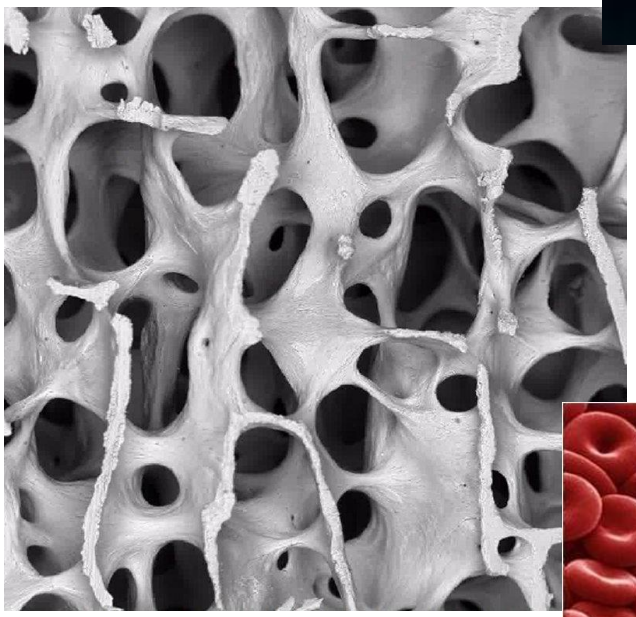
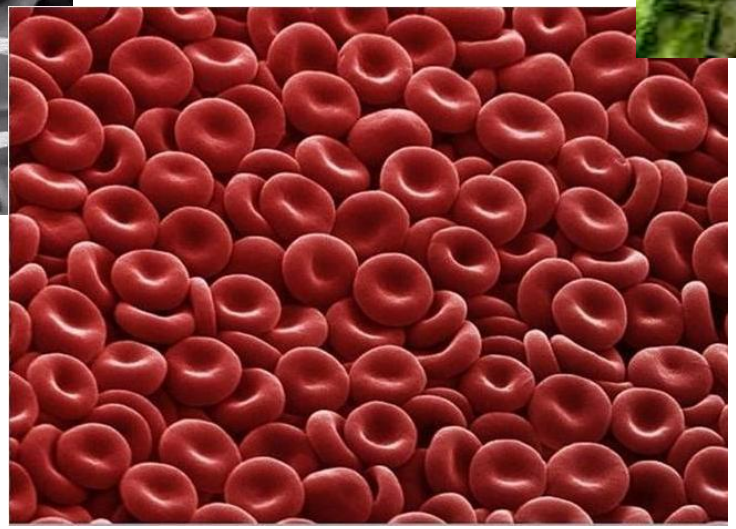
Cells

Cells are the **basic structural, functional, and biological unit** of all known living organisms.

Cells are often called the **"building blocks of life"**.

