1.1- Subtopics:

Ch.1-Cellular and Molecular Biology	
	1.1- Introduction to biology
1	Functions of Life
2	Organization
3	The Scientific method
4	The Metric System
5	Accuracy and Precision
6	Microscopy
7	Ultracentrifuge.
8	Lab Cell Techniques
9	Lab Safety
10	**Introduction Mix Questions**

1.1.1- THE LIFE FUNCTIONS

All living organisms whether unicellular or multicellular carry out certain life processes.
They include:

1. INGESTION — Intake of nutrients

2. DIGESTION — Enzymatic breakdown, hydrolysis, of food so it is small enough to be absorbed and assimilated by the body.

3. RESPIRATION — Metabolic processes that produce energy (adenosine triphosphate or ATP) for all the life processes.

4. TRANSPORT — Distribution of molecules from one part of a cell to another or from one cell to another

5. REGULATION — Ability to maintain internal environment stabile, also called homeostasis

6.SYNTHESIS

Combining of small molecules or substances into larger, more complex ones

7. EXCRETION

Removal of metabolic wastes

8.EGESTION.

Removal of undigested waste

9. REPRODUCTION.

Ability to produce fertile offspring of the same kind

10.IRRITABILITY.

Ability to respond to stimuli

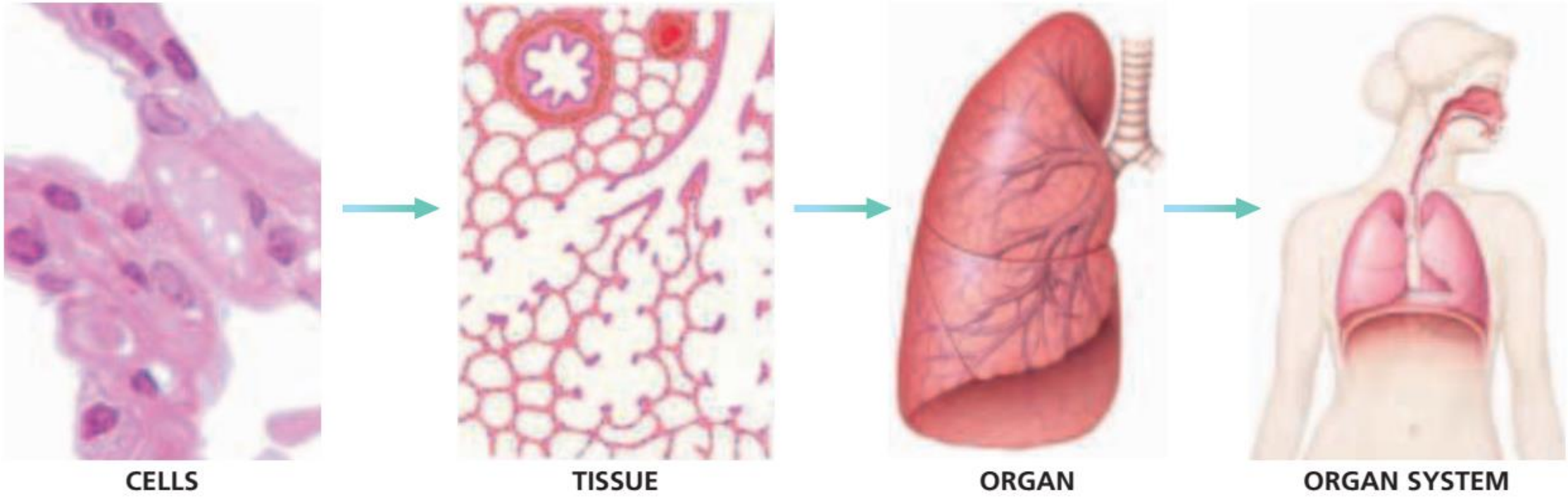
11. Movement

Moving the organism or part of the organism.
Locomotion is moving from place to place for animals or some animal like cells.

12.METABOLISM.

Sum total of all the life functions

1.1.2- Organization in a living organism



In a multicellular eukaryotic organisms, cells organize into tissues.
Tissues organize into organs. Organs are part of organ systems, in which organs work together to perform body functions.

