



Microscopy/ cell morphology and tissues observation

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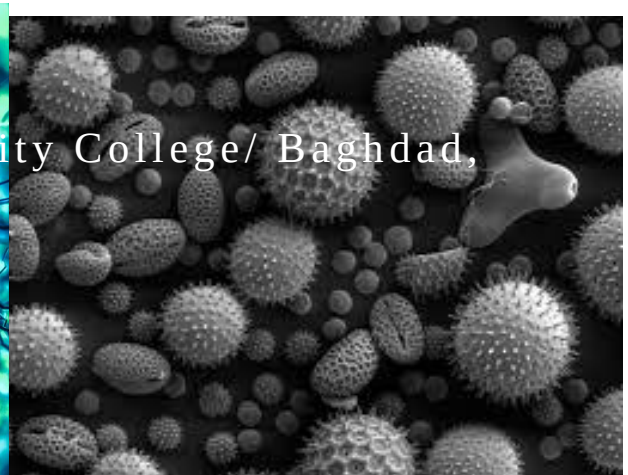
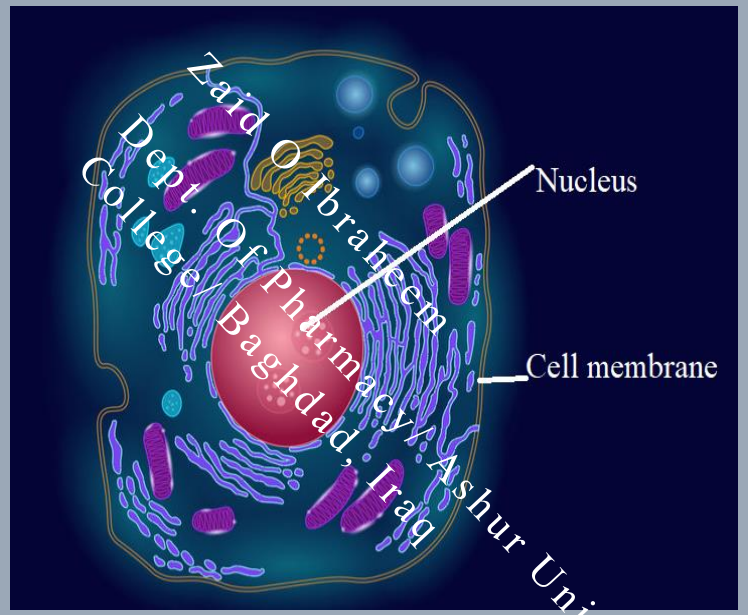


- CELLS AND TISSUES



Cells

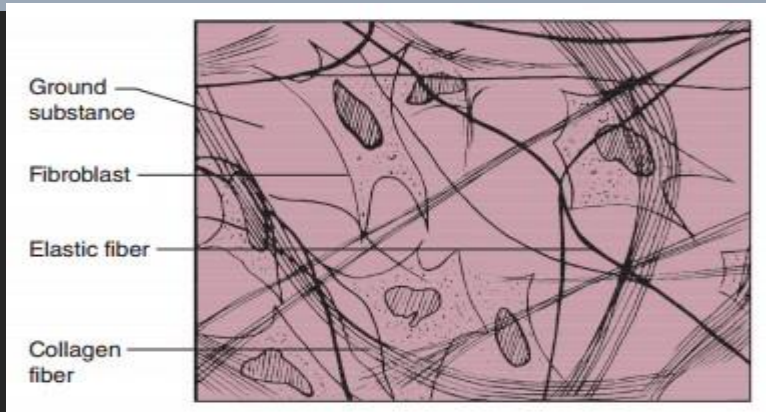
Cells are the smallest living building unit of the biological system.

They are surrounded by a semi-selective permeable membrane which regulates entry of nutrients and exodus of waste products.

They have a nucleus which master most of the cellular functions that are performed by different organelles.