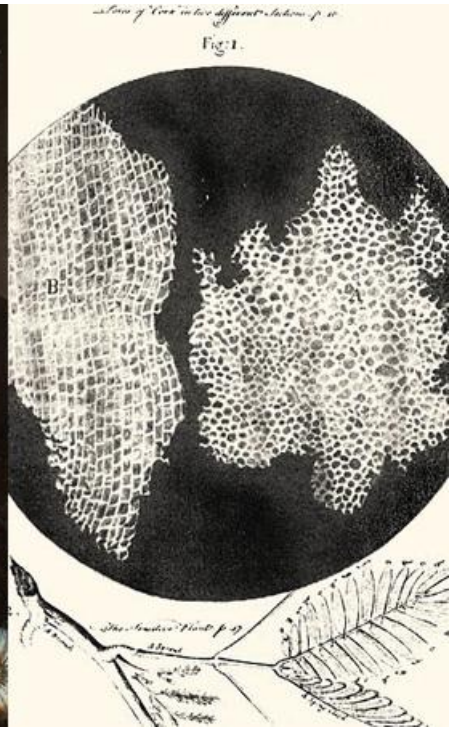


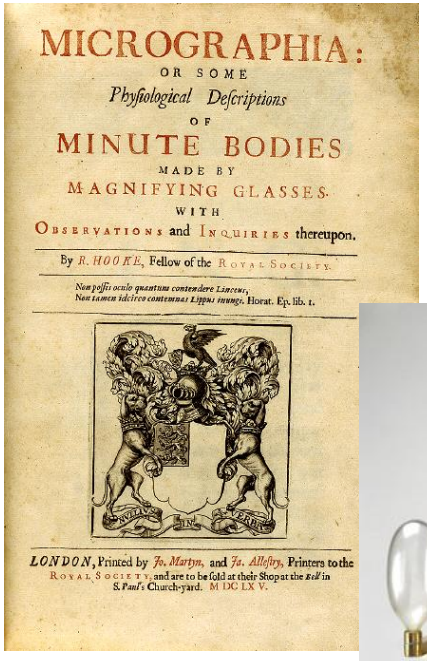


The study of cells is called **cell biology**.

Knowing the **components** of cells **and how cells work** is fundamental to all biological sciences.

Discovery of Cells




MICROGRAPHIA:
OR SOME
Physiological Descriptions
OF
MINUTE BODIES
MADE BY
MAGNIFYING GLASSES.
WITH
OBSERVATIONS and INQUIRIES thereupon.
By *R. HOOKE*, Fellow of the ROYAL SOCIETY.
Non possis oculo quantum contendere Lynceus,
Non tamen idcirco contemnas Lippus inungi. Horat. Ep. lib. 1.
LONDON, Printed by *Jo. Martyn*, and *Ja. Allestry*, Printers to the ROYAL SOCIETY, and are to be sold at their Shop at the *Bell* in S. *Paul's* Church-yard. MDCLXV.

***Micrographia*, published in 1665, was a bestseller!**

Hooke's design microscope system

Robert Hooke (1665):

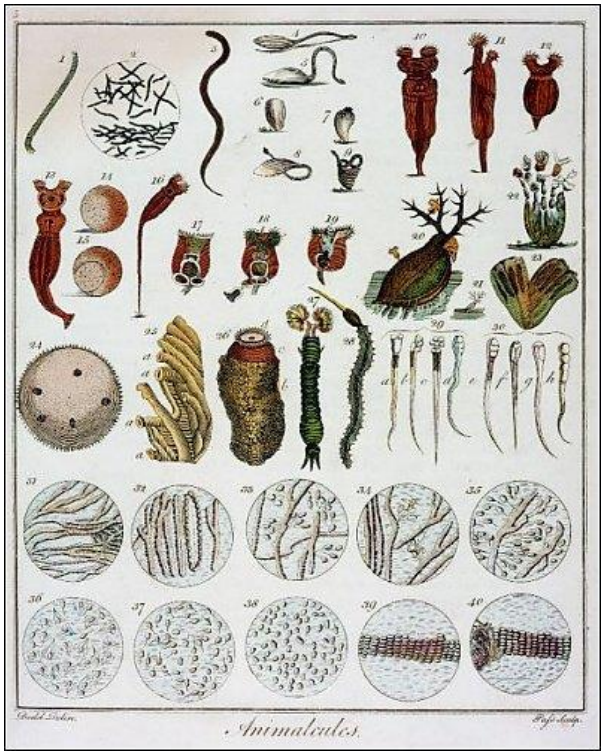
- **Observed a thin slice of cork (dead plant cells) with a compound microscope (20-50x) that he himself designed.**
- **Described what he observed as "little rooms" (*cells*).**

Discovery of Cells

Antonie van Leeuwenhoek (1675):

- Discovered a way to create a very small, high-quality glass spheres that became the lenses of his tiny microscopes, with the smallest spheres providing the highest (up to 500X) magnification.

- The first person to observe living cells and describe single-celled organisms (infusoria in 1674, bacteria in 1676) and the vacuole of a plant cell.
- Commonly known as "the Father of Microbiology".



