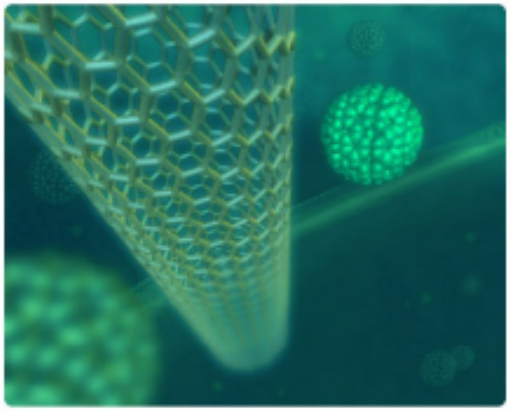
Science 10 Unit C: Biology

The Microscope!

Science and technology go hand in hand.



Sometimes, the science drives the technology...

and sometimes the technology drives the science.

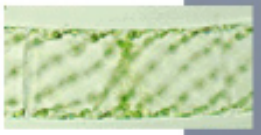
A great example of technology leading to scientific breakthrough is the microscope.

Today, we will learn about the history of this magestic beast.

https://www.youtube.com/watch?v=bjcewKLlb2Y&ab_channel=StatedClearly

Early 'scope = Leeuwenhoek's

- Called a simple microscope because it has only one lens
- Basically a powerful magnifying glass
- He observed bacteria, yeast and other microscopic organisms
- He had no formal science training but kept very careful records which helped scientists all over the world

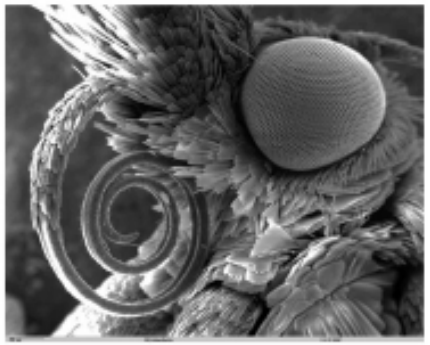


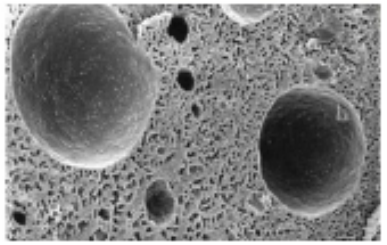
Robert Hooke's Microscope

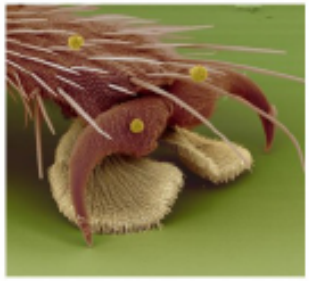
- **Built a microscope with two lenses this is known as a compound microscope**
- **One set of lenses enlarges the object and the other magnifies the image**
- **He coined the term cells while looking at a thin sliver of cork he thought they looked like Monk's cells at a monastery.**
- **Maximum magnification: 1000x**

Present Day: Electron Microscope

- A beam of electrons passes through the object
- Can view the image on a special screen or take a picture which is known as a micrograph
- Can magnify biological materials up to 100,000X
- Can magnify non biological materials up to 1 ,000,000X!!

