

Introduction to the Cell Biology

Tishk International University,
Education Faculty, Biology Dept,
Cell Biology, 1st Semester/W1

CELL BIOLOGY?

- **Cell biology** (formerly **cytology**, from the [Greek](#) *kytos*, "container").

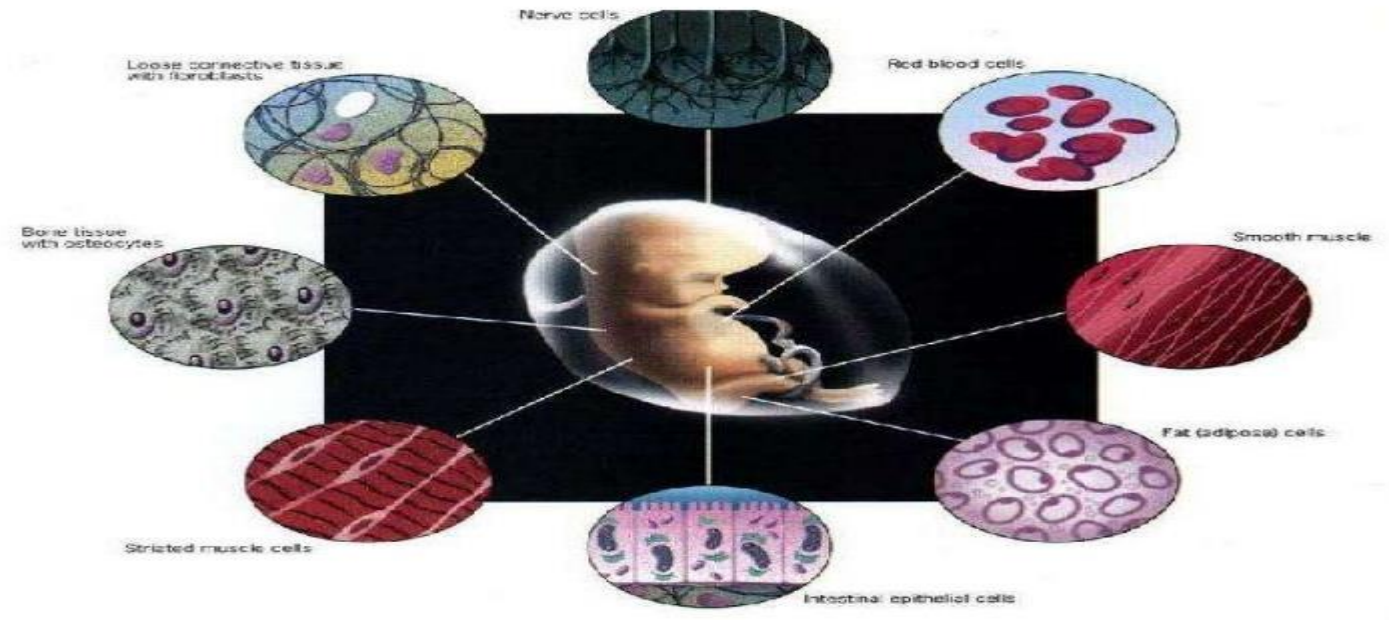
Cell properties/ physiology

Structure

Organelles

Interaction with the
environments

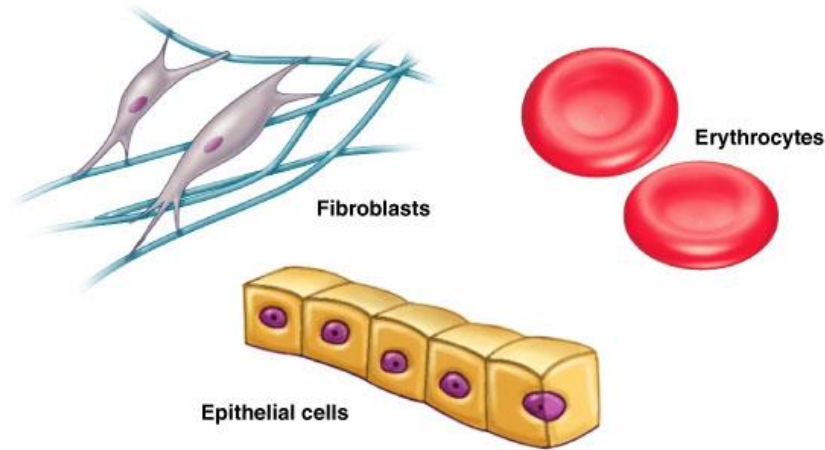
- Cell is structural and functional unit of all living organism.