Tissues

Tissue is an arrangement made up of a cluster of cells that serve certain function and are found interspersed in a matrix made up of a ground substance and fibers

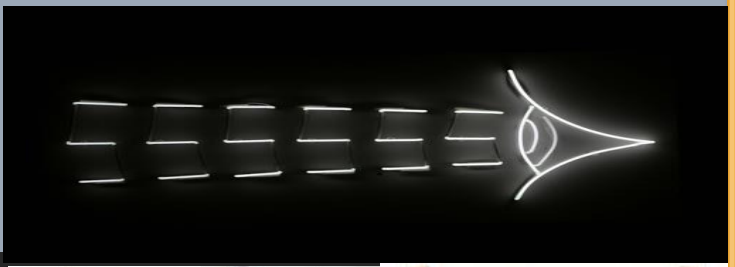


LEVELS OF CELL MORPHOLOGY OBSERVATION

Cells morphology is observed at 3 levels

1-Gross morphology

Visualization of objects by naked eyes. The minimum detectable point by naked eye measures 200 µm in diameter.

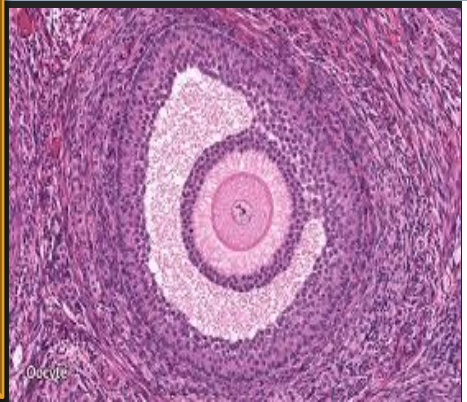






2-Structural morphology

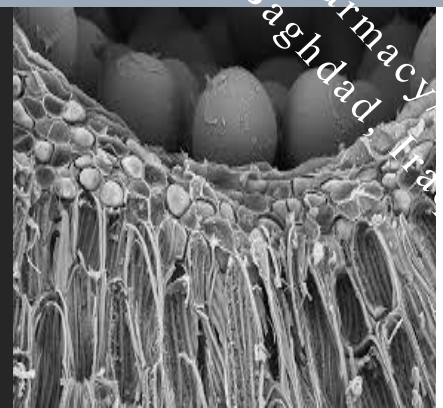
Visualization of the main tissues components (cells, fibers & ground substance using the compound light microscope (L/M). Only the outer contour and nuclei of cells can be observed.





3-Ultrastructural morphology

Visualization of the subcellular components using the electron microscopy





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Microscopy

Microscopy is a technical field of biology; used to observe objects invisible by naked eyes.

Microscopy is used to determine structural and ultrastructural morphology

It helps magnify small objects thousand times

Classification of microscopy

- Optical microscopy
- Electron microscopy
- Scanning probe microscopy



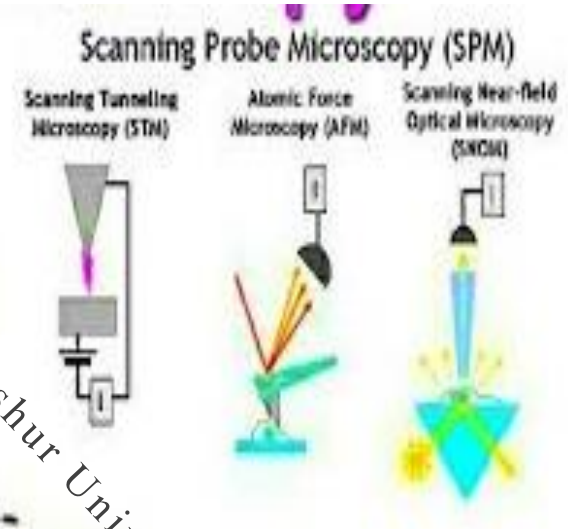



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Image quality in microscopy

The image should be of high resolution and contrast

The image should be free of noise, artifacts and distortion.