1.1.4- THE METRIC SYSTEM AND MEASURING

Length	Mass
1 km (kilometer) = 1000 M (meters)	1 kg (kilogram) = 1000 g (grams)
1 M = 0.001 km or 1 × 10–3 km	1 g = 0.001 kg or 1 × 10–3 kg
1 M = 1000 mm (millimeters	1 g = 1000 mg (milligrams)
1 mm = 0.001 M = 1 × 10–3 M	1 mg = 0.001 g or 1 × 10–3 g
1 mm = 1000 µm (micrometers)	1 mg = 1000 µg (micrograms)
1 µm = 0.001 mm or 1 × 10–3 mm	1 µg = 0.001 mg or 1 × 10–3 mg
1 km (kilometer) = 1000 M (meters)	1 kg (kilogram) = 1000 g (grams)

Volume
1 L (liter) = 1000 mL
1 mL = 0.001 L or 1 × 10–3 L

TABLE 1-1 *SI Base Units*

Base quantity	Name	Abbreviation
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous (light) intensity	candela	cd

TABLE 1-3 *Some Derived and Other Units*

Quantity	Name	Abbreviation
Area	square meter	m^2
Volume	cubic meter	m^3
Density	kilogram per cubic meter	kg/m^3
Specific volume	cubic meter per kilogram	m^3/kg
Celsius temperature	degree Celsius	°C
Time	minute	1 min = 60 s
Time	hour	1 h = 60 min
Time	day	1 d = 24 h
Volume	liter	1 L = 1,000 cm^3
Mass	kilogram metric ton	1,000 g = 1 kg 1 t = 1,000 kg

TABLE 1-2 *Some SI prefixes*

Prefix	Abbreviation	Factor of base unit
giga	G	1,000,000,000 (10^9)
mega	M	1,000,000 (10^6)
kilo	k	1,000 (10^3)
hecto	h	100 (10^2)
deka	da	10 (10^1)
base unit		1
deci	d	0.1 (10^{-1})
centi	c	0.01 (10^{-2})
milli	m	0.001 (10^{-3})
micro	μ	0.000001 (10^{-6})
nano	n	0.000000001 (10^{-9})
pico	p	0.000000000001 (10^{-12})

1.1.5- Accuracy and Precision

Saying that a line is 26 mm long means that the line is *nearly* 26 mm long.

Saying that a line is 26.0 mm long means that the line is *exactly* 26 mm long.

This depends on how many significant figures you use in your statement.

Accuracy describes how closely a measurement approaches an actual, true value.

e.g. when you measure a mass of a 1 kg cube and you find it a 1.0 kg.

Precision describes how close repeated measurements are to one another, regardless of how close those measurements are to the actual value.

e.g. when a 5 students measure the same cube and all find it to be 980 gm.
They are all precise but not accurate. That is because the balance they use has some error.

Precise and accurate measurements have some different meanings.

A light microscope uses light.
Its magnification = ocular lens magnification (usually 10x) times objective lens magnification (40 to 15x).

the specimen will appear *upside down and backward* from the way it sits on the stage of the microscope.

Phase contrast microscope is a light microscope used to examine moving cells.

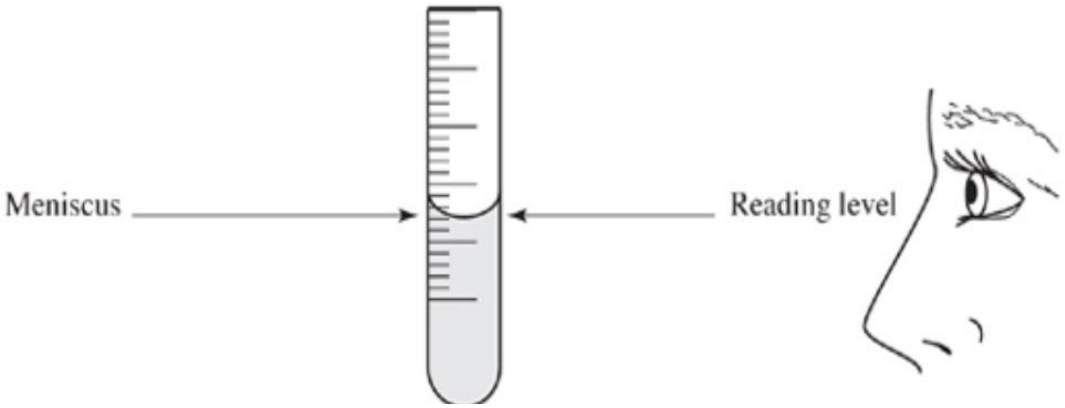
Electron microscopes can magnify an image more than 300,000×.