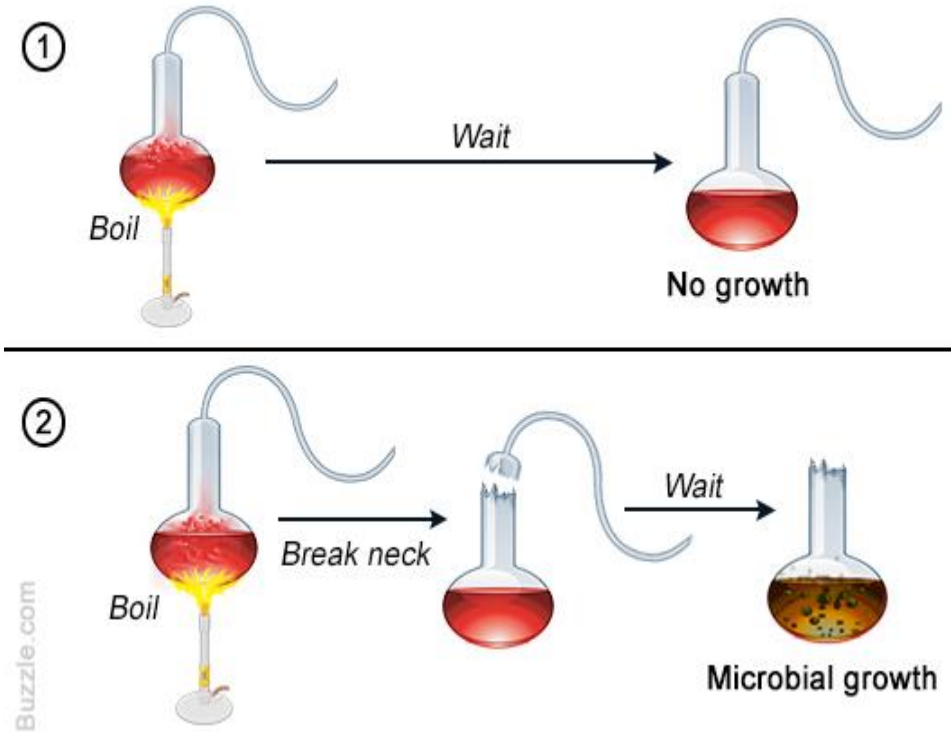
Cell Theory

describes the properties of cells as basic units of structure and reproduction in all organisms *(unicellular or multicellular).*

- **Matthias Schleiden (1838): concluded that all plants are composed of cells.**
- **Theodor Schwann (1839): concluded that all animals are composed of cells.**
- **Rudolph Virchow (1855): postulated that cells come only from other cells.**

