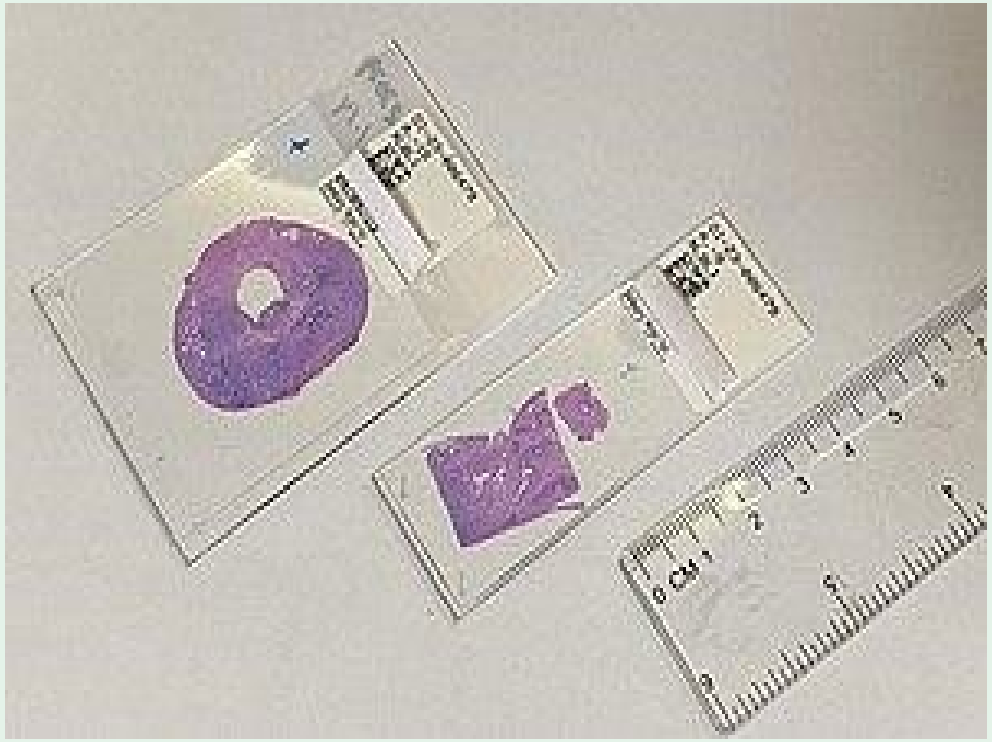
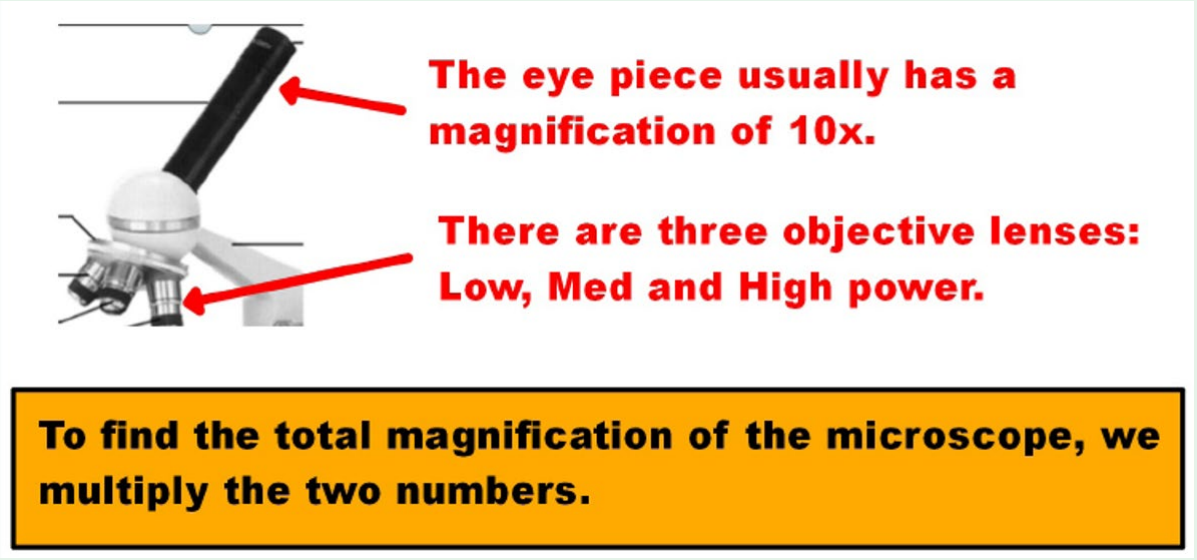
SCIENCE 10 UNIT C: BIOLOGY

