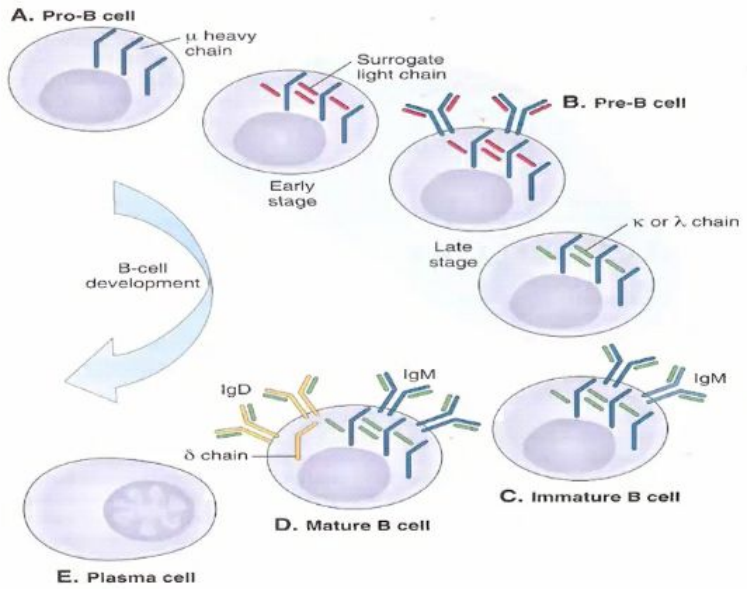
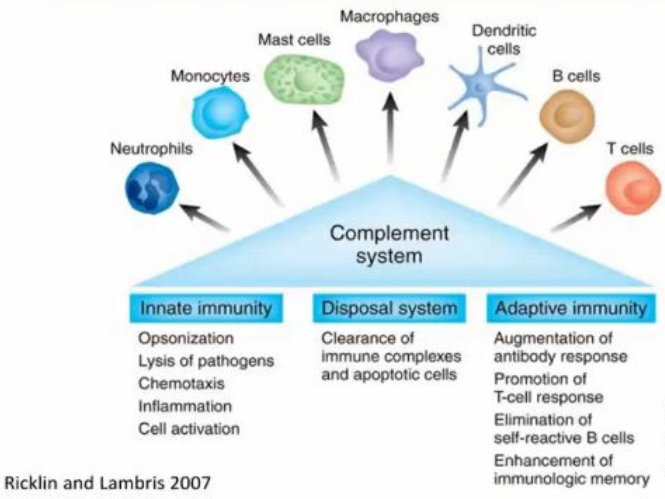
B cell development



Innate and adaptive immunity

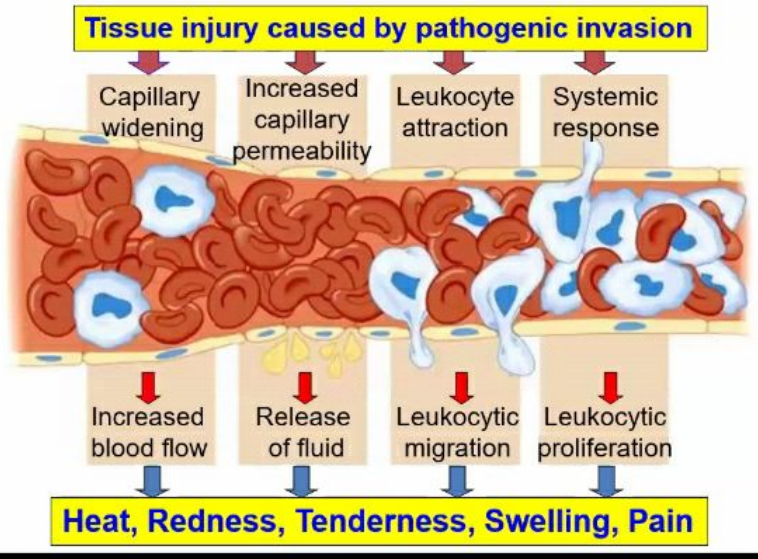
Innate Immunity	Adaptive Immunity
• Present at birth	• Develops during lifetime
• Non-specific immunity	• Specific immunity
• Independent of previous exposure to antigen	• Develops after exposure to antigen
• No time lag	• A lag period
• No immunologic memory	• Development of memory
• Provides first and second lines of defense	• Provides third line of defense

The Complement System

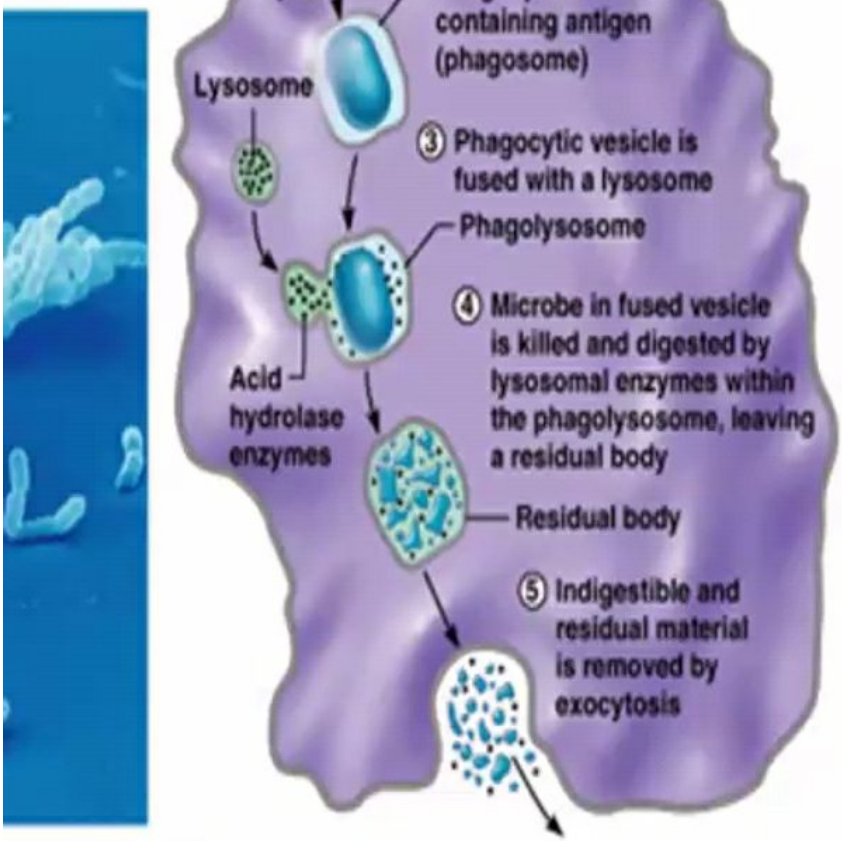


Ricklin and Lambris 2007

THE INFLAMMATORY RESPONSE



f Phagocytosis



Rule of 8:

- MHC II × CD4 (Helper T cells) =8
- MHC I × CD8 (Cytotoxic T cells) = 8

I From IMANIA KHIZAR (Roll No 53) to Everyone
F18-053

From AHSAN JAVED (87) . to Everyone
f18-087

MHC Proteins

- MHC proteins mark a cell as self
- There are two classes of MHC proteins:

i. **Class I MHC proteins** – Expressed on all nucleated cells in the body including APCs. (Not expressed on RBCs as they are non-nucleated cells)

ii. **Class II MHC proteins** – Expressed only on APCs

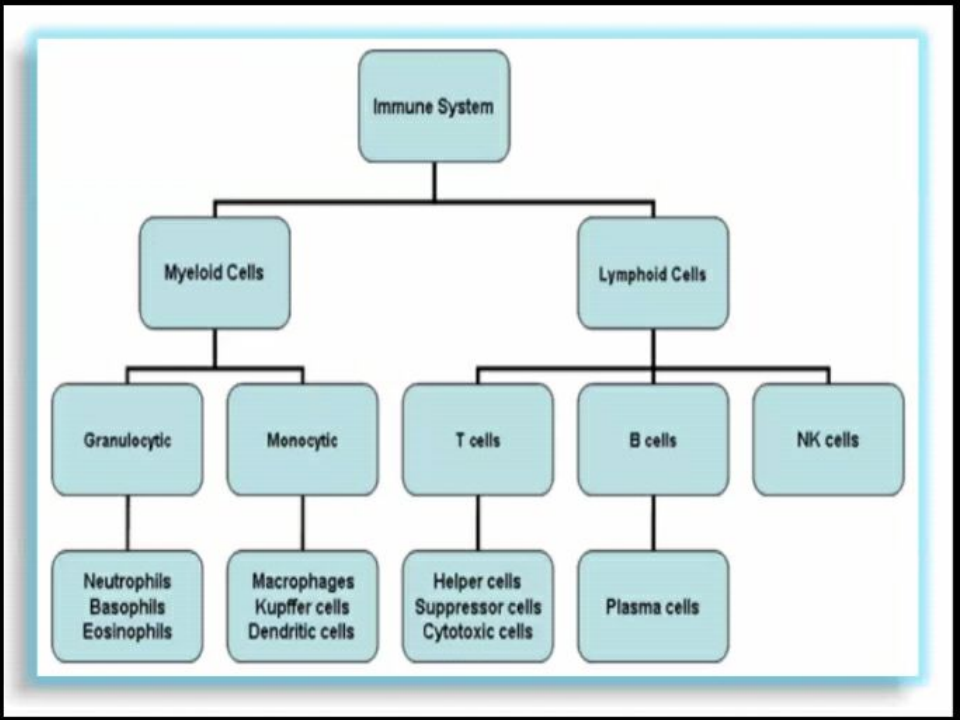
Difference between T Cells and B Cells

T Cells	B Cells
• Originate from bone marrow and mature in thymus	• Originate and mature in bone marrow
• They recognize only protein peptide (Ags) encoded in MHC and expressed on the surface of other cells (APC)	• They do not require MHC
• Do not produce antibodies	• Produce antibodies
• They are divided into functionally distinct populations T- helper cells T- suppressor cells	• They are not

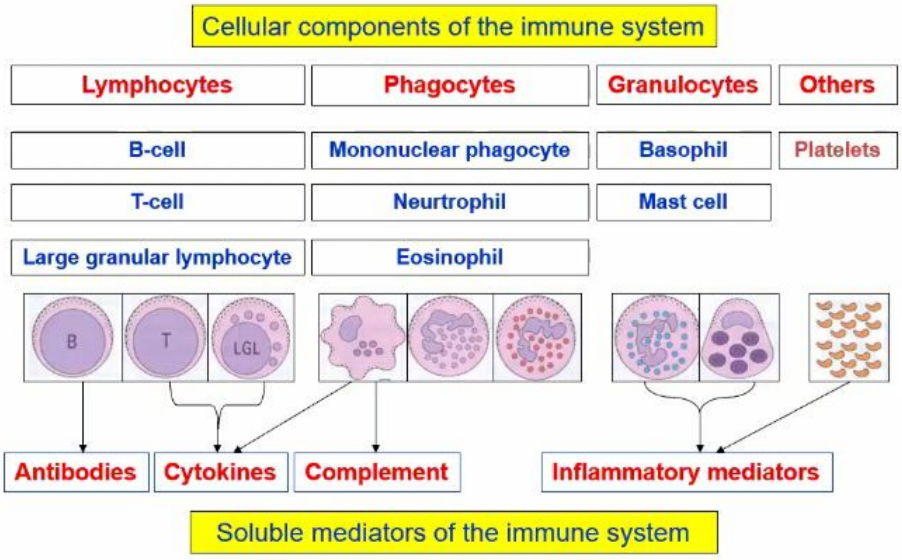
- All lymphocytes originates in the bone marrow
- T lymphocytes mature in the thymus
- B lymphocytes mature in the bone marrow

LYMPHOCYTES

- Two types of lymphocytes
  - ***T-Cells*** (Thymus derived)
    - CD4+ T-Cells (helper cells)
    - CD8+ T-Cells (cytotoxic cells)
  - ***B-Cells*** (Bone Marrow derived)


Immune System
Myeloid Cells
Lymphoid Cells
Granulocytic
Monocytic
T cells
B cells
NK cells
Neutrophils
Basophils
Eosinophils
Macrophages
Kupffer cells
Dendritic cells
Helper cells
Suppressor cells
Cytotoxic cells
Plasma cells