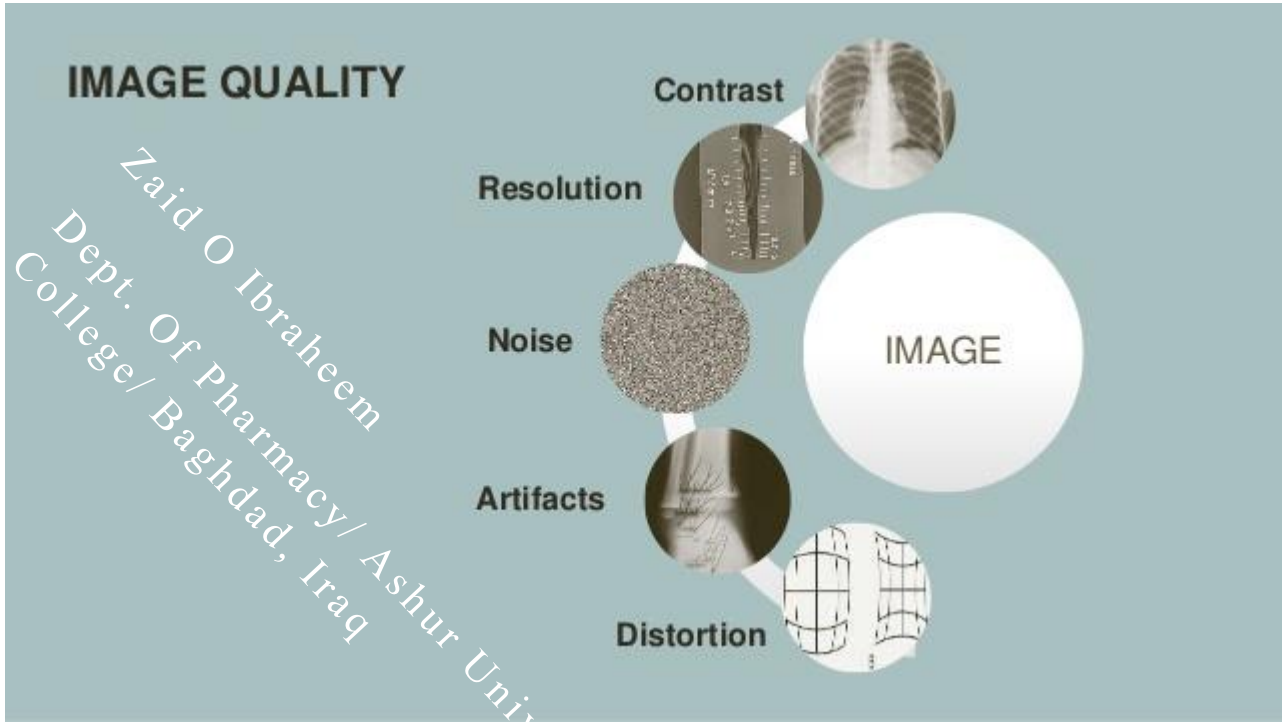
RESOLUTION

Ability of the microscope to distinguish between two adjacent points and is related to the magnification power.

Since the smallest viewable object is 200 μ, if the resolution power is 1000 times, it means that the observer can view objects as small as 200 nm (volume of cells) but can not view the sub-cellular content

CONTRAST

Difference of light intensity of two adjacent points or with the background so it is easier to identify.



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Optical Microscopy

Optical microscopy is based on observing a beam of light passed through a stained or unstained specimen fixed on a slide .

The light beam passes through a series of magnifying lenses to magnify the object by 100-1000 times.

The minimum detectable diameter under the light microscope is 0.2 µm which is 1000 times less than that observed by naked eyes.

Classification of optical microscopy

based on the (staining and incidence of the beam

Bright field microscopy (simplest form of optical microscopy)

A beam of light passes through an unstained specimen making use of the difference in the light diffraction of the cell components. It has a low contrast

Staining light microscopy

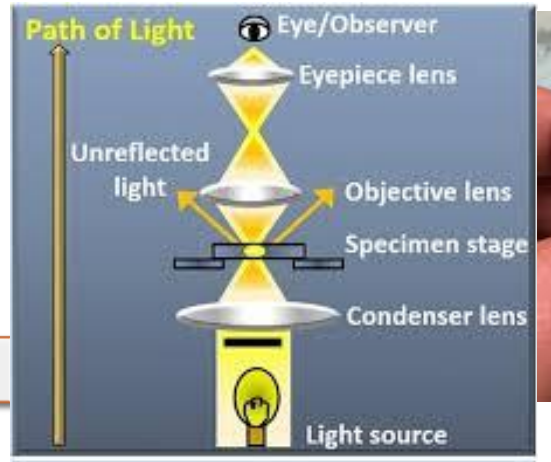
Similar to the bright field but the tissue specimens are stained to get a better contrast for the image

Oblique microscopy

Similar to the bright field but the incident light fall obliquely to get 3-dimension