MICROSCOPE USE AND CELL THEORY



MAGNIFICATION FACTORS

- Compound microscopes use two lenses to create an image
- Each lens has its own **magnification factor**

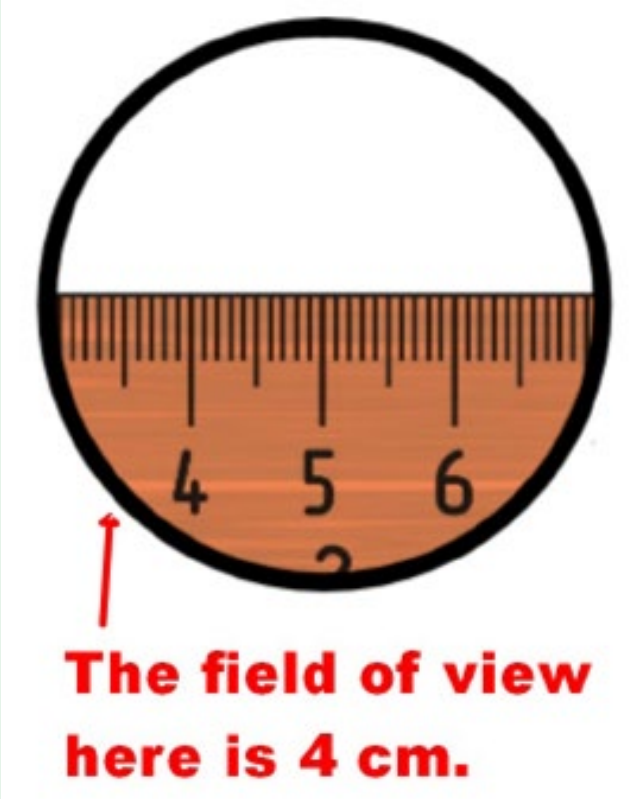


MAGNIFICATION EXAMPLE

- The low power objective lens has a magnification factor of 4x. If the eye piece has a magnification of 10x, what is the total magnification? [40x]

FIELD OF VIEW

- **<u>Field of view (FOV)</u>** is the area you see through a microscope
- At low power, FOV can be measured by how wide the circle is



FIELD OF VIEW

- At high power, measuring with a ruler is impractical
- FOV can be <1mm

$$\frac{\text{HP FOV}}{\text{LP FOV}} = \frac{\text{LP Magnification}}{\text{HP Magnification}}$$

- HP = high powered, LP = low powered

FIELD OF VIEW EXAMPLE

- A student uses a microscope with the following specs:
  - Eye Piece: 10x
  - Low Power Objective: 4x
  - High Power Objective:30x

If the FOV at low power is 3.5cm, what is the FOV at high power? [0.46cm]

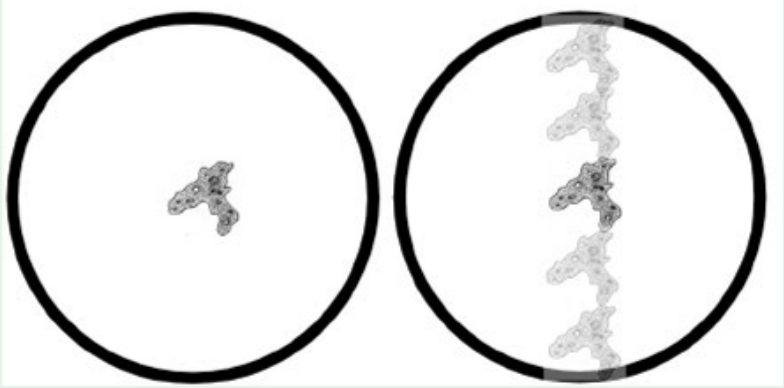
ESTIMATING SAMPLE SIZE

- If we know field of view, we can estimate size
- Estimate how many of the sample fit into the field of view, then divide