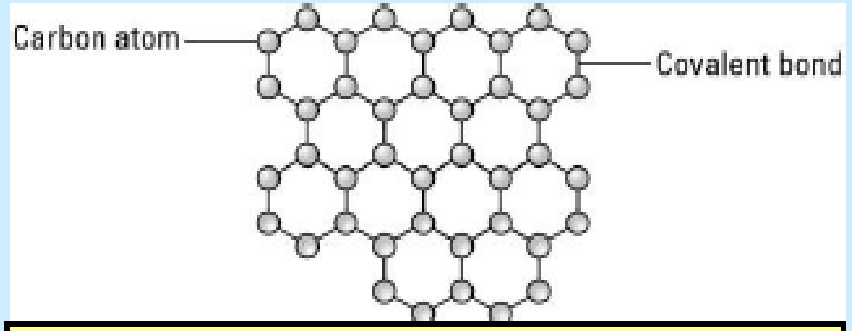




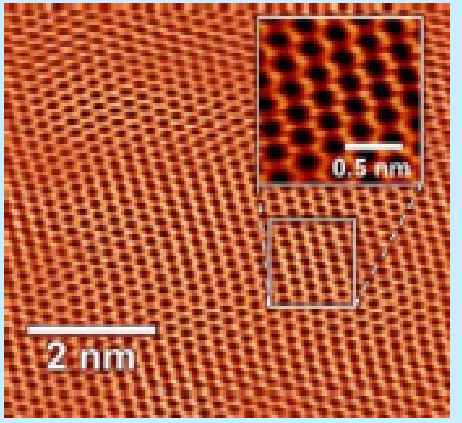


Electron Microscopes

- Electron Microscopes - Developed in the 1930s in Germany but Canadians refined it!
- Uses a beam of electrons to produce an image.
  - electron beams are smaller than light beams which gives a higher resolution image.
- Electron microscopes can magnify up to 50 000 000X!
  - Can see individual carbon atoms in graphene and diamond!