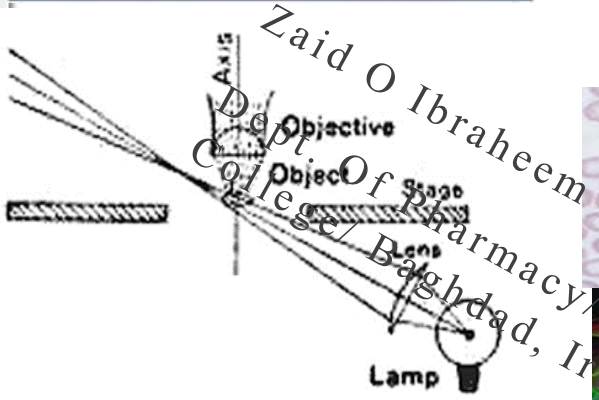
Fluorescent microscopy

A beam of high energy light passes through a specimen stained with a fluorescent dye . It gives higher contrast than others

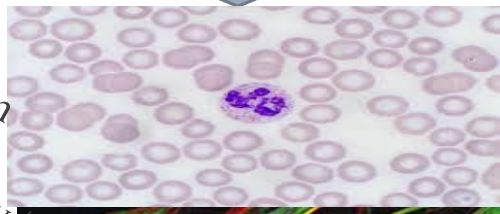


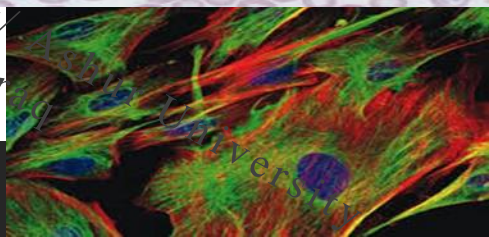
BRIGHT FIELD MICROSCOPY


Stained slide to be viewed in microscope



Oblique microscopy





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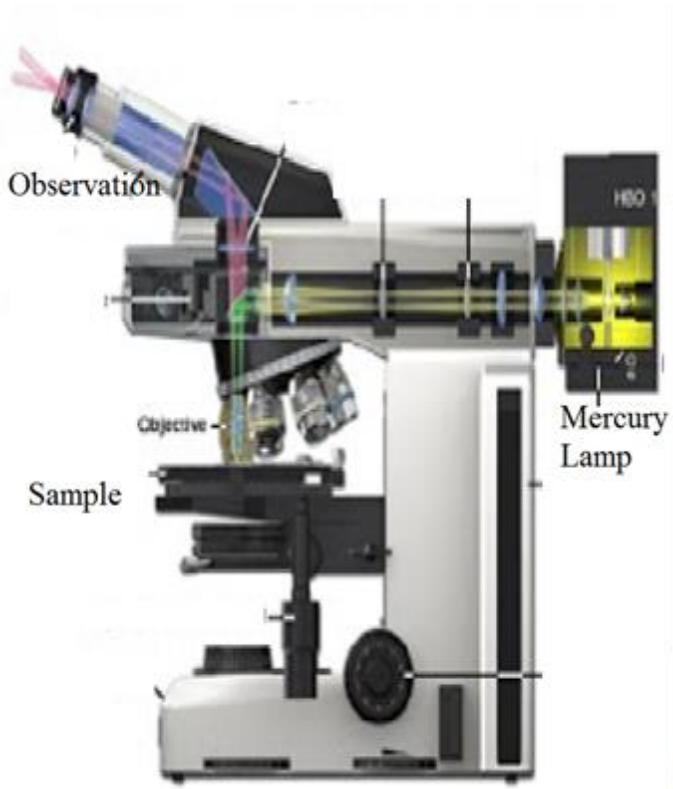
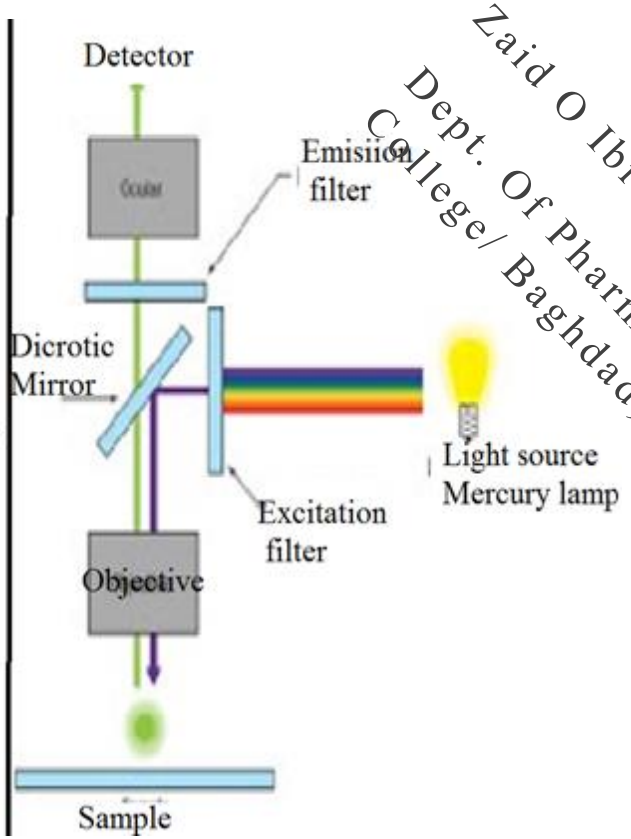