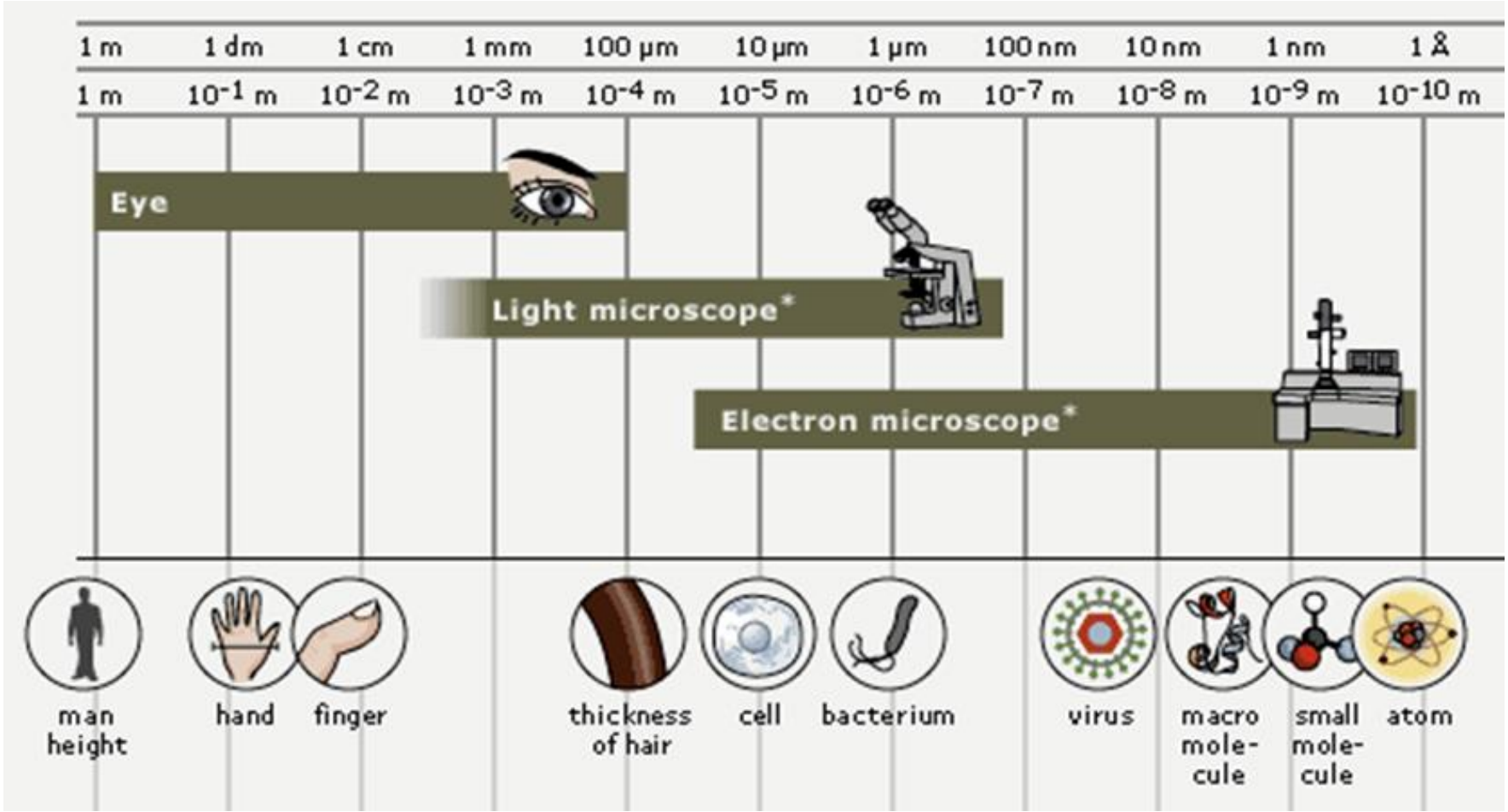
Swan-neck flasks experiment, Louis Pasteur 1864

- **Demonstrated that organisms such as bacteria and fungi *do not spontaneously appear* in sterile, nutrient-rich media, but only invade them from outside.**



- The theory of Spontaneous Generation (1861): *living things can originate from non-living*.
- Pasteur exposed boiled broths to air in vessels that had open long s-shaped necks that would not allow dust particles to pass to the growth medium.
- **Nothing grew** in the broths unless the flasks were broken open, thus **disproving the theory of spontaneous generation**.

How to observe cells?

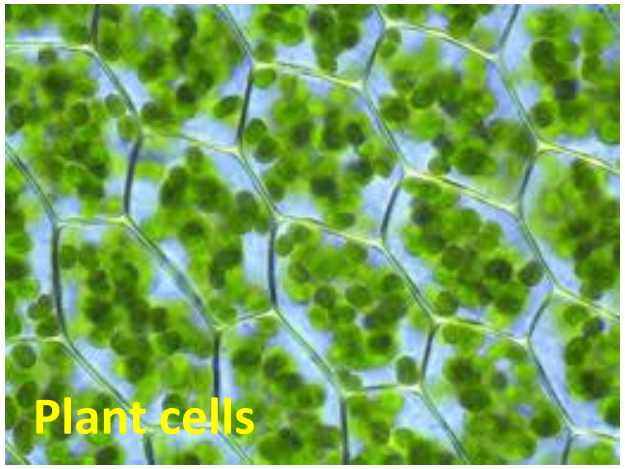


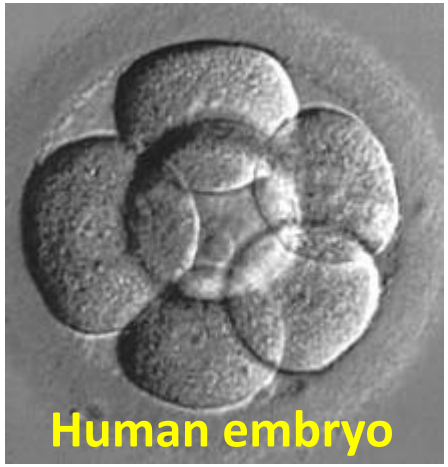
- **Magnification**: refers to the microscope's power to increase an object's apparent size.