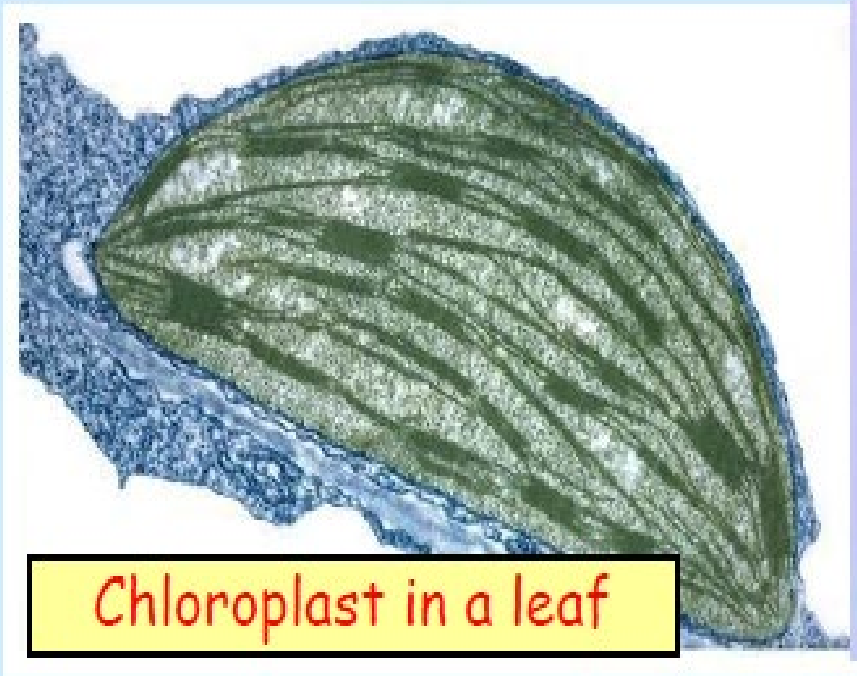
Atomic structure of graphene



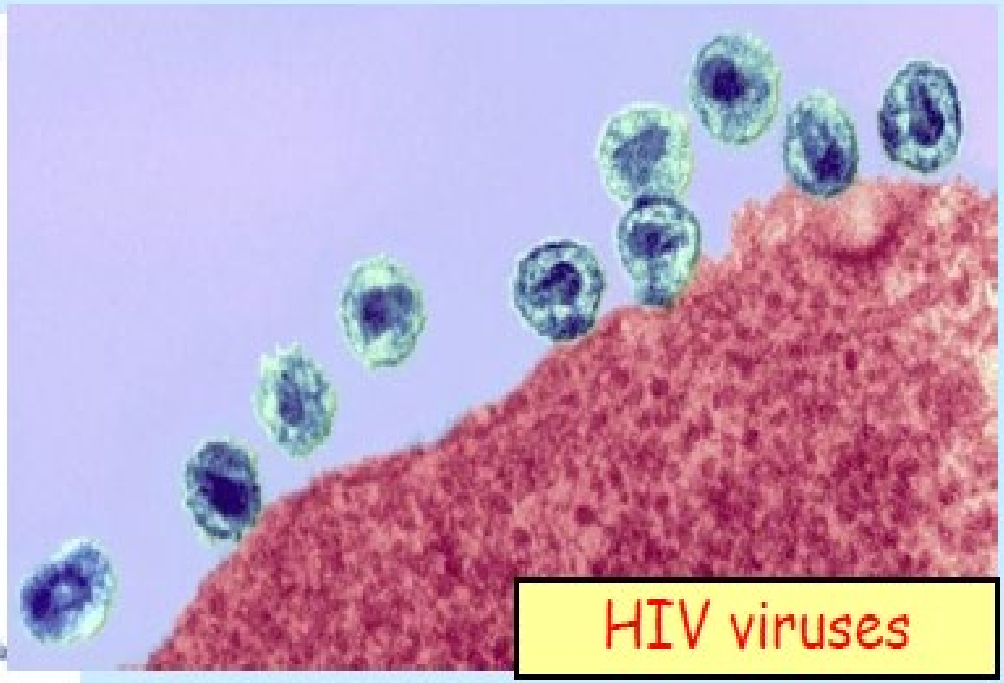
Two Types of Electron Microscopes

1) Transmission Electron Microscope (TEM) - Uses thin slices of specimens (similar to light microscopes)

- Specimen must be dead to view



Chloroplast in a leaf

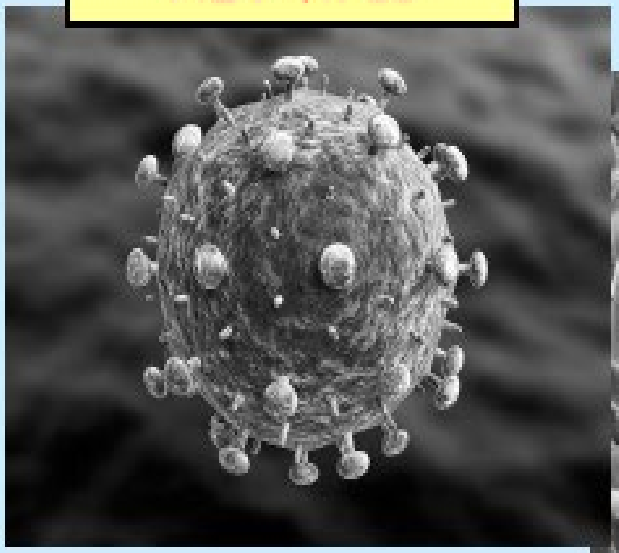


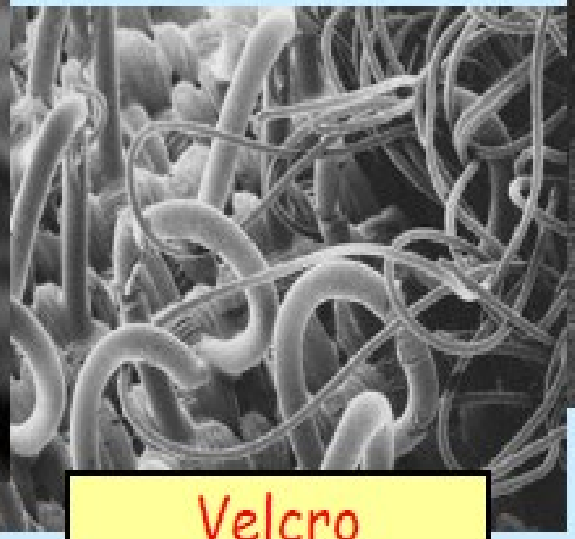
HIV viruses

Scanning Electron Microscope (SEM)

- Bounces electrons off the surface of the object to give a 3D image
- Organisms can be living!