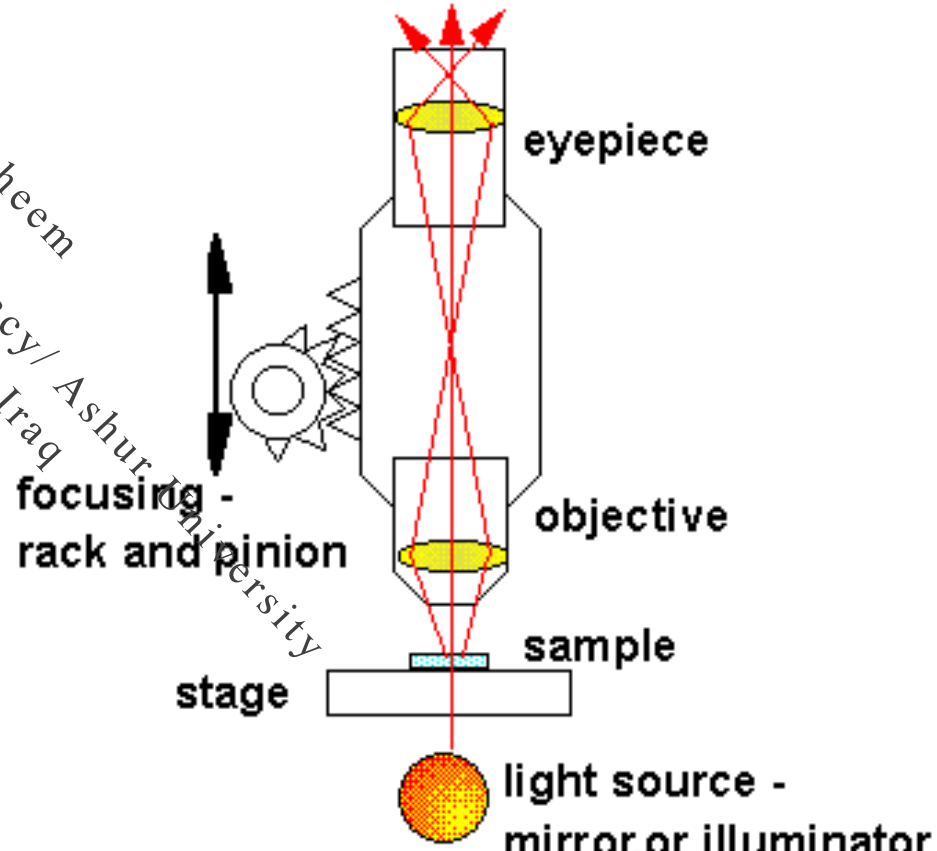
Fluorescent and compound light microscope







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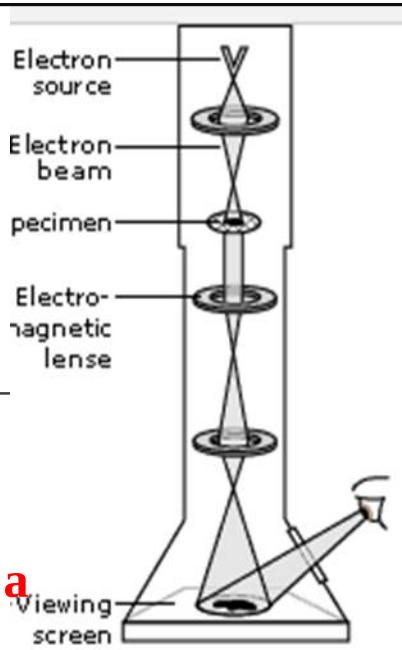
Electron microscopy

Electron microscopy is based on passing a beam of cathode ray (stream of electrons)

The cathode ray passes through an object or a piece of living tissue; pre-fixed in special slides)

Then, the ray falls on a photographic film to produce a TV quality image.