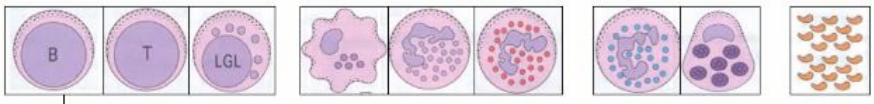
Cells Of The Immune System



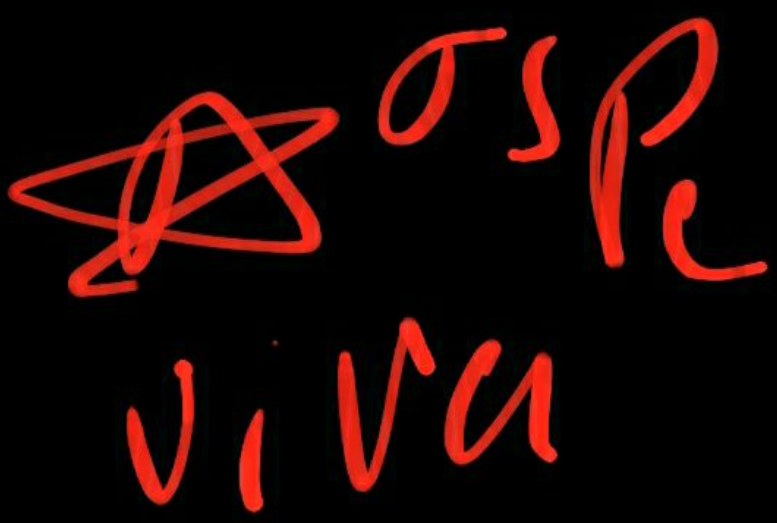
Cells Of The Immune System

Cellular components of the immune system

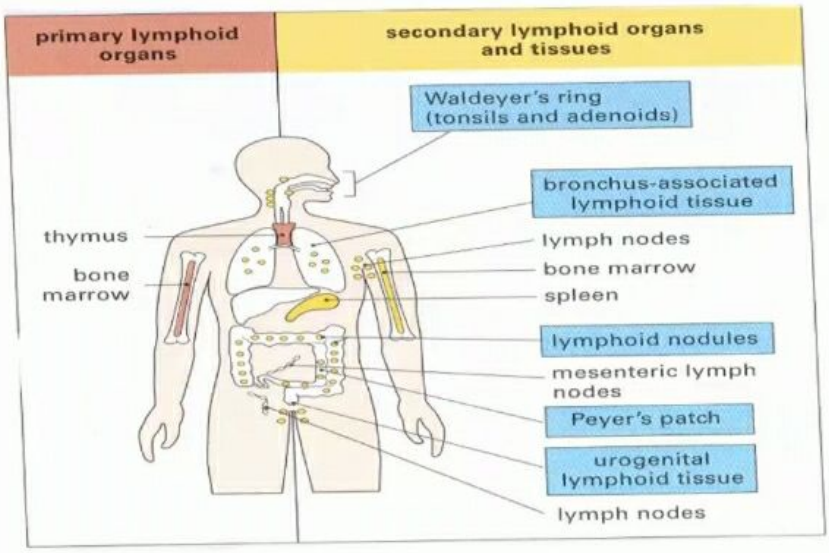
Lymphocytes	Phagocytes	Granulocytes	Others
B-cell	Mononuclear phagocyte	Basophil	Platelets
T-cell	Neurtrophil	Mast cell	
Large granular lymphocyte	Eosinophil		



Soluble mediators of the immune system



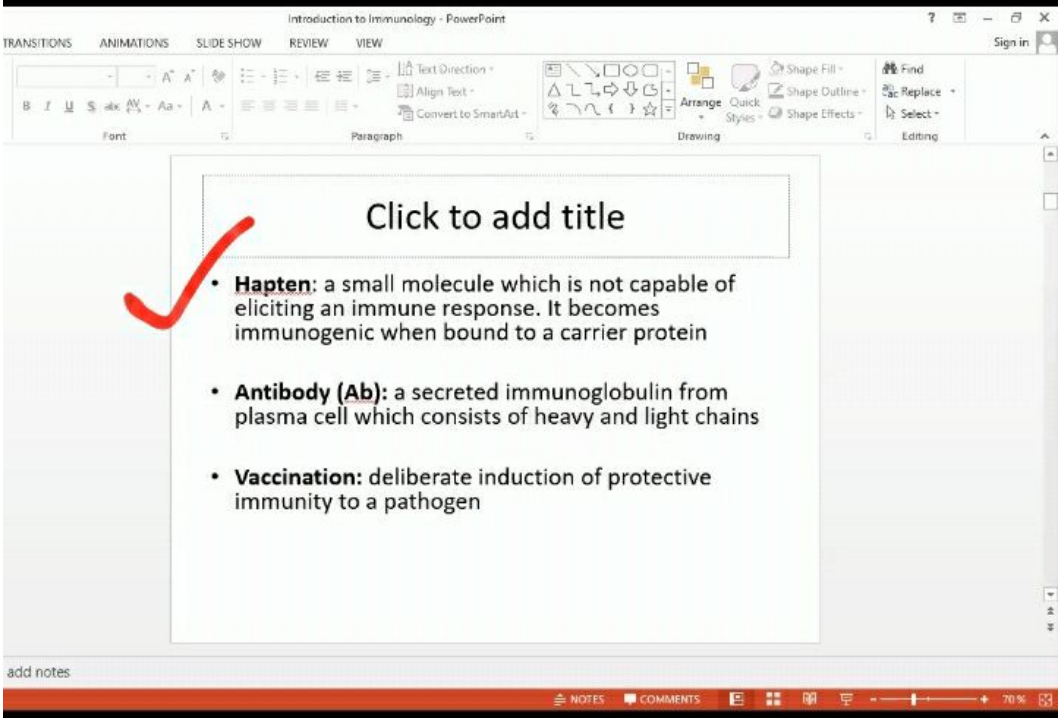
Major Lymphoid organs and tissue



Zoom

Leave

mCQ



From Malik Muzamil f18-083 to Everyone

f18-083

Unmute

Start Video

Share

Participants

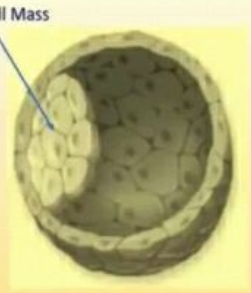
25

More

6 day blastocyst taken

3. Embryonic Stem Cells (ESC)

- Obtained from Inner Cell Mass (ICM) of embryo
- Scientist take ESC from In vitro fertilized embryos
- ESC can differentiate into more cell types than ASCs
- Most reliable and highly efficient way of stem cell collection
- Many ethical issues are involved



Blastula 6 days

viva SEQ

Terms To Understand

Potency:

Potential or capacity of cells to differentiate into other cell types is called potency

Totipotent:

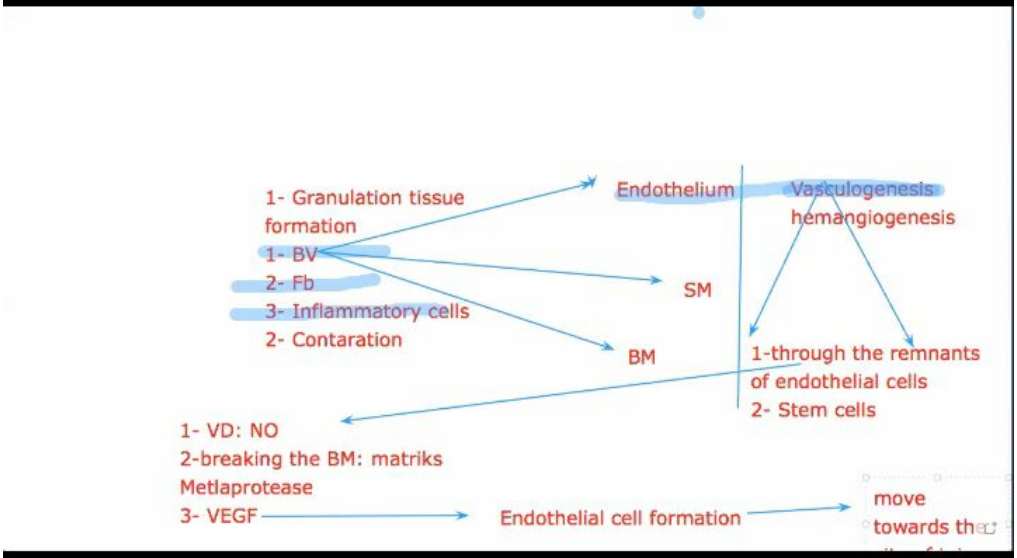
Cells which can differentiate into all other cell types:
Zygote and Cells After First Few Divisions