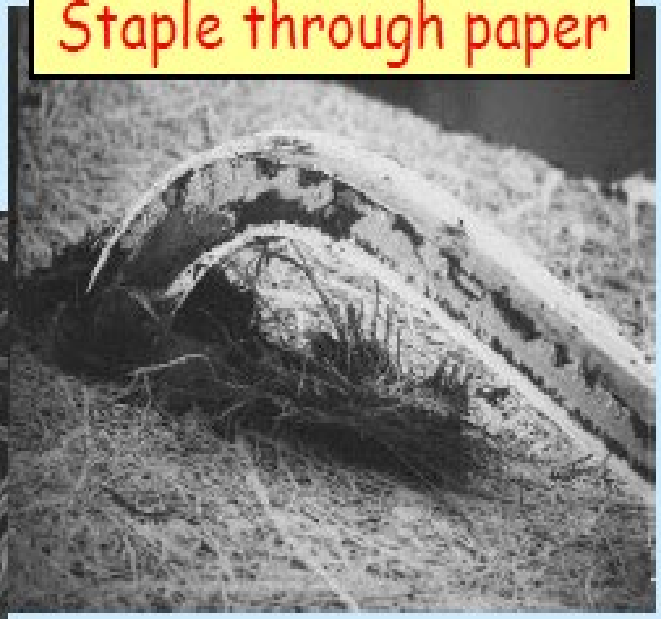
HIV virus





Velcro

Staple through paper



Microscope Videos

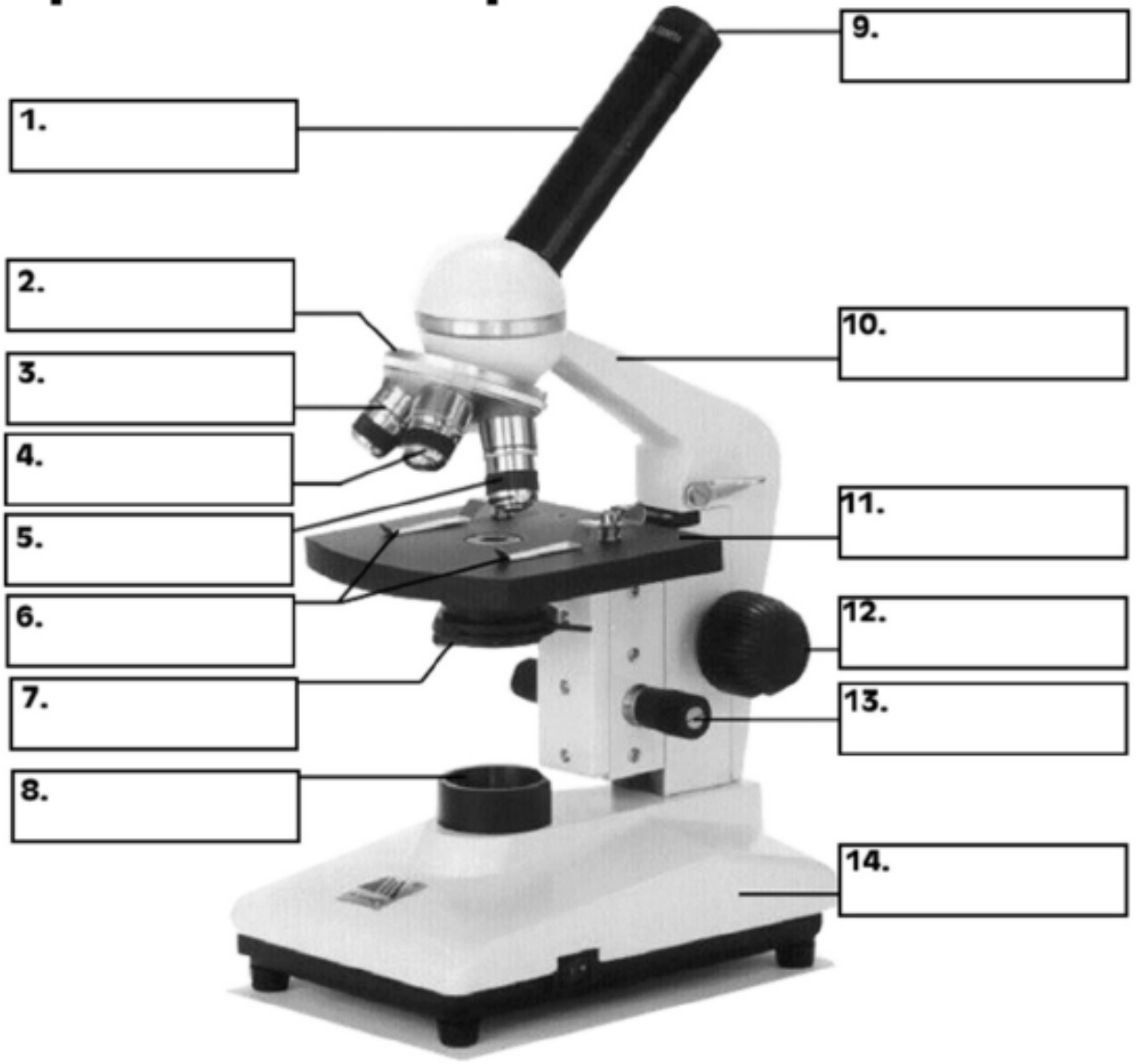
50 Things Looking Totally Bizarre Under A Microscope (6 min)

https://www.youtube.com/watch?v=gYnPeHU2wYI

Top 10 Most Astonishing Electron Microscope Pics In The World

https://www.youtube.com/watch?v=qWmwgY7iHmY