The image from the electron microscope has excellent resolution (how clear the image appears).
That is because the electron beam has a very short wavelength.

Specimens seen by the electron microscope are dead.

TEM, Transmission electron microscope is used to examine the inside structures. While the
SEM, Scanning electron microscope is used to examine the surface of the structures or cells.

Measuring with a Graduated Cylinder

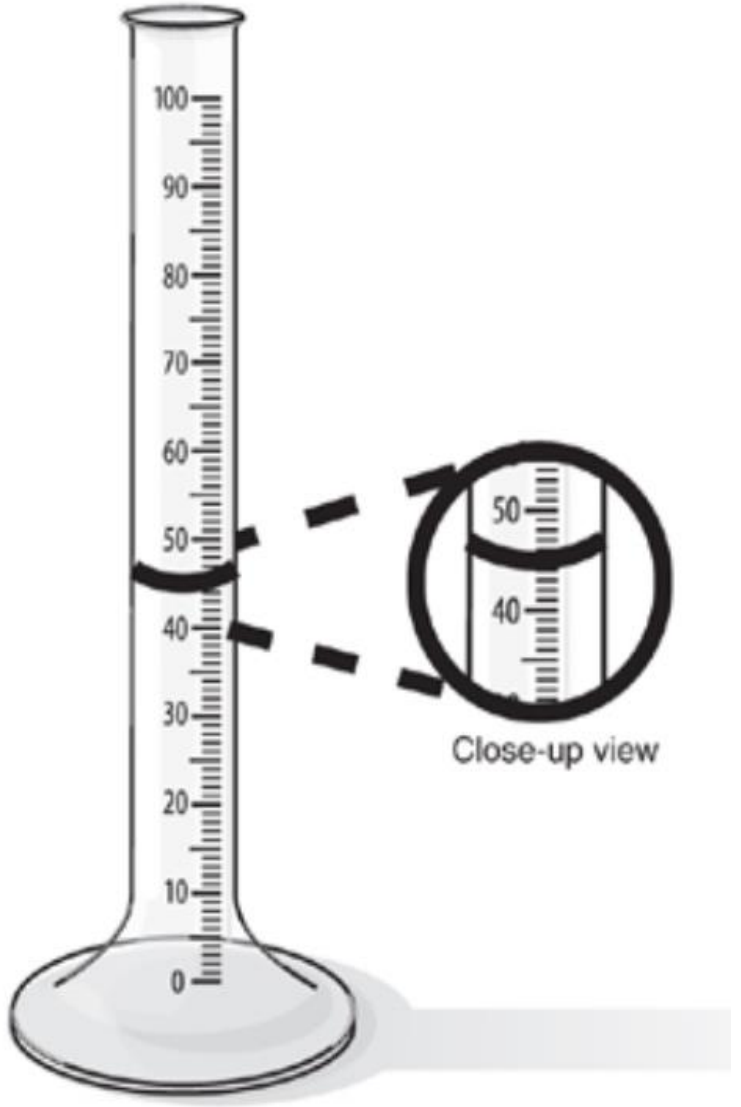


To use a *graduated cylinder* to measure liquid; use the *meniscus* (bottom of the curve) at eye level to take your measurement.

e.g. when you measure the amount of liquid in the sketch shown, the correct measure (both accurate *and* precise) is---

44.0 mL

both accurate *and* precise.