Pluripotent:

Cells which can differentiate into nearly all other types except extraembryonic layers

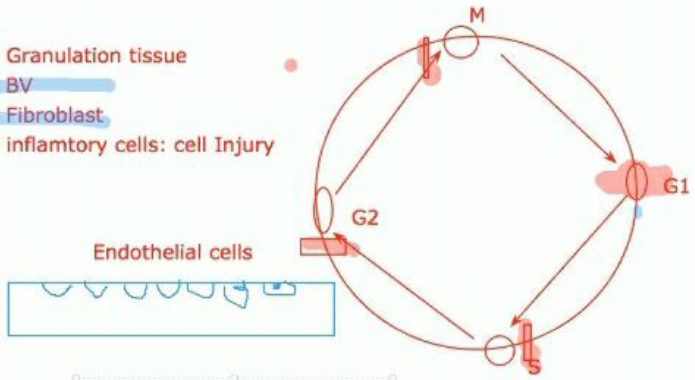
Types of Stem Cells: **4 main kinds of stem cells:**

- 1) **Tissue-specific Stem Cells (Multipotent)**
  - Also known as "somatic stem cells" or "adult stem cells"
  - These are stem cells found in all people and are used to replace cells in many kinds of tissue as they wear out and die.
- 2) **Pluripotent Stem Cells**
  - These include embryonic stem cells and induced pluripotent stem cells.
  - These cells can become any kind of tissue in the body.
- 3) Induce Pluripotent cells and 4) Mesencymal stem cells



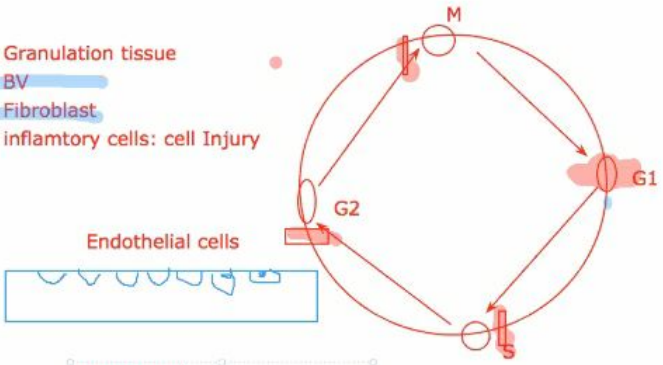
viva tissue repair

1- Granulation tissue
a; BV
b: Fibroblast
3: inflamtory cells: cell Injury



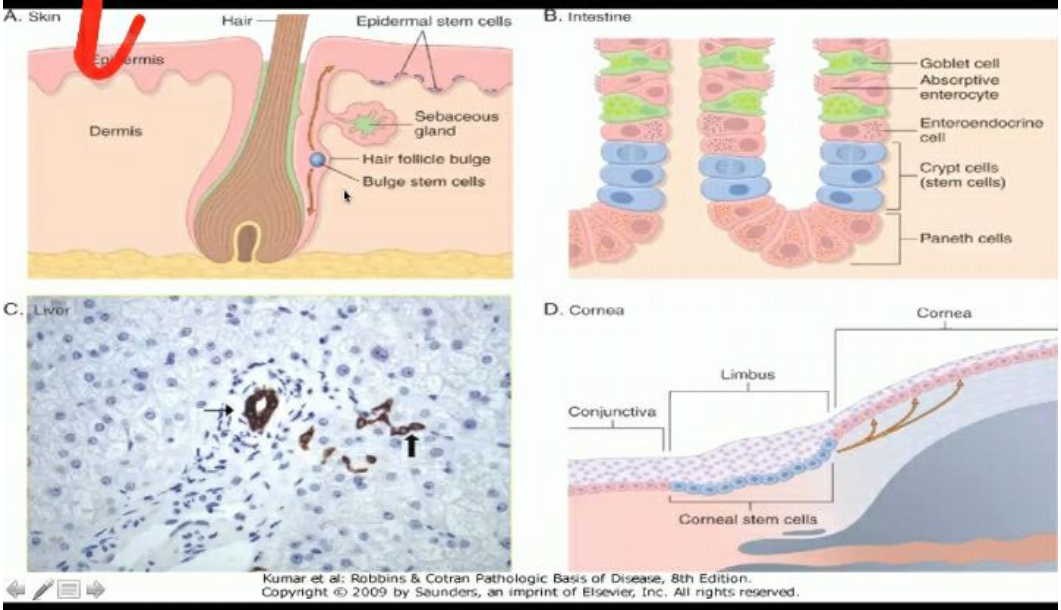
2- contraction

1- Granulation tissue
a; BV
b: Fibroblast
3: inflamtory cells: cell Injury



previously

Viva mcq



Acute inflamw

What Is The Normal Sequence Of Events In Inflammation?

1) Cellular injury (e.g., necrosis, infection) +/- hemorrhage
   ↓ (initiators of inflammation)
2) Vascular changes:
   ↓ Hyperemia & incr. vascular permeability* (occur concurrently)
3) Leukocyte emigration* & leukocyte actions
   ↓
4) Healing w/ return to nl structure (resolution) or scar