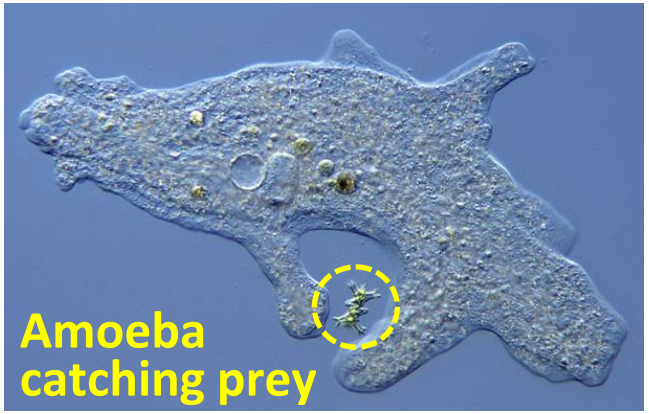
- **Resolution**: refers to the microscope's power to show detail clearly.

Observing cells: Light Microscope

- Invented around 1590-1600, name "microscope" given in 1625.
- Uses visible light and a system of lenses.
- Magnification of up to ~2000X.
- Resolution ~200-500 nm (limited by *diffraction of visible light*).
- Makes it possible to observe living cells in true color.



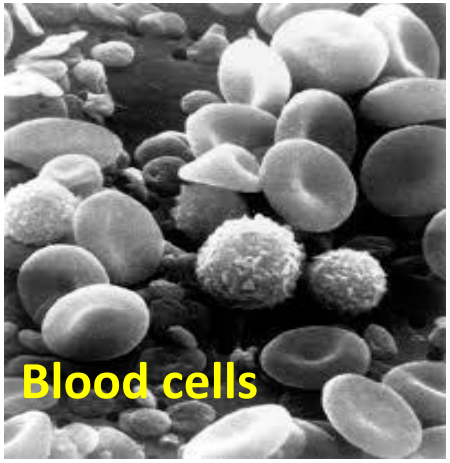


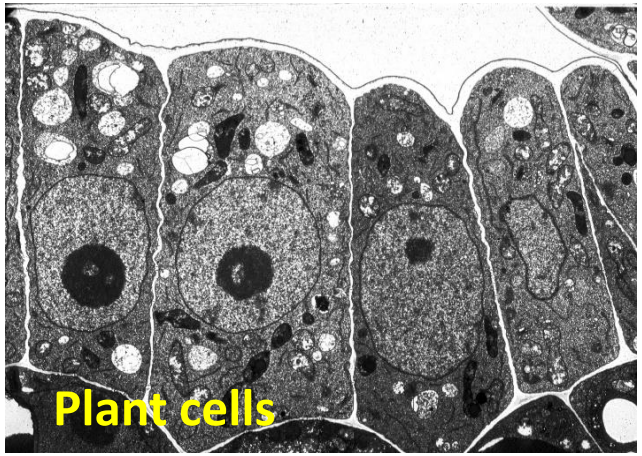


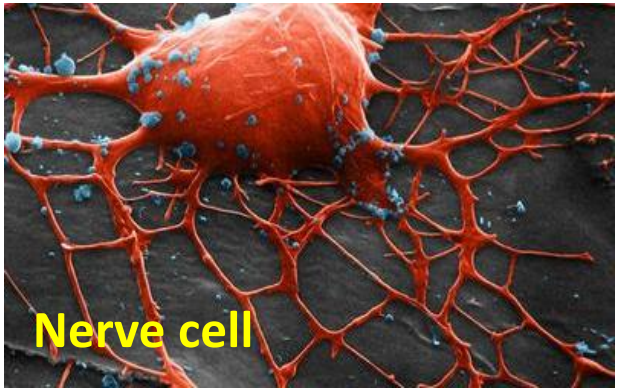
Observing cells: Electron Microscope

- Uses accelerated electrons as a source of illumination together with electrostatic and electromagnetic lenses to control the electron beam and focus it to form an image.
- 2D or 3D black and white images (may be colorized) with magnification of up to ~10,000,000X – great detail view!
- Preparation needed (for example, *chemical fixation* or *freeze drying*) kills the cells.