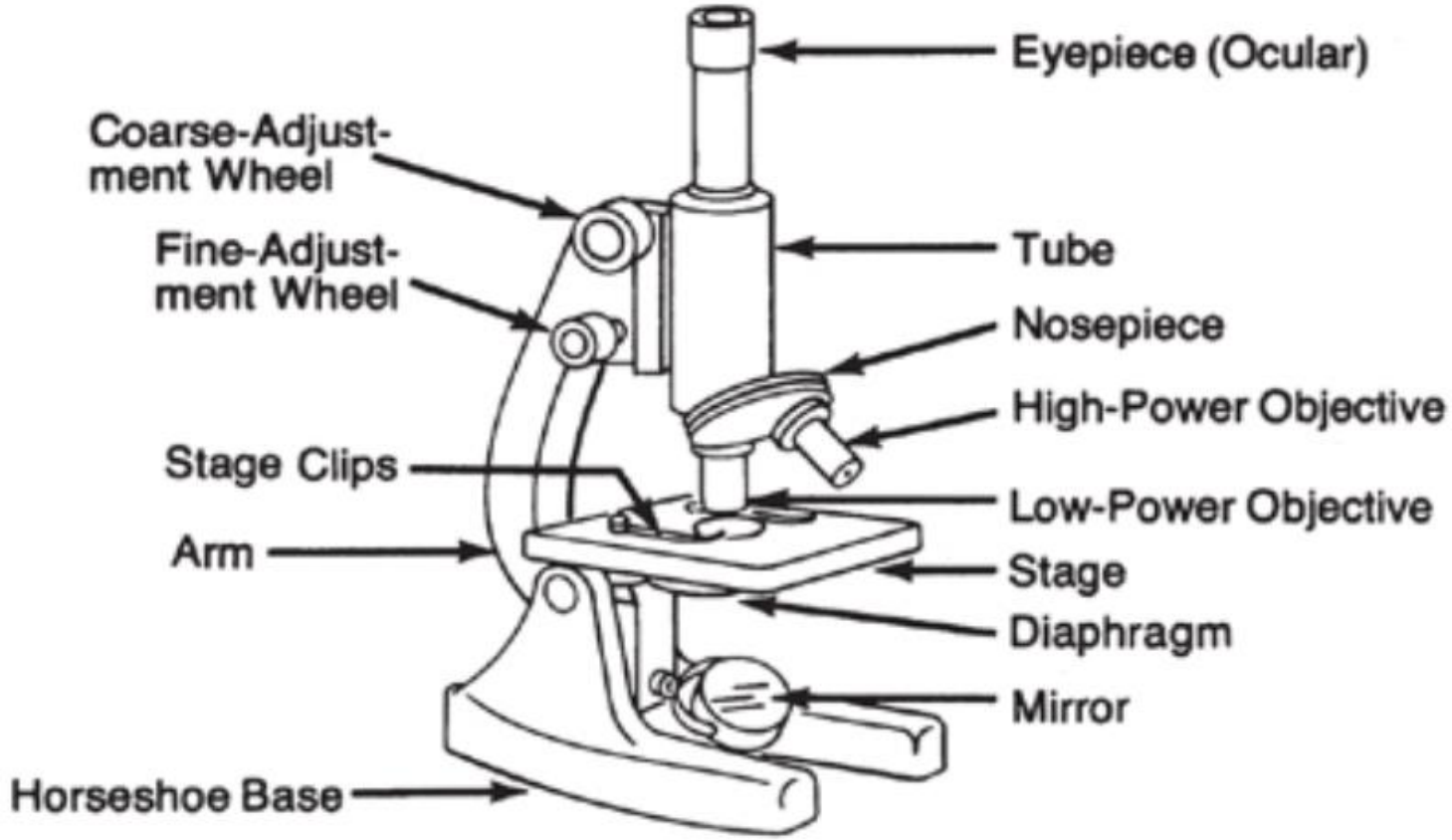
1.1.6- TOOLS AND TECHNIQUES TO STUDY CELLS- MICROSCOPY..

The compound microscope

Two properties are essential to know how good is a microscope, Magnification and resolution.

Resolution describes the ability to see two distinct near points as two.

A toy microscope, which may enlarge an image 400×, has little resolving power, so the images are blurred.



Magnification

Magnification is calculated by multiplying the magnification of the ocular lens by that of the objective lens.