* Initial exudate: protein-rich
Later exudate: protein-rich & leukocyte-rich

MC From Muqeet Choudhary(F16-022) to Everyone
F16-022

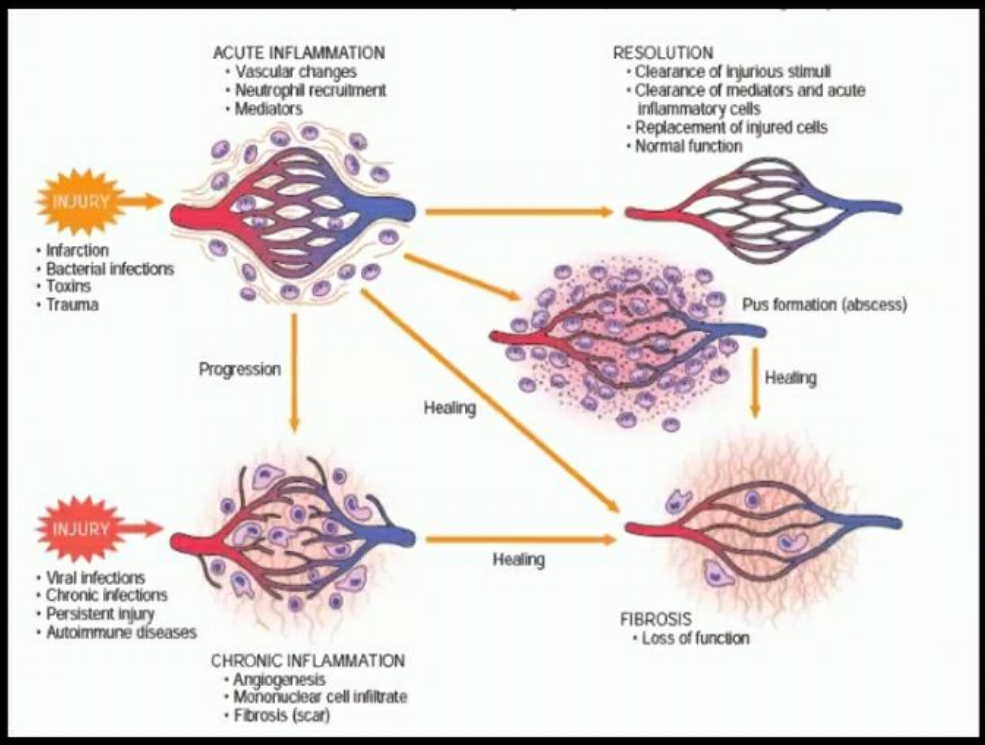
MULAZIM HUSSAIN BUKHARI's screen

MORPHOLOGIC PATTERNS OF ACUTE INFLAMMATION

4 pattern

- *1-Serous inflammation*
- *2- Fibrinous inflammation*
- *3- Supportive (purulent) inflammation*
- *4-Ulceration*

SEQ



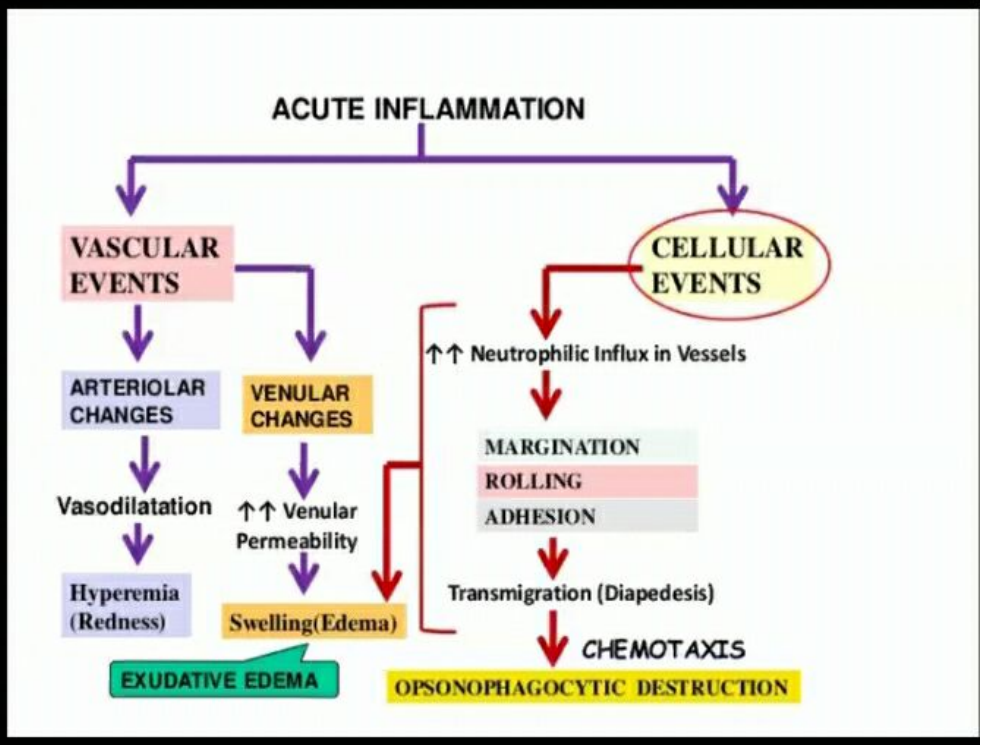
MULAZIM HUSSAIN BUKHARI's screen

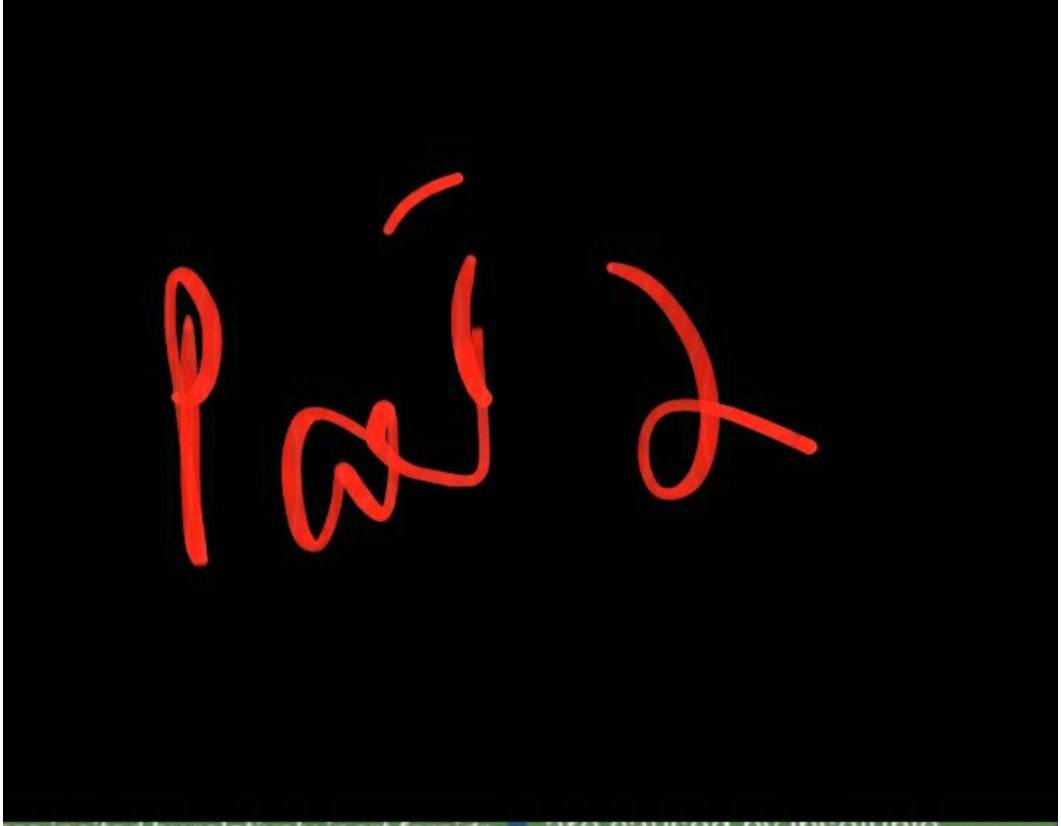
Results of Inflammation

1. **Complete resolution**—regeneration of native cells and restoration of the site to normal
2. **Abscess formation**—infections by pyogenic organisms
3. **Healing by connective tissue replacement (fibrosis) and scarring**— occurs after substantial tissue destruction, when the inflammation occurs in tissues that do not regenerate, or when there is abundant fibrin exudation
4. **Progression to chronic inflammation**