FOV = 20mm

Estimated Samples = 5

20mm/5 = 4mm sample



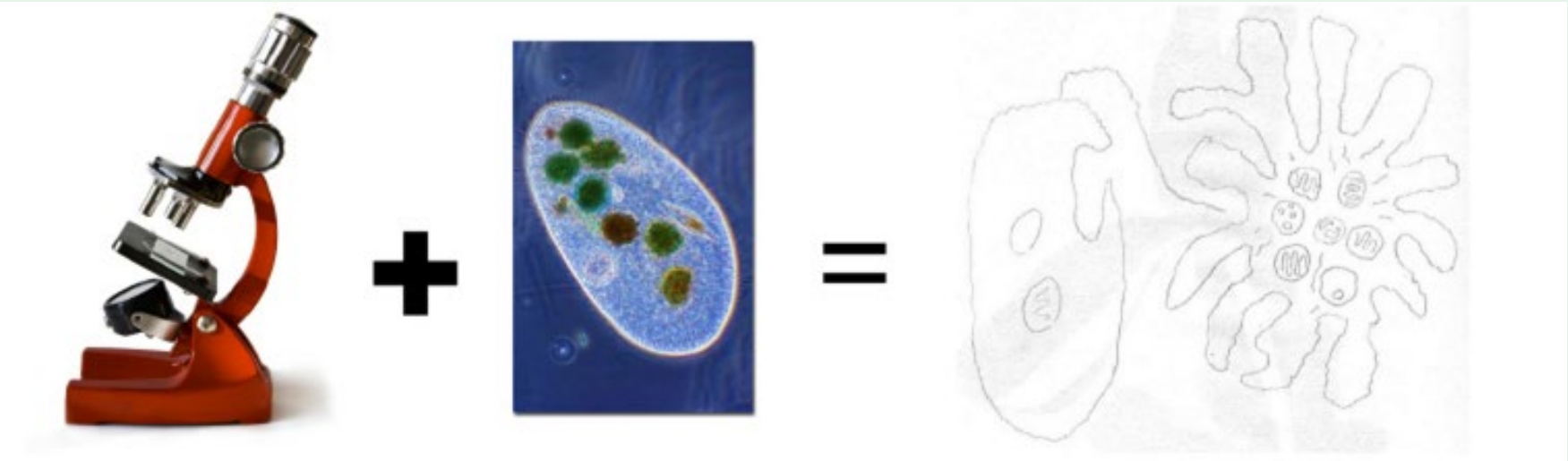
MICROSCOPE UNITS

- Size under microscopes is very small
- May use micrometers (10^{-6} m or 1 µm)

- E.g the estimated size of an organism is 7.55µm. What is its size in cm? mm?

DRAWING MICROSCOPE OBSERVATIONS

- This is a crucial skill for communicating data
- We will run through the process today to prepare for your upcoming microscope lab



STEPWISE DRAWING PROCESS

1. Use unlined white paper
2. Draw only one cell, and only what you can see
3. Draw the image in clear unbroken lines, taking up half the page
4. Add details using only the outline of the structure, do not shade or colour
5. Label the diagram using lines

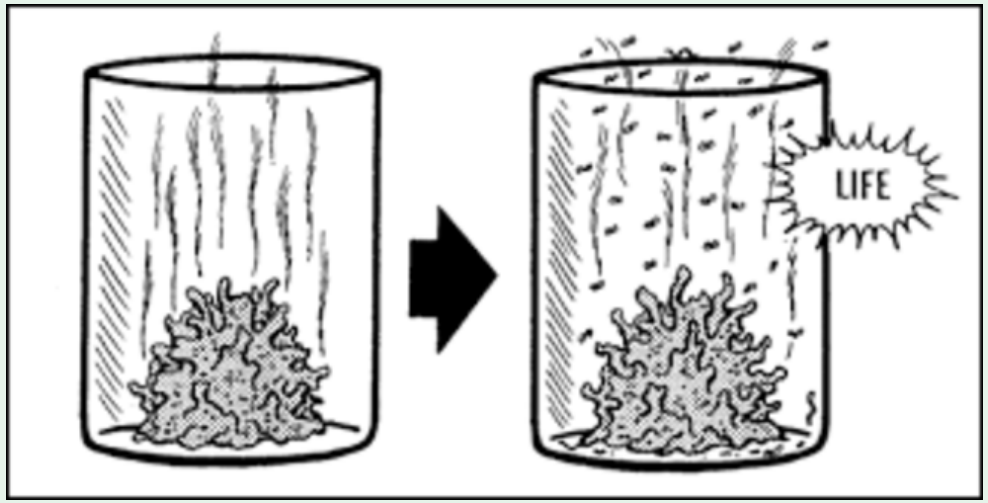
STEPWISE DRAWING PROCESS

6. Measure the length of the diagram in millimeters and add it
7. Include information in the right hand corner
    - Your name *(e.g. Mr. Cuesters)*
    - Subject of drawing *(e.g. E. coli)*
    - Magnification of microscope *(e.g. 40x)*
    - Size of the object *(e.g. 2mm)*
    - FOV *(e.g. 10mm)* and Fit Number (provided)

Now that we understand microscopes, let’s look at their impacts on biology.