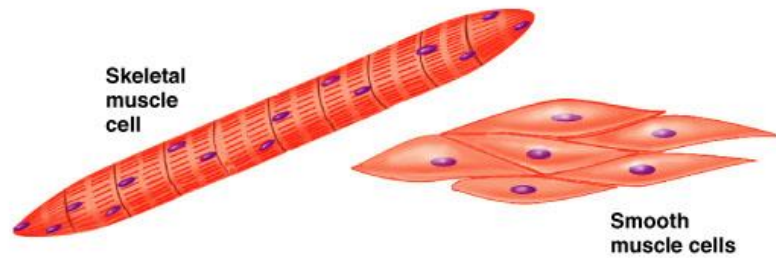
The cell is the structural unit of life.

All organism is make up of cells.

Cell Diversity

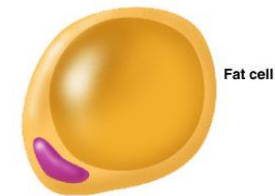


(a) Cells that connect body parts or cover and line organs

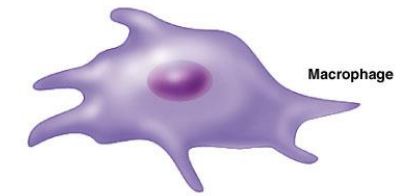


(b) Cells that move organs and body parts

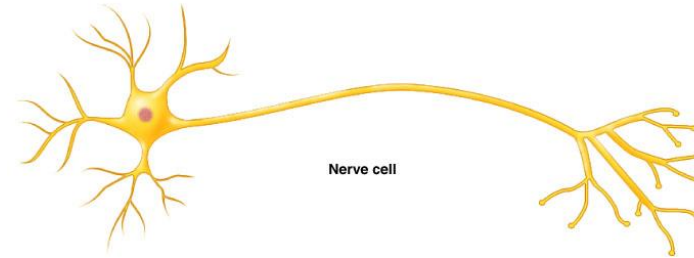
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(c) Cell that stores nutrients



(d) Cell that fights disease



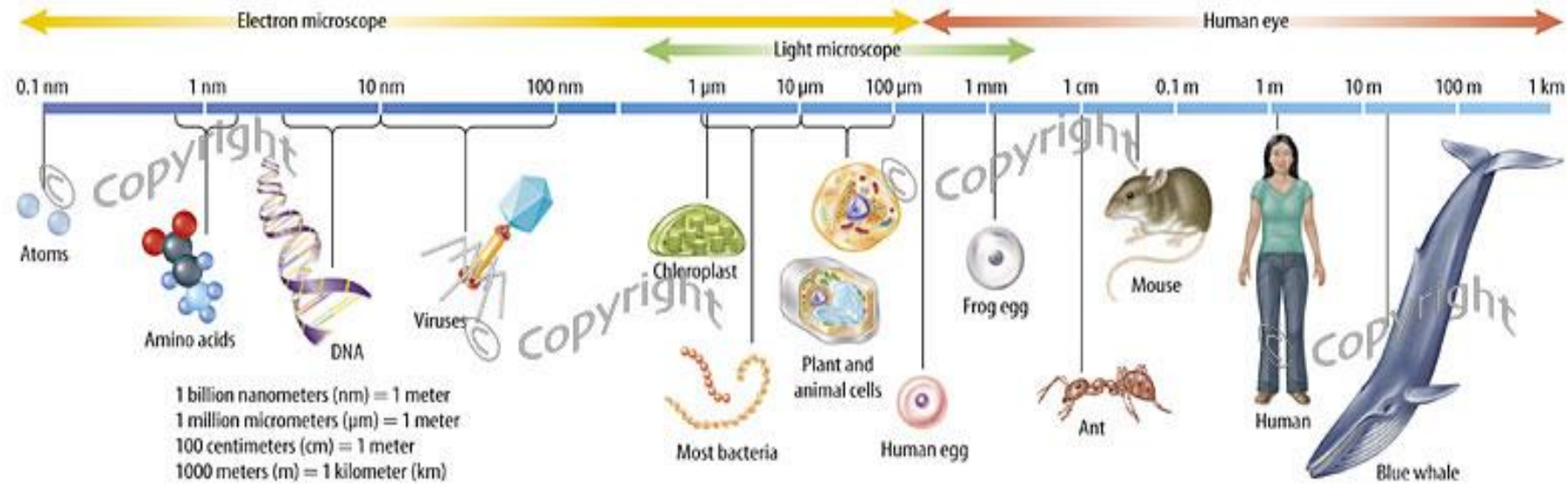
(e) Cell that gathers information and controls body functions