It is used to observe structures smaller than 0.2µm.

Types of electron microscopy

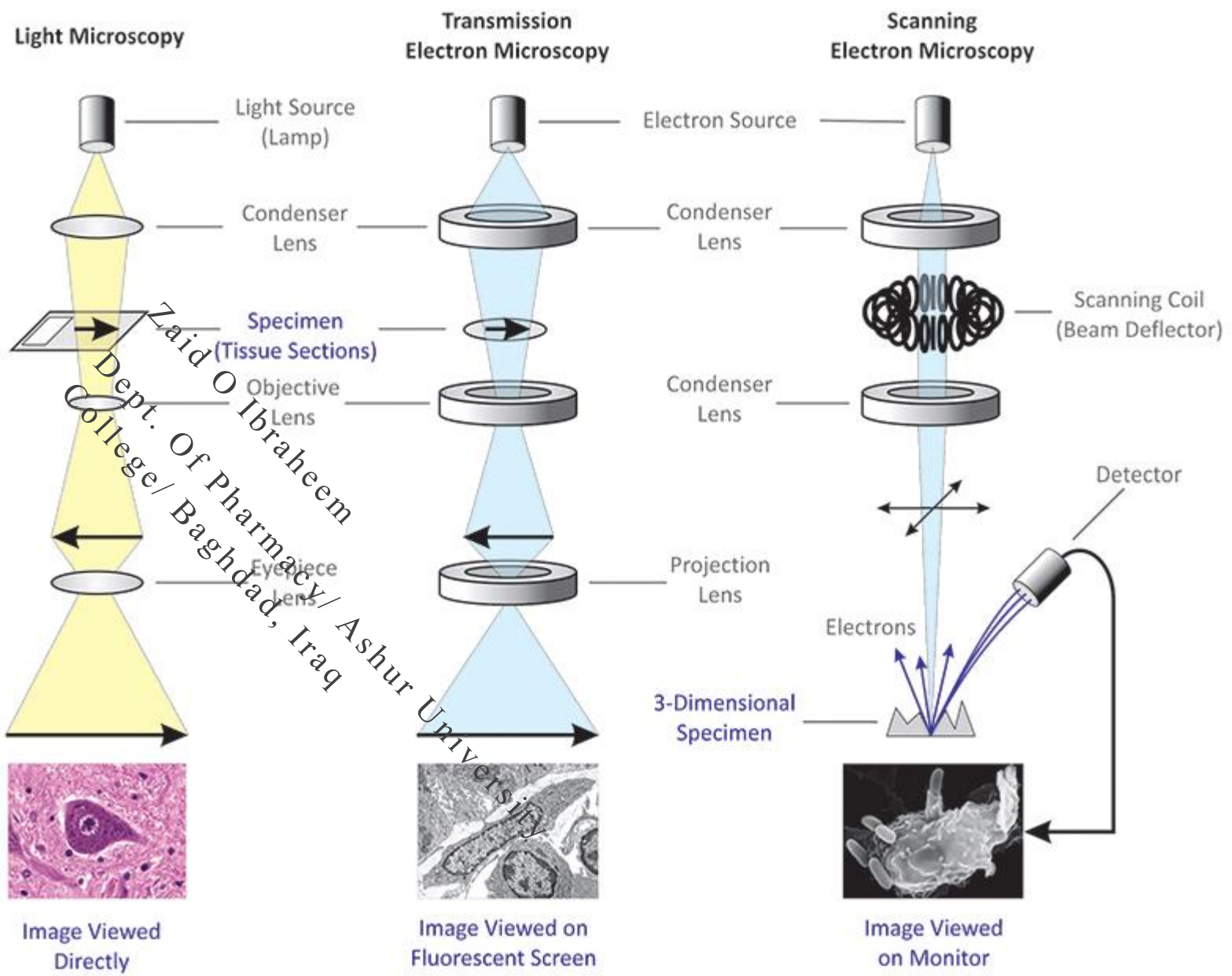
- Transmission electron microscopy
  TEM
- Scanning electron microscopy