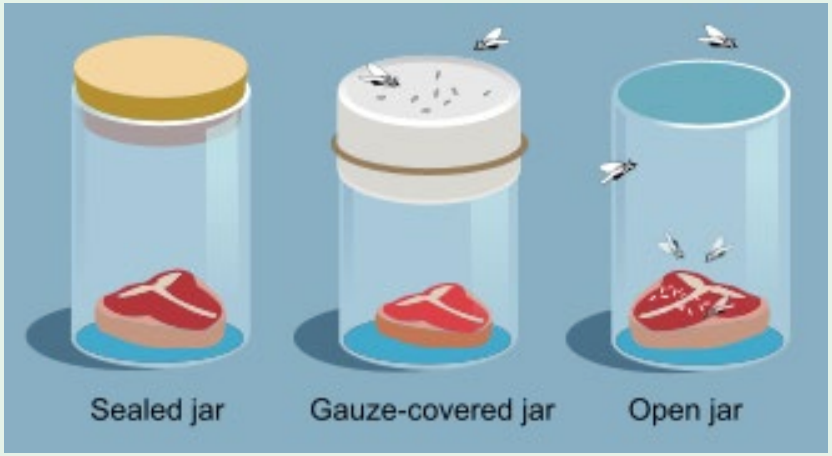
SPONTANEOUS GENERATION

- **Abiogenesis** or **spontaneous generation** is the belief that life emerges from non-living material
  - Mice suddenly develop in unguarded wheat
  - Frogs suddenly appear in mud
- Supported by Aristotle, held until the 1800s



DISPROVING ABIOGENESIS

- In 1668, Italian physician Francesco **Redi** tested it with **three jars** of spoiled meat
- One was open, one was sealed, one was open to air but not flies
- Which jars do you think produced maggots? What were the manipulated and responding variables?

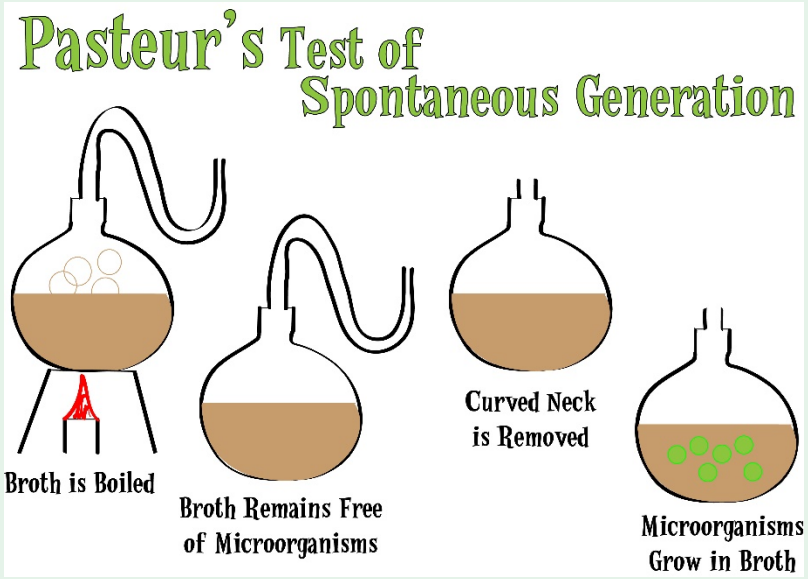


DISPROVING ABIOGENESIS

- Microscopes led to the discovery of microbes a few years after Redi's experiments
- Ironically, this led to more belief in abiogenesis
  - "How can such small creatures reproduce?"

DISPROVING ABIOGENESIS

- In the 1800s, Louis Pasteur was convinced abiogenesis was false
- Ran an experiment proving that spoiled broth was due to microbes in the air



DISPROVING ABIOGENESIS

- Pasteur's experiment proved two important things

1. Non-living objects cannot produce living objects
2. There are living organisms too small to see with the naked eye

This eventually led to…

CELL THEORY

- Our current understanding of life has three tenets

1. All living things are made up of one or more cells
2. All life functions take place in cells, they are the smallest unit of life
3. All cells are produced from other living cells through cell division