Parts of the Compound Microscope:



3 things affect what is seen in a microscope:

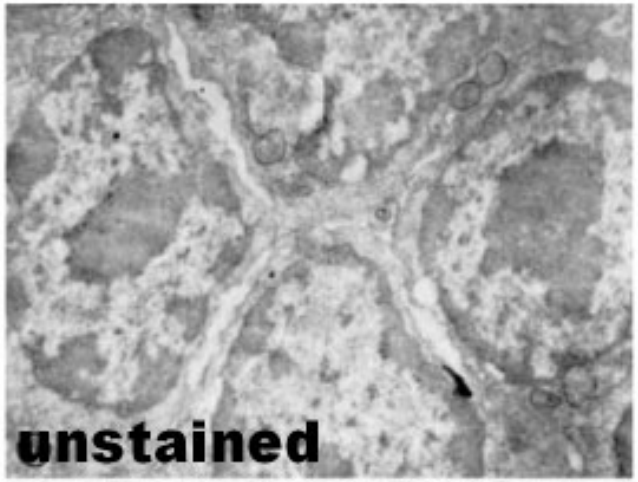
- Magnification (how many times it is larger than normal).
- Contrast (light and dark between 2 structures)- high contrast is good.
- Resolution (ability to distinguish between 2 structures that are close together)- high resolution is good.