Acute vs. Chronic Inflammation

Feature	Acute	Chronic
Onset	Fast: minutes to hours Innate immune system	Slow: days Adaptive immune system
Duration	Hours to days	Weeks to months or years
Cellular infiltrate	Mainly neutrophils, followed by macrophages	Macrophages, plasma cells, and lymphocytes
Vascular changes	Prominent (vasodilation, increased permeability)	Not prominent; angiogenesis
Tissue injury	Self-limited	Progressive
Fibrosis	Usually mild	Often severe
Local and systemic signs	Prominent	Less


ACUTE INFLAMMATION
VASCULAR EVENTS
CELLULAR EVENTS
ARTERIOLAR CHANGES
VENULAR CHANGES
↑↑ Neutrophilic Influx in Vessels
Vasodilatation
↑↑ Venular Permeability
MARGINATION
ROLLING
ADHESION
Hyperemia (Redness)
Swelling(Edema)
Transmigration (Diapedesis)
CHEMOTAXIS
EXUDATIVE EDEMA
OPSONOPHAGOCYTIC DESTRUCTION

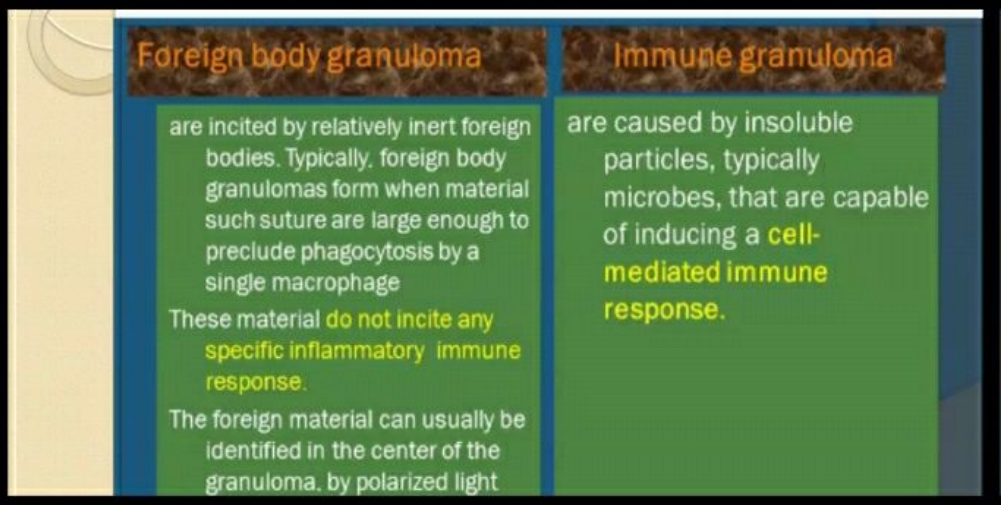


are incited by relatively inert foreign bodies. Typically, foreign body granulomas form when material such suture are large enough to preclude phagocytosis by a single macrophage

These material do not incite any specific inflammatory immune response.

The foreign material can usually be identified in the center of the granuloma, by polarized light (appears refractile).

are caused by insoluble particles, typically microbes, that are capable of inducing a cell-mediated immune response.



SEQ

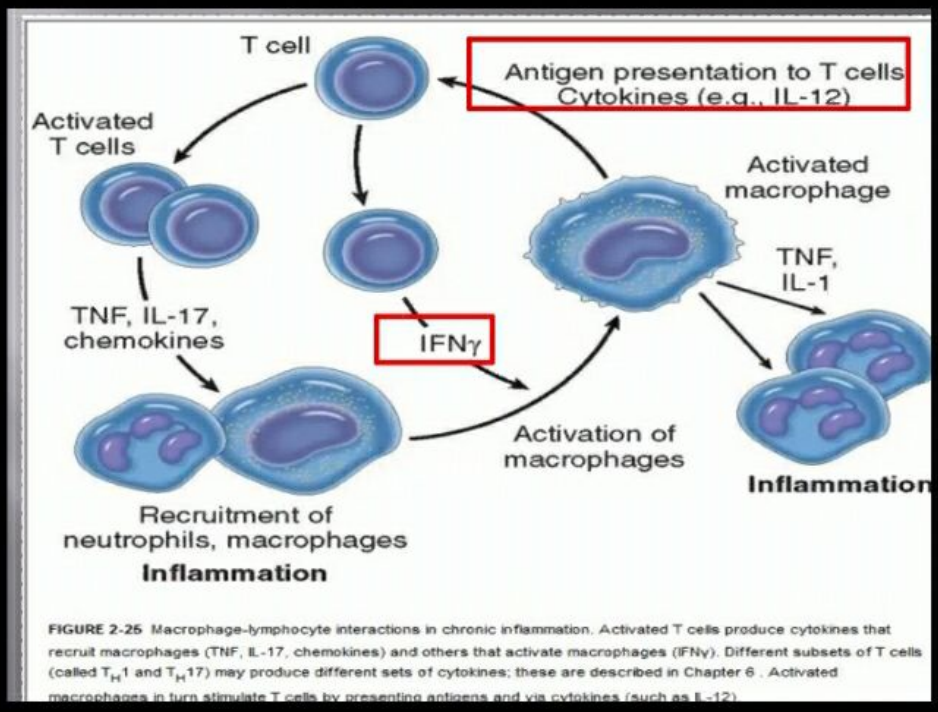
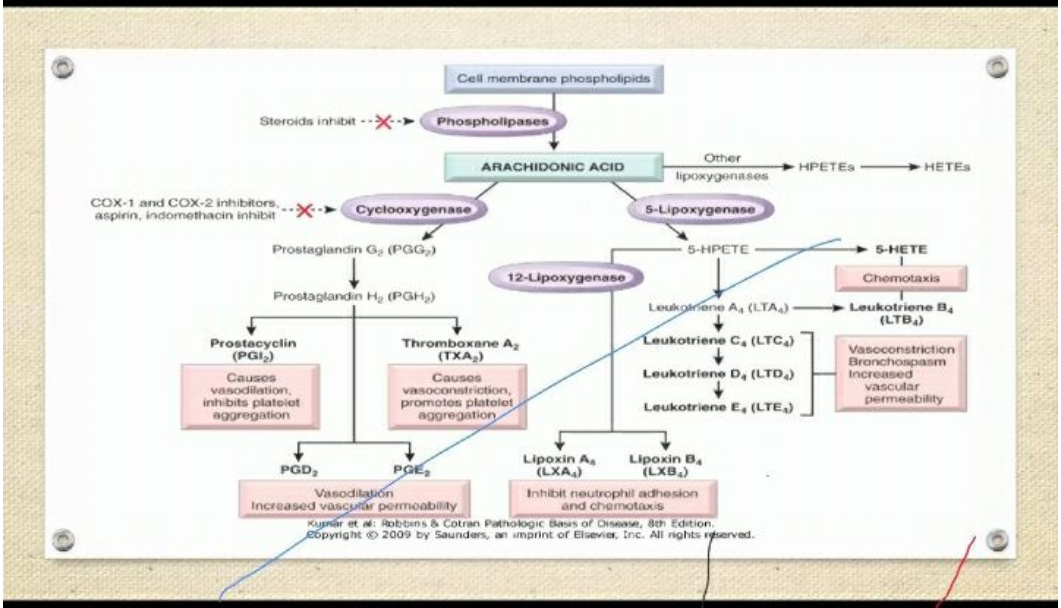
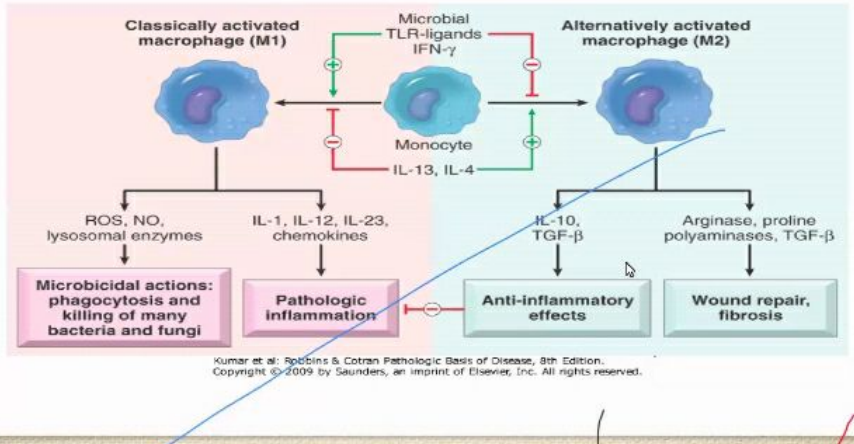