(f) Cell of reproduction

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- Most cells are between 1-100 μ m in diameter which can be visualized by light microscope.



1.1 The Discovery of Cells (1)

- The discovery of cells followed from the invention of the **microscope** by Robert Hooke, and its refinement by Anton Leewenhoek.



The Discovery of Cells (2)

- **Cell theory** was articulated in the mid-1800s by Schleiden, Schwann and Virchow.
 - All organisms are composed of one or more cells.
 - The cell is the structural unit of life.
 - Cells arise from pre-existing cells by division.

contributors

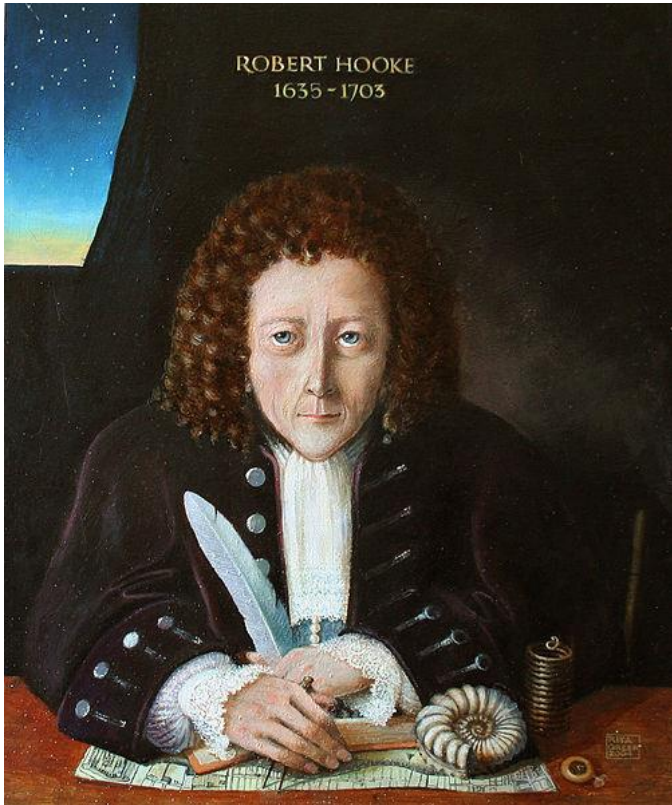
There are **5** contributors to the cell theory:

1. Robert Hooke
2. Anton van Leeuwenhoek
3. Matthias Schleiden
4. Theodor Schwann
5. Rudolf Virchow

Each of the above contributors produced evidence through investigations and experiments that led to today's cell theory!