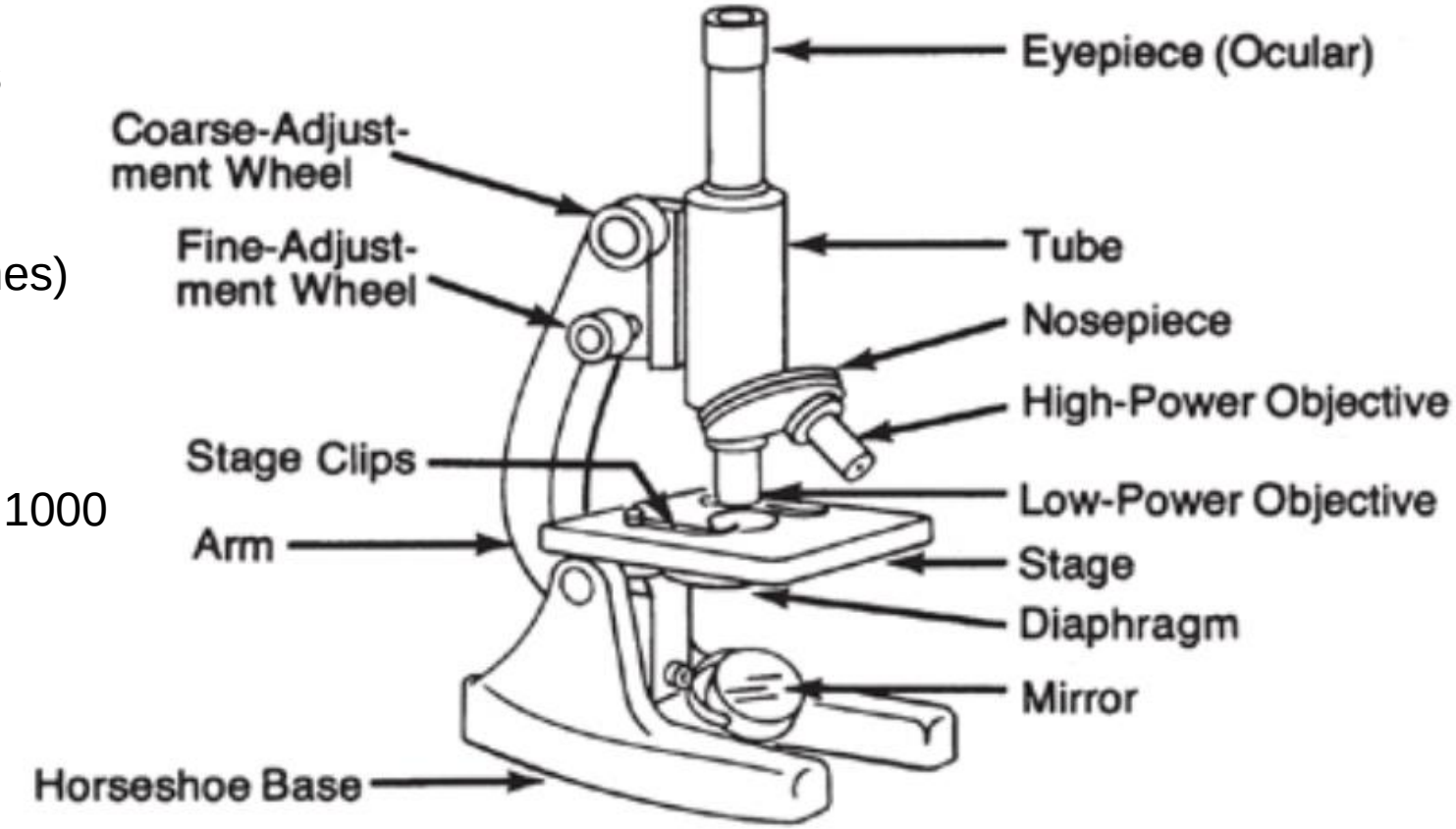
e.g. if the ocular lens = 10 x (x means times) and the objective lens = 40 x, magnification =

10x (means times) X 40x (means times)

= 400 x (means times)

The school lab microscope is usually 1000 to 1500 x magnification.

The compound microscope



When you use the microscope, remember that the image appears upside-down and backward from the actual specimen you placed onto the slide.

Also, the higher the magnification you use, the darker the field will appear because you are viewing a much smaller area.

e.g. the letter e

its image is -----

Special types of microscopes:

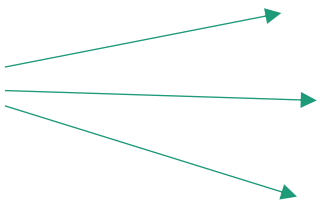
1.Phase-contrast microscope

2.Transmission electron microscope

3.Scanning electron microscope

A phase-contrast microscope is a light microscope that enhances contrast. It uses violet light. It is useful in examining living, *unstained cells e.g. moving sperms*.

