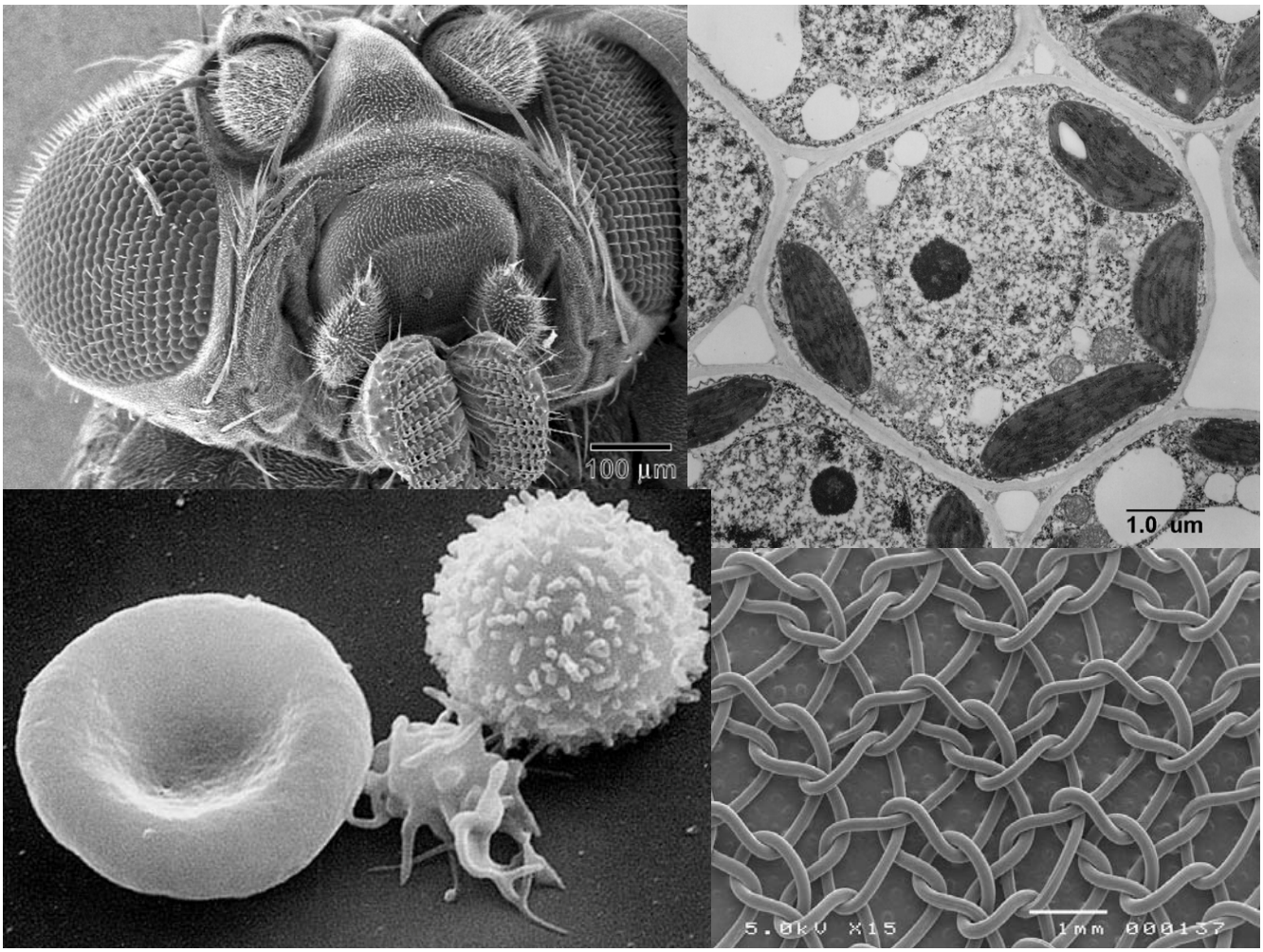
Advances in Microscopy

- If you change the light source to UV light on a light microscope and stain the slides with fluorescent dye, you can see more cellular structures



Electron Microscope

- There is a limitation to light microscope because with increasing power there is decreasing clarity
- 1931, Ruska and Knoll used electrons to produce a highly magnified image that allowed them to see 400X
- Today's electron microscope can magnify objects up to 2 000 000X



Pros	Cons
• Magnifies specimens to great detail • Visualizes all the organelles in cells • Three-dimensional images • Can detect diseases	• Specimen needs to be dead for processing and visualization • Large machines • Require training to use • Expensive • Specimens need to be cut very thinly and coated in plastic

Types of Electron Microscopes

- TEM – Transmission Electron Microscope
  - Lenses are magnetic
  - As electron beam passes through the specimen, some of the electrons are reflected or change direction
  - Electrons that pass through the specimen produce an electron micrograph

- SEM – Scanning Electron Microscope
  - Uses the electrons that are reflected or scattered to produce the image of the specimen
  - Results in a three-dimensional image
  - Only the exterior of the specimen can be visualized with SEM