Robert Hooke

English Scientist



- Used the compound microscope to observe cork.
- Hooke observed that cork is composed of small, hollow compartments.
- The parts prompted Hooke to think of small rooms (cells) in a monastery, so he gave them the same name: **CELLS**.
- **Investigated cork through experimenting with the compound microscope and came up with the name cells!**

Key Note: Hooke discovered the cell in 1665, which started formulating the cell theory!

https://en.wikipedia.org/wiki/Robert_Hooke

Cork

https://commons.wikimedia.org/wiki/File:Cork_oak_trunk_section.jpg

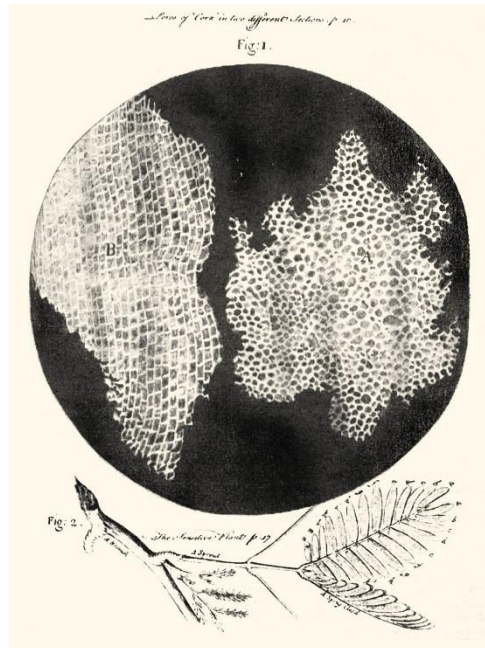


Monastery

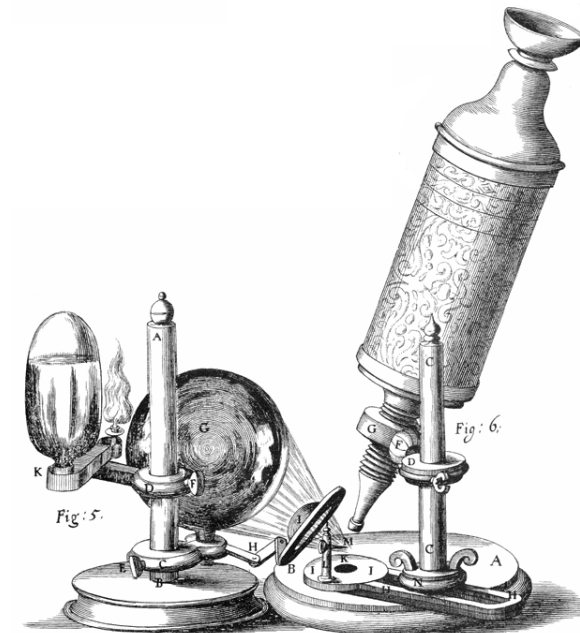


Hooke's Investigation/experiment

Hooke's Observations



Hooke's Microscope



Anton van Leeuwenhoek

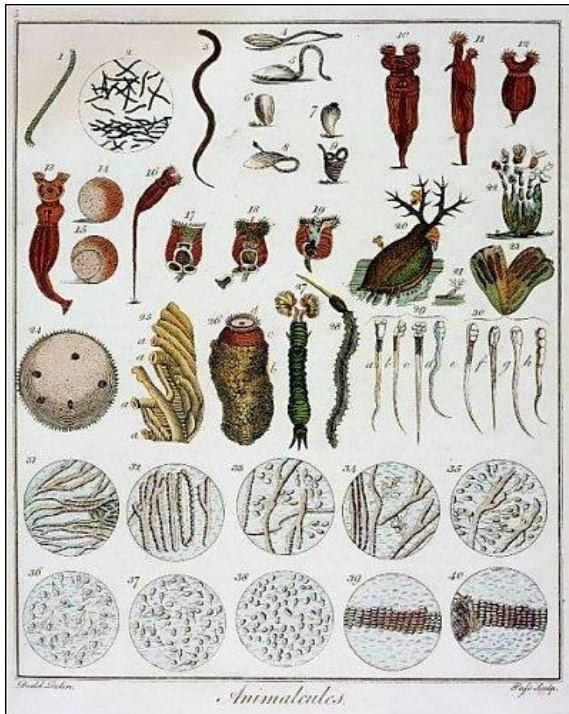


Dutch Tradesman

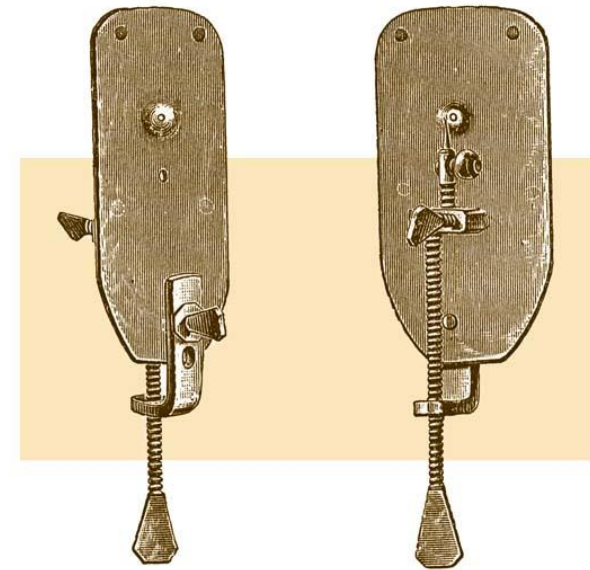
- Study new approaches for creating lenses to observe cloth.
- Leeuwenhoek's microscope was more powerful than Hooke's compound microscope.
- **From investigating and experimenting with his microscope, Leeuwenhoek became one of the first scientists to refer to living cells when he observed an abundant number of single-celled organisms, which he called animalcules (plant & animal), swimming in a drop of pond water!**

Leeuwenhoek's investigations/experiment

Leeuwenhoek's Observations



Leeuwenhoek's Microscope



Matthias schleiden



German Scientist

- Fascinated with plant cells, Schleiden used the compound microscope and studied plant cells.
- **From investigating and experimenting with plants, projected plant parts are made of cells!**
- Discussed what he observed with his dear friend, German scientist Theodor Schwann.