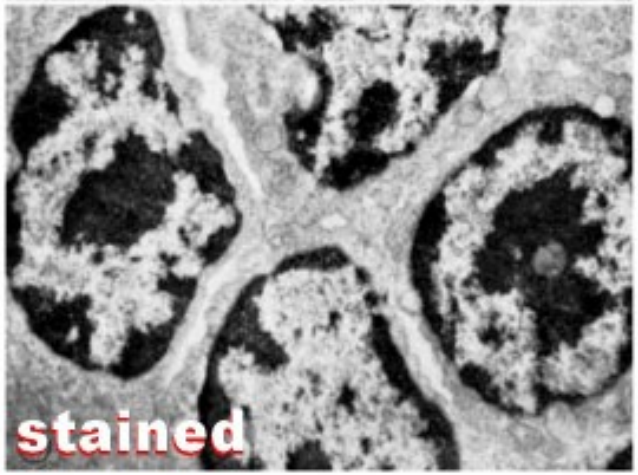

low resolution

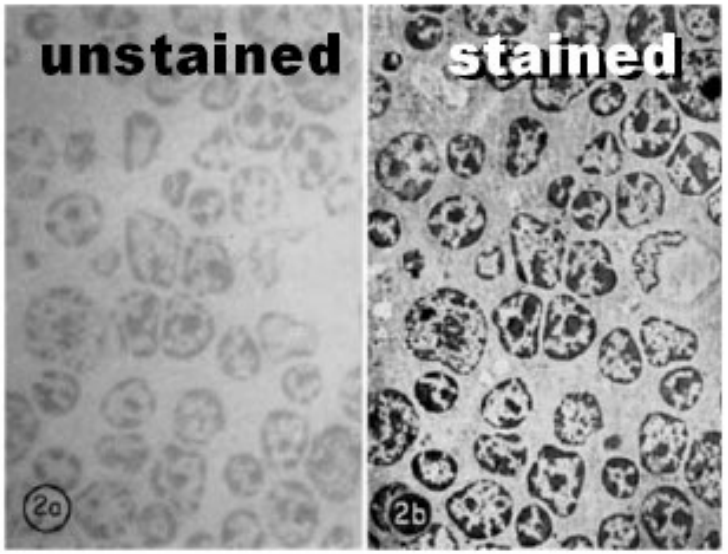

high resolution

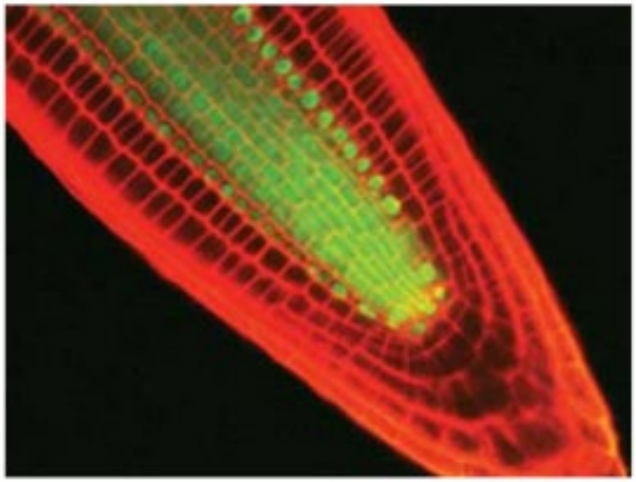

low contrast

One way we can increase contrast is by adding a stain to a slide.