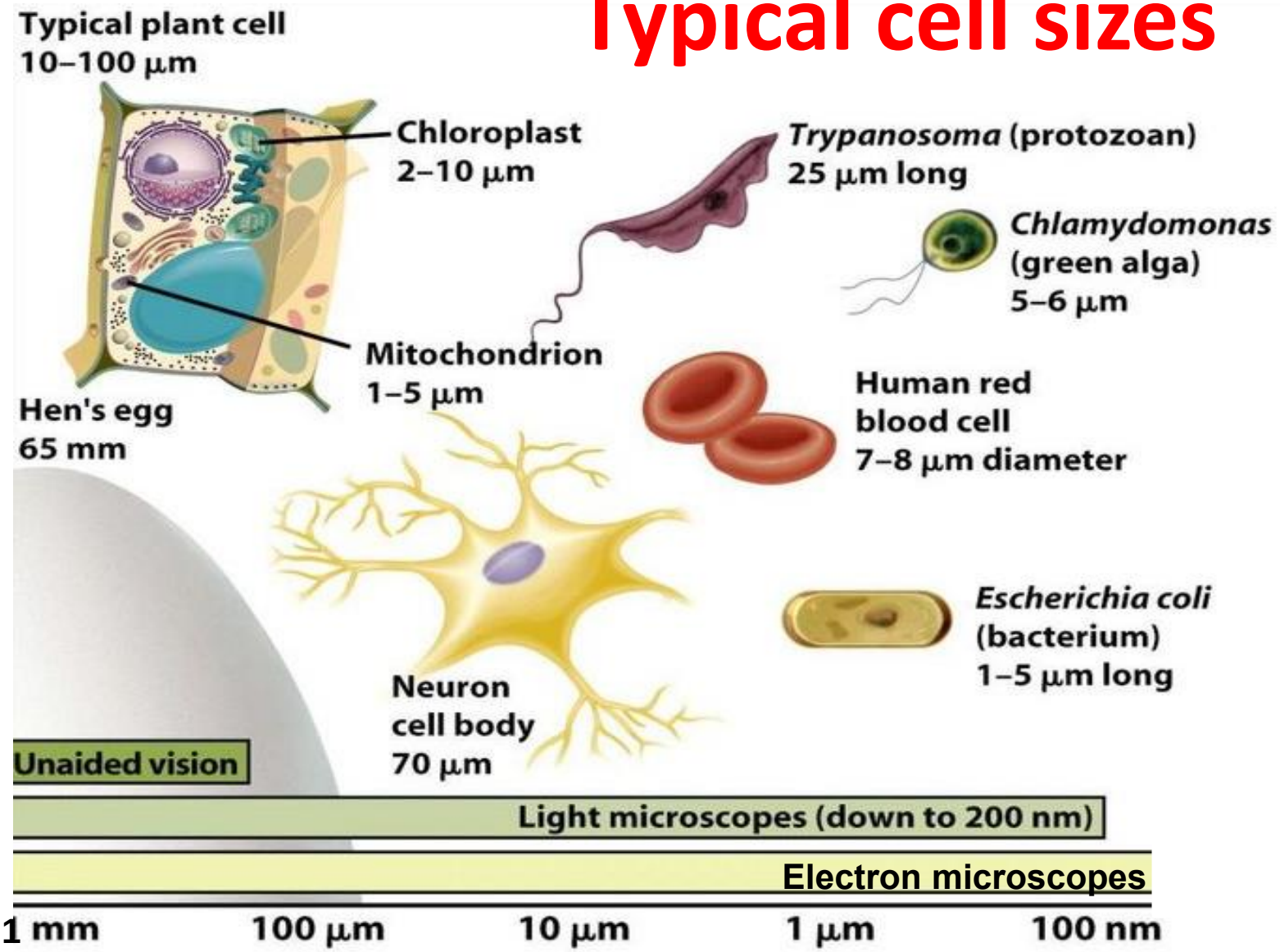
Invented ~1930; first commercial device produced by Siemens in 1939.







Typical cell sizes



Interactive tool https://learn.genetics.utah.edu/content/cells/scale/