Theodor Schwann



German Scientist

- Studied plant & animal cells, and was intrigued by the similarities between the two.
- **From investigating and experimenting with plant & animal cells, Schwann was able to determine that all animals are made of cells!**
- Schwann published the 1st statement of the cell theory: all living things are made of cells and cell products!

Rudolf Virchow



- Based on his investigations and experiments, he stated that all cells come from preexisting cells, which is the 2nd part of the cell theory: all existing cells are produced by other living cells!

Key Note: After Virchow's completed his work, the cell theory was finally formulated in 1838!

Cell Theory

There are **3** major parts of the cell theory:

1. All organisms are made of cells.
2. All existing cells are produced by other living cells.
3. The cell is the most basic unit of life.

Recap

Cell Theory

There are **3** major parts of the cell theory:

1. All organisms are made of cells.
2. All existing cells are produced by other living cells.
3. The cell is the most basic unit of life.

These three parts were discovered between 1665-1838.

Key Note: It took over 173 years for the cell THEORY to be formulated, wow!

Contributors

There are **5** contributors to the cell theory:

1. Robert Hooke
2. Anton van Leeuwenhoek
3. Matthias Schleiden
4. Theodor Schwann
5. Rudolf Virchow

Eye-Catchers

Robert Hooke

- came up with the name *cells*

Anton Van Leeuwenhoek

- referred to living cells called animalcules (plant & animal) after observing a drop of pond water

Matthias Schleiden

- projected plant cells are made of cells

Theodor Schwann

- determined all animals are made of cells (1st statement of the cell theory)