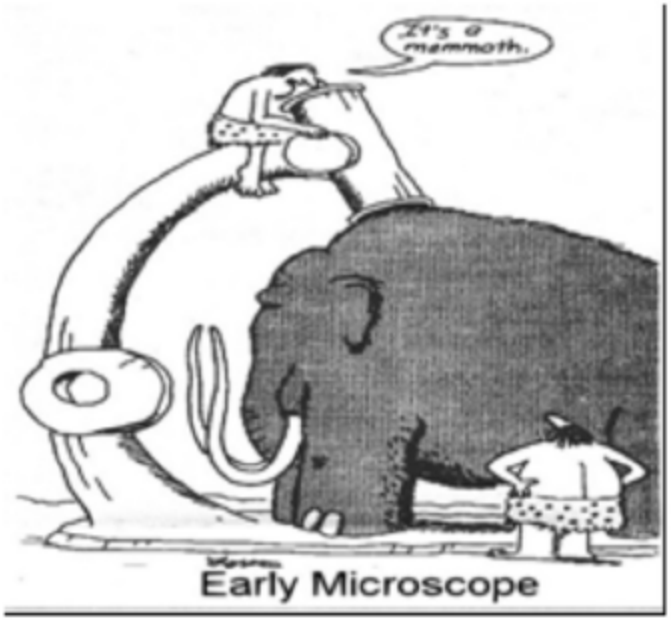








fluorecent stains can be used to show more contrast



Early Microscope

As microscopes became more powerful, biologists were able to see smaller and smaller objects.

One such object is the cell.

Studying the cell began to really bring up some questions to accepted theories at the time, such as spontaneous generation.

Spontaneous Generation

- the idea that life can emerge from non-living matter

How to test this idea? People at the time of Leeuwenhoek would place sweaty underwear and wheat husks into a jar and waited 21 days until baby mice appeared! Spontaneous Generation!



Another experiment placed some meat in three empty jars to see which meat would generate maggots.

The first jar was open to the enviroment and produced maggots.

The second jar was closed to the environment and did not produce maggots.

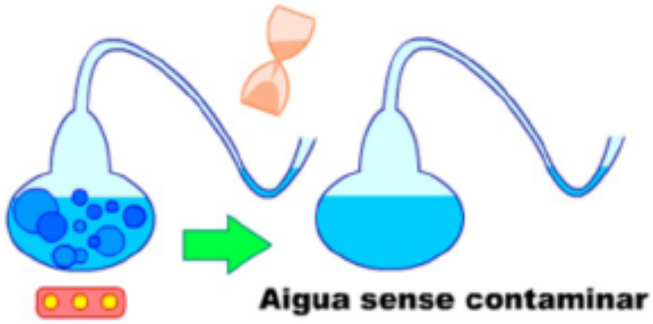
The third jar allowed air in and out, but had no access to the environment.

Q: What was the manipulated, controlled and responding variable in this lab?

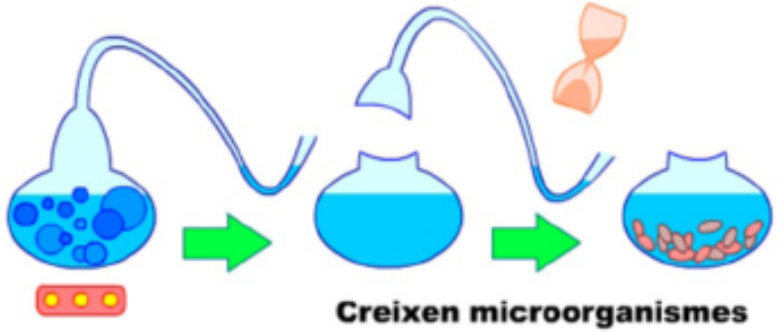
Despite the conclusive findings of this lab, the idea of spontanous generation still stuck around.

In 1859, the French Academy of Sciences held a contest to see who could come up with the best experiment to prove or disprove spontaneous generation.

The winner was Louis Pasteur. Pasteur designed an experiment with boiled chicken broth.



Flask 1: Boiled chicken broth + no contact with air = no mold appearing.



Flask 2: Boiled chicken broth + contact with air = mold

This experiment demonstrated two important ideas:

1. Non-living objects can not produce living objects

2. There are living organisms too small to see with the naked eye

And these ideas eventually lead to...

The Cell Theory

- all living things are made up of one or more cells
- all life functions take place in cells; they are the smallest unit of life
- all cells are produced from other living cells through cell division

This theory finally put to bed the idea that living things could appear from non-living things.

This theory was also formed out of the first observations of plant cells under a microscope.