TEM

- Used in biology to view the inside of the cell
- Detects the subcellular content of cells
- The cathode ray passes through the object
- No special treatment

SEM

- Used in industry to view solid particles
- Get a 3 dimensional view of the object
- The cathode ray just hit the surface of the object and give a 3-D photo for the surface
- Special coating with metals that reflect the beam of the cathode ray



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Light microscopy	• A beam of light passes through a specimen (unstained or stained) and compound light microscope is used. • Resolution :- the photo is magnified using a series of magnifying lenses. • The contrast is improved using stains (coloring acidic or basic stains or fluorescent stains.
Electron microscopy	• A beam of cathode ray passes through a sample and the photo is captured through a T.V screen to get a TV quality image. • Both of the contrasts and resolutions are high
Specimen Probe Microscopy	• This type of microscopy uses special probes that apply laser beam to create a mechanical stress and make use of the Piezoelectric characters of the atoms as they show some changes in their electric or photogenic properties which are detected using specific detectors.

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Types of microscopy

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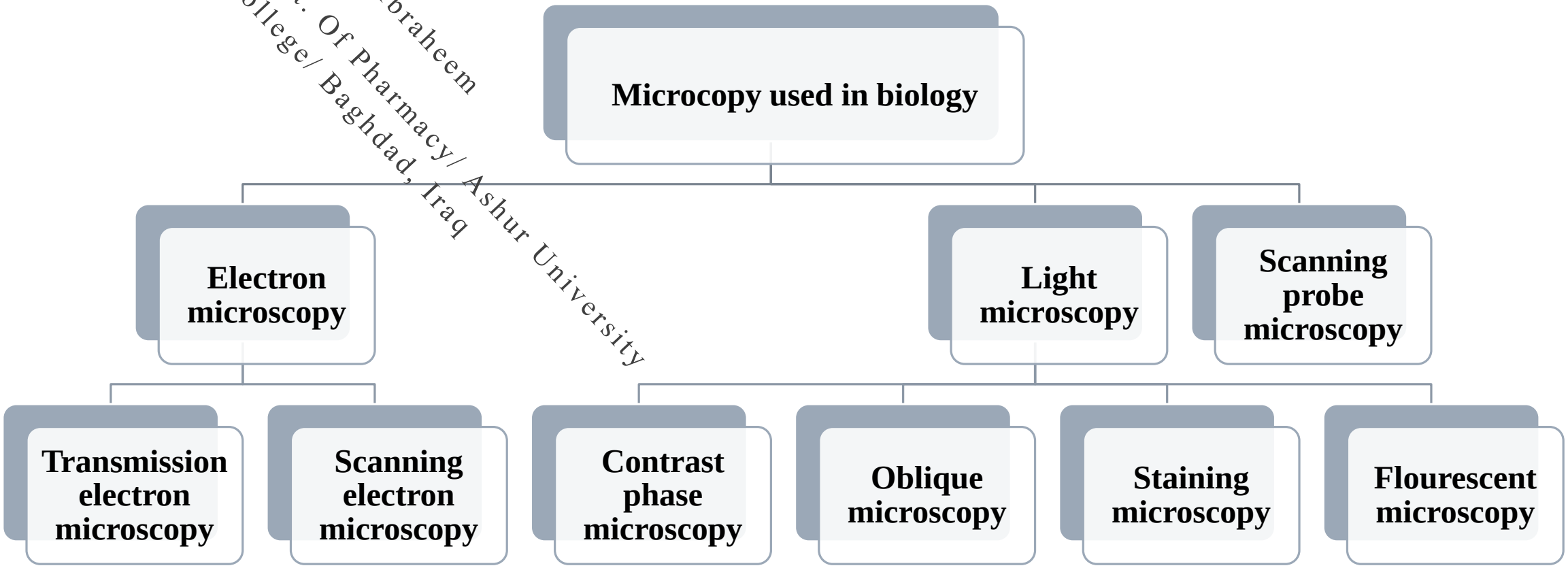



Thank you

DR ZAID O IBRAHEEM