FIGURE 2-25 Macrophage-lymphocyte interactions in chronic inflammation. Activated T cells produce cytokines that recruit macrophages (TNF, IL-17, chemokines) and others that activate macrophages (IFNγ). Different subsets of T cells (called T_H1 and T_H17) may produce different sets of cytokines; these are described in Chapter 6 . Activated macrophages in turn stimulate T cells by presenting antigens and via cytokines (such as IL-12).

LT B4

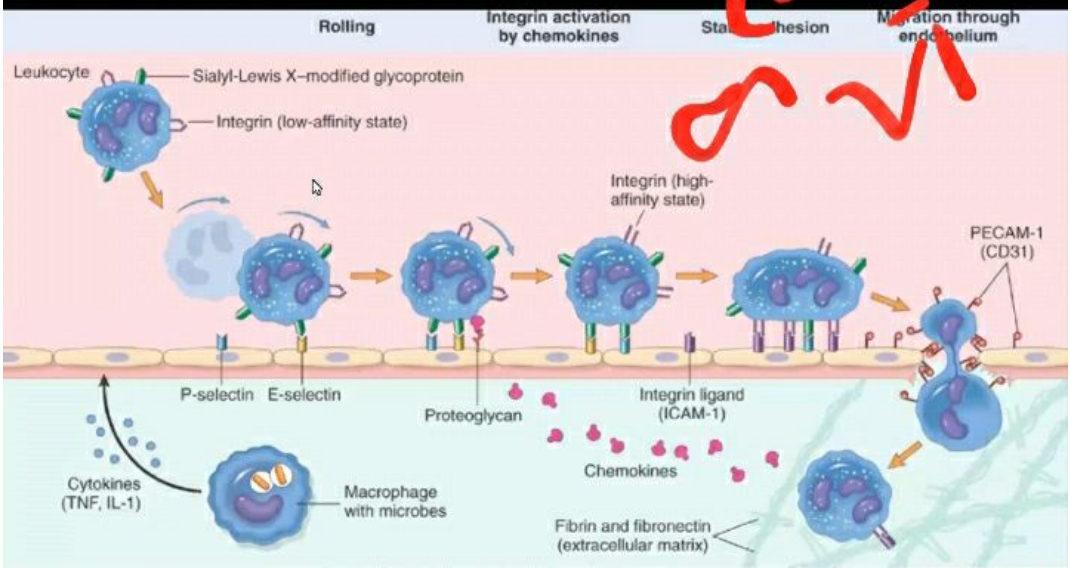




Leukocytes receptors that recognize external stimuli and deliver activating signals

1. *Receptors for microbial products: Toll-like receptors (TLRs)* recognize components of different types of microbes
2. *G protein-coupled receptors* found on neutrophils, macrophages, and most other types of leukocytes recognize short bacterial peptides containing *N*-formylmethionyl residues
3. *Receptors for cytokines:* Leukocytes express receptors for cytokines that are produced in response to microbes. One of the most important of these cytokines is interferon-γ (IFN-γ), which is secreted by natural killer cells reacting to microbes and by antigen-activated T lymphocytes during adaptive immune responses
4. *Receptors for opsonins:* Leukocytes express receptors for proteins that coat microbes. The process of coating a particle, such as a microbe, to target it for ingestion (phagocytosis) is called *opsonization*, and substances that do this are *opsonins*. These substances include antibodies, complement proteins, and lectins.

SEQ
Selectin/Integrin



REVERSIBLE /IRREVERSIBLE CELL INJURY

- Reversible cell injury: Certain functional and morphologic changes that are eversible if the damaging stimulus is removed.
- Irreversible cell injury: It results with continuing damage up to a stage from where cells can not recover, ultimately leading to cell death.