1.Phase-contrast microscope



Living

unstained

e.g. moving sperm or amoeba.

Electron microscopes use a beam of electrons, instead of a beam of light, to produce superior resolving power as well as magnification over 100,000×.

The source of electrons is a tungsten filament within a vacuum column.

The transmission electron microscope (TEM) is useful for studying the interior of cells.

The scanning electron microscope (SEM) is useful for studying the outer surface of cells.

The resulting images have a three-dimensional appearance.
Once again, the cells are dead. Specimens observed under the EM are not alive

The tissue is no longer alive after processing.

Preparation of specimens is elaborate. Tissue must be fixed, dehydrated, and sectioned on a special machine, a process that requires many hours and much expertise.

The TEM is a delicate machine and requires special engineers to maintain it.

Specimens must be sliced so thin that only a small portion of a tissue sample can be studied at one time.

The machine costs hundreds of thousands of dollars

1.1.7- Ultracentrifuge.

It enables scientists to isolate specific components of cells in *large quantities* by cell fractionation.

By using this technique, hundreds of organelles, such as mitochondria, can be studied under an electron microscope or analyzed biochemically

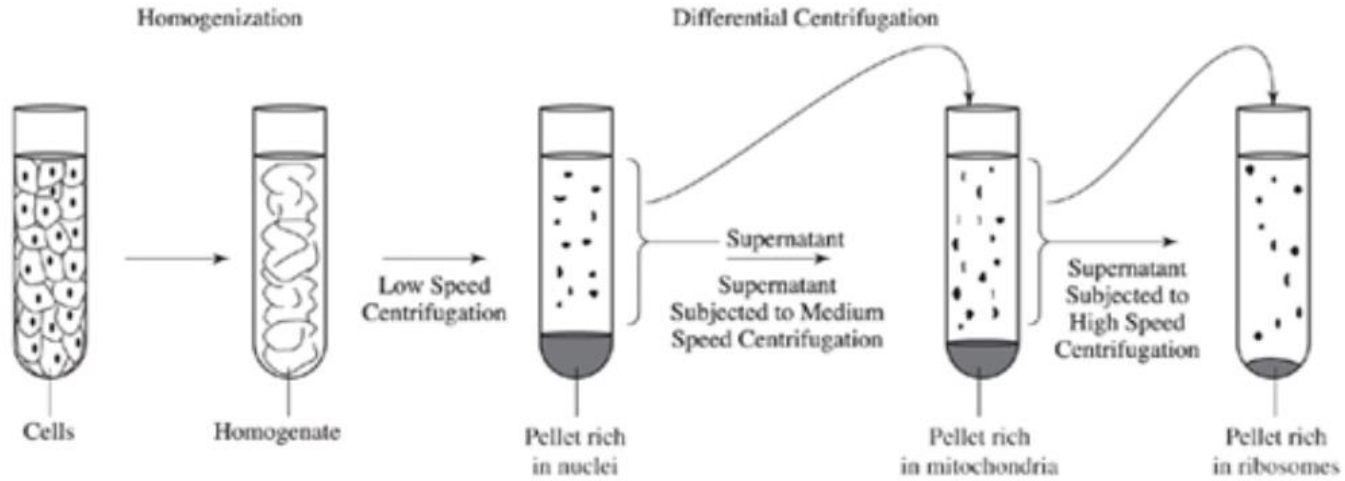
First, tissue is mashed in a blender. The resulting liquid, called **homogenate**, is spun at high speed in an ultracentrifuge and separated into layers based on differences in density.

Nuclei are forced to the bottom *first*,

then ribosomes

followed by mitochondria

then clear fluid



1.1.8- Cytology Lab Techniques:

Freeze fracture, also called **freeze-etching:**

is a complex technique used to study details of membrane structure under an electron microscope.

After preparation, only a cast of the original tissue is available to examine.

Tissue culture

Tissue culture is a technique used to study the properties of specific cells in vitro (in the laboratory).

Living cells are seeded onto a sterile culture medium to which a variety of nutrients and growth stimulating factors have been added.

Different cells require different growth media. Cell lines can be grown in culture for years provided great care is taken with them.

While the cells are growing, they can be examined unstained under a phase-contrast light microscope.