Rudolf Virchow

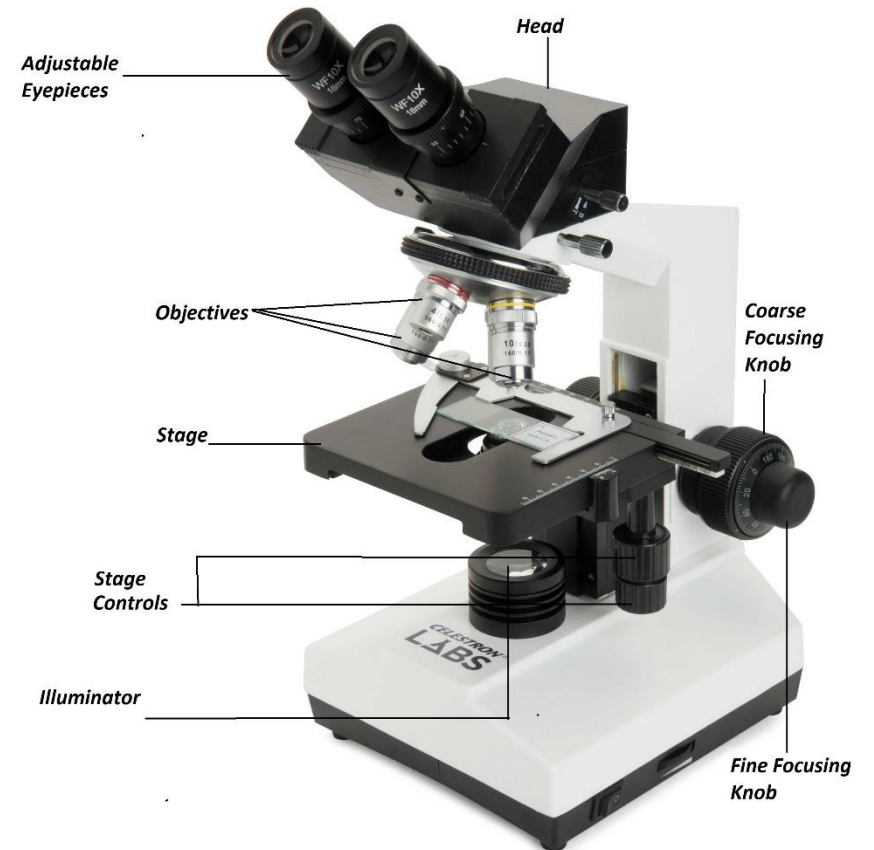
- stated all cells come from preexisting cells (2nd statement of the cell theory)

Microscopes

- 2 major type of microscopes
 - **Light Microscope**
 - Visible light is passed through the specimen and then through glass lenses
 - **Electron Microscope**
 - Focuses a beam of electrons through the specimen/ cannot be used to observe living cells.
 - **Transmission EM (TEM):**
 - Used mainly to study the internal structure of cells
 - 2D image
 - Highest magnification (200,000 x)
 - **Scanning EM (SEM):**
 - Used mainly for detailed study of the surface of a specimen
 - 3D image
 - (100,000 x)

Light Microscope-Compound Microscope

- Two lenses,
- provide a magnification of 1,000 times
- Compound microscopes are bright field microscopes, meaning that the specimen is lit from underneath, and they can be binocular or monocular.