7. NUTRITIONAL IMBALANCE

- **Inadequate calorie/protein intake**
  I. Marasmus and kwashiorkor
  II. Anorexia nervosa
- **Excess calorie intake**
  I. Obesity
  II. Atherosclerosis
- **Vitamin deficiency**
  I. Vitamin A ….. Xerophthalmia
  II. Vitamin B 12 ….. Megaloblastic anemia, Subacute combined degeneration of spinal cord
  III. Vitamin C ….. Scurvy
  IV. Vitamin D ….. Rickets and osteomalacia
  V. Folate ….. Megaloblastic anemia and neural tube defects
  VI. Niacin ….. Pellagra (Diarrhea, dementia and dermatitis)

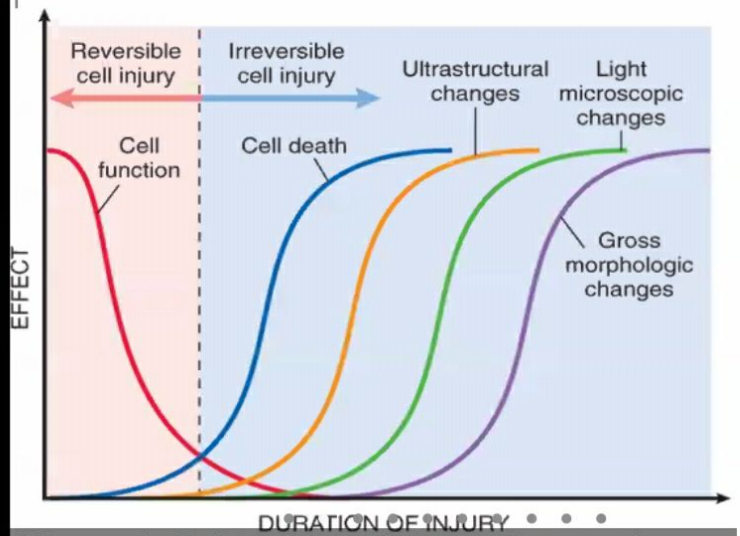
FACTORS AFFECTING CELLULAR RESPONSE

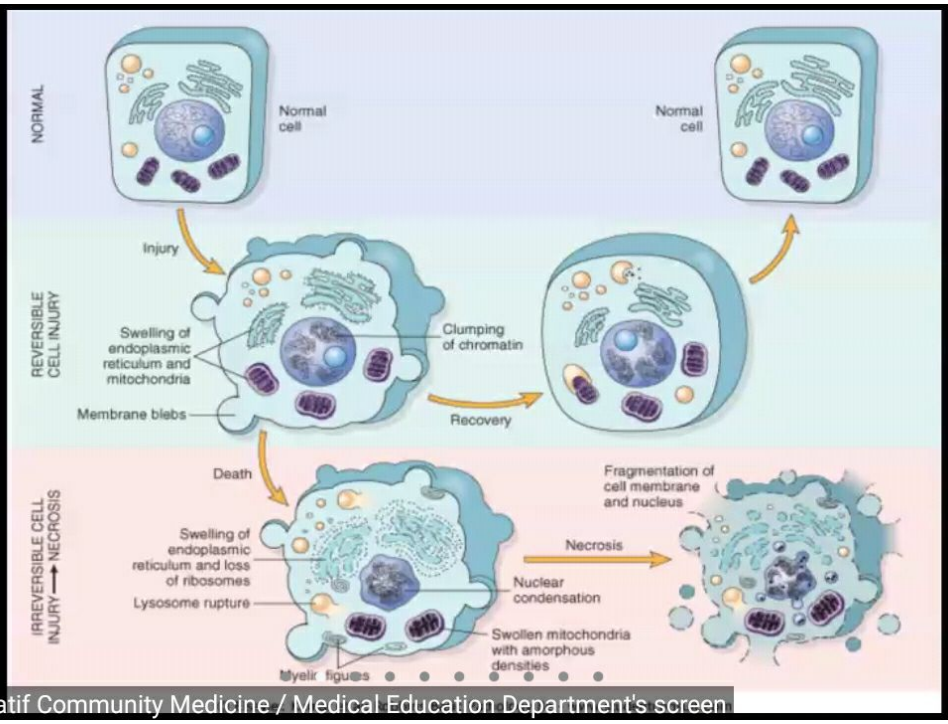
- Type of injury
- Duration and pattern
- If more than 3 minutes lac of oxygen
- Severity and intensity
- Type of cell affected
- Cell's metabolic state
- Cell's ability to adapt

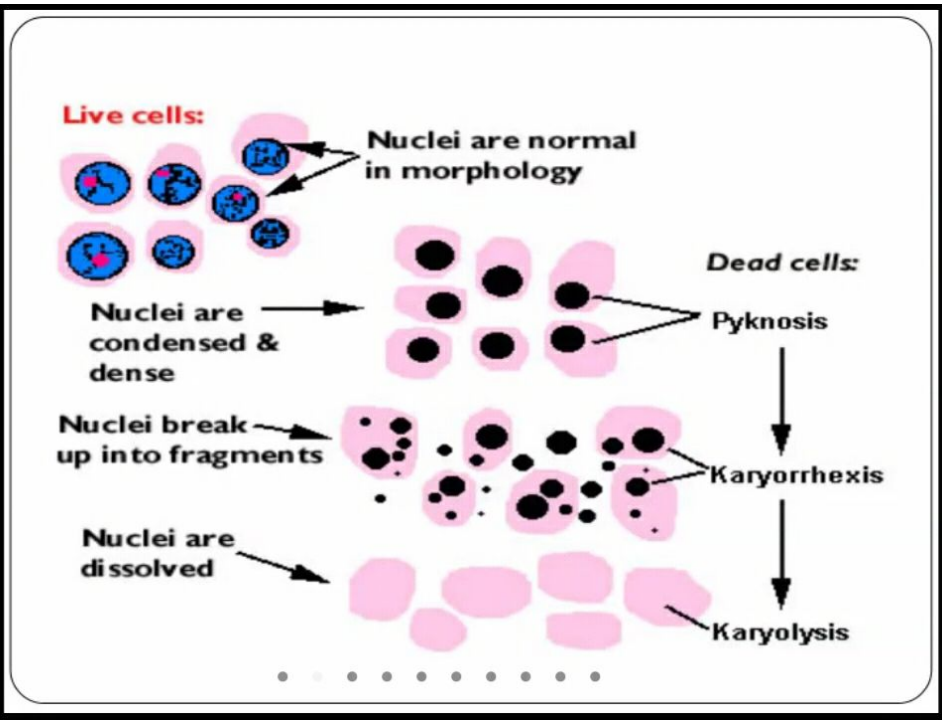
Neutralizing of free Radicals

- Superoxide dismutase
  - superoxides
- Glutathion peroxidase
  - Peroxides, hydroxyl and acetamonophin radical
- Catalase
  - Peroxidase radicals
- Vitanin A,E and Beta carotenes
  - Blocks free radical formations and degrades already synthesised Free radicals

Morphologic Alterations in Cell Injury






Live cells:
Nuclei are normal in morphology
Dead cells:
Nuclei are condensed & dense
Pyknosis
Nuclei break up into fragments
Karyorrhexis
Nuclei are dissolved
Karyolysis