2) Stereo Microscope

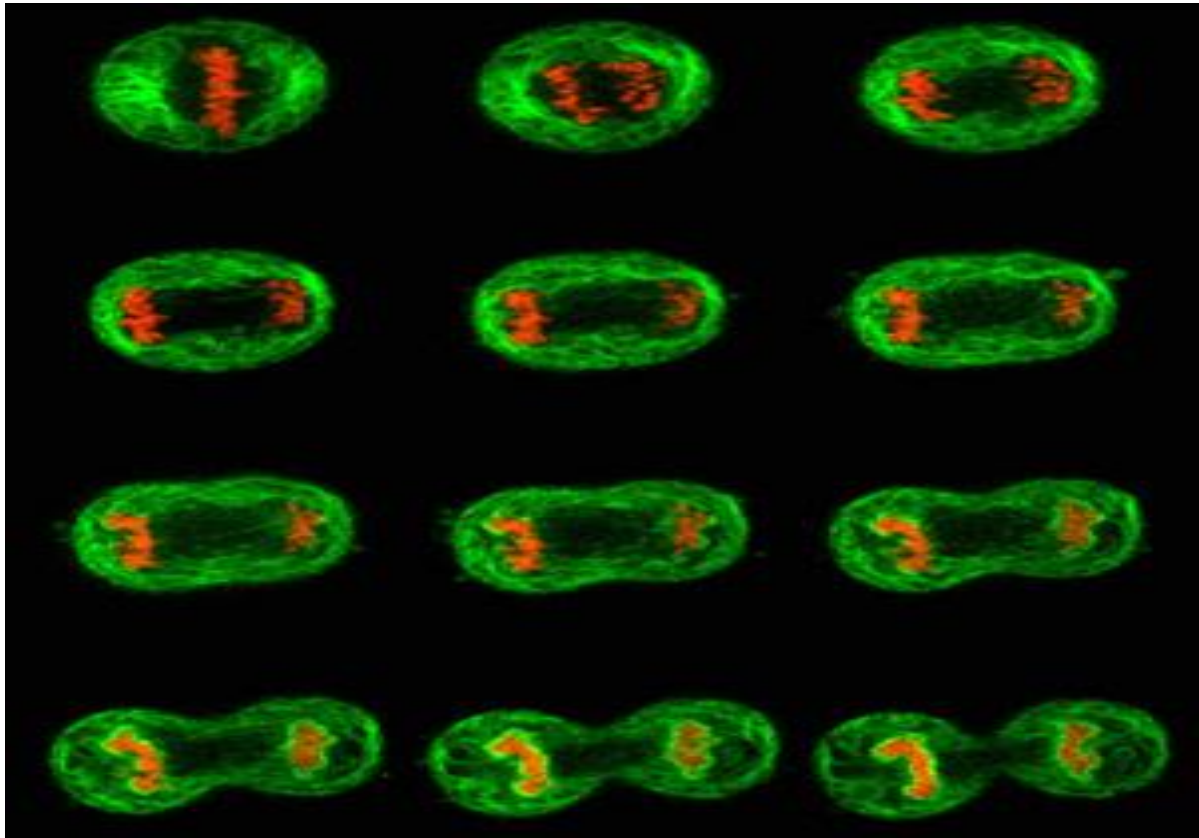
- also called a dissecting microscope, provides magnification of up to 300 times.
- don't require a slide preparation.
- provide a 3-D view of objects'
- surface textures, and they allow the operator to manipulate the object during viewing.
- Stereo microscopes are used in biological and medical science applications as well as in the electronics industry, such as by those who make circuit boards or watches.



3) Fluorescence Microscope

- Microscopes can be used to view different aspects of a sample by varying how an image is created.
- Fluorescence microscopes use specific colors of light to interact with dyes.
- As the dyes become illuminated, certain structures can be isolated and viewed with their respective dyes.
- This type of microscope is useful technique for visualizing proteins, subcellular structures and cellular processes in intact cells (live or fixed).
- A camera is usually attached to capture images from the microscope.

Image of fluorescence Microscope

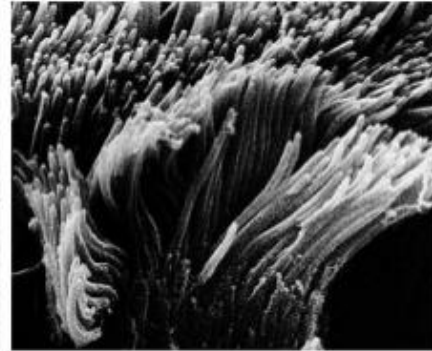
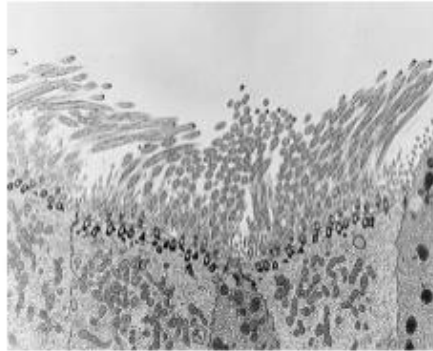


2) Electron Microscope

- **2.1. Scanning Electron Microscope;**
- uses electrons rather than light for image formation.
 - must be specially prepared that being coated with a thin layer of a conductive material.
- produces a 3-D, black-and-white image on a computer screen.
- researchers in the physical, medical and biological sciences to examine a range of specimens from insects to bones.



● ● ● | TEM & SEM



- **2.2. Transmission Electron Microscope;**
- Unlike the SEM, however, the TEM uses a slide preparation to obtain a 2-D view of specimens, so it's more suited for viewing objects with some degree of transparency.
- useful in the physical and biological sciences, metallurgy, nanotechnology and forensic (criminal) analysis.



SEM Electron microscope image

