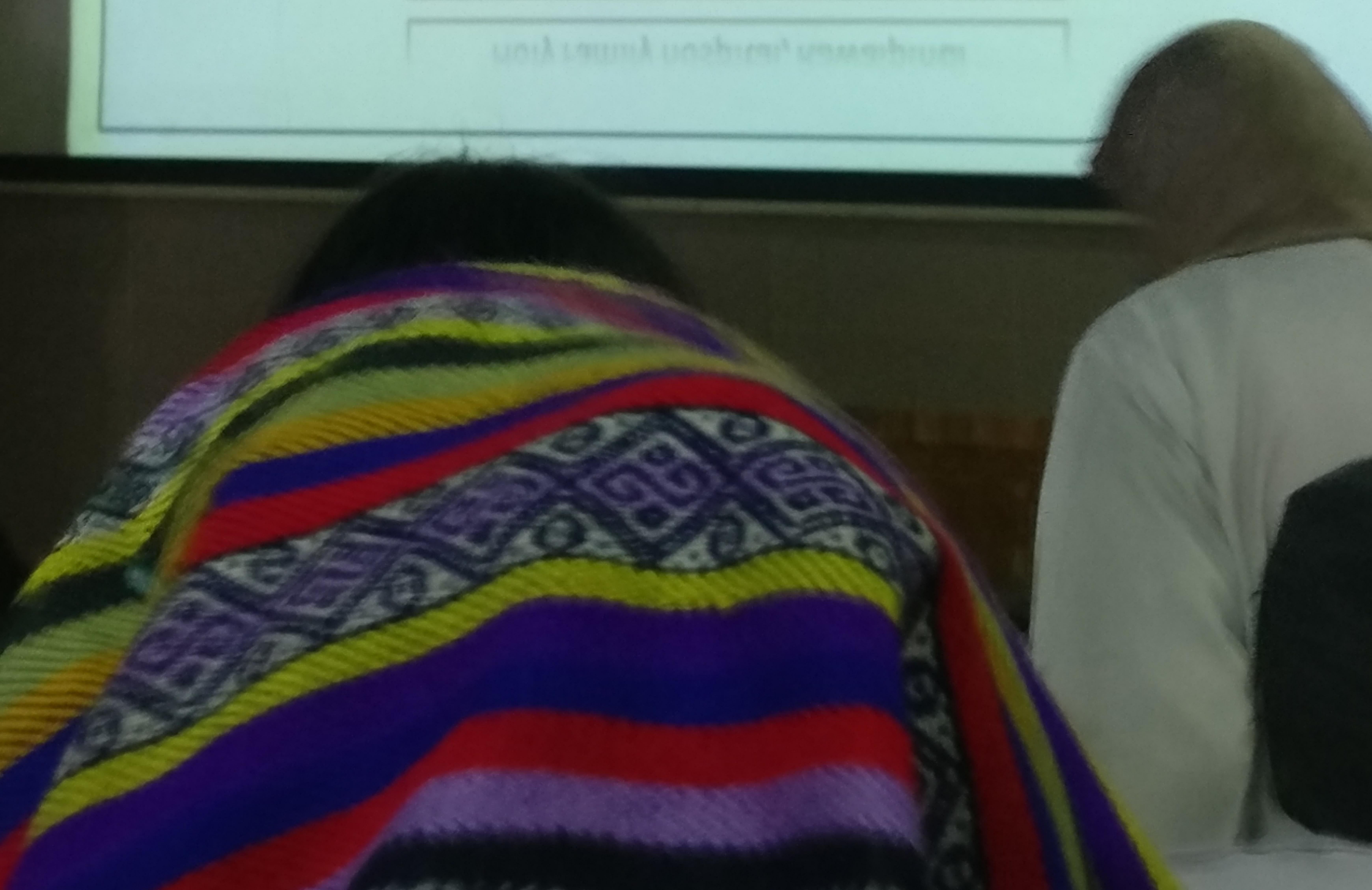


Physiological Responses to Infection

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INFECTION

- Invasion of micro-organism into body

Physiological Responses

- DEFENSE

DEFENSE

- From External attack
- From Internal attack

External Attack

- Enemy Army
- Secret Agencies
- Miscommunication

Internal Attack

- Criminals
- Foreign support/ funded
- Anti social
- Cyber crimes
- Robbers/ thieves
- Gangsters

Body Defense

Immune Response



Body Responses/Forces

- Types

1. General

- Innate immune response (natural) → recognizes pathogen-associated molecular patterns (PAMPs)
- Non-Myeloid

2. Specific

- Antigen-specific immune response
- Myeloid

Innate Immune System

Non-Myeloid cells

First line of defense against infections

- Epithelial cells & Fibroblasts
- Barrier between internal & external environment by antimicrobial peptides
 - Defensins (α and β)
 - Cathelicidin
 - Statins
- MOA
 - Electrostatic interactions between their positive charge & pathogen negative charge on their cell wall
→ mediate inflammatory response allowing cytokine release, cell proliferation, angiogenesis, wound healing, and chemotaxis
- Currently, their synergistic activity with antibiotics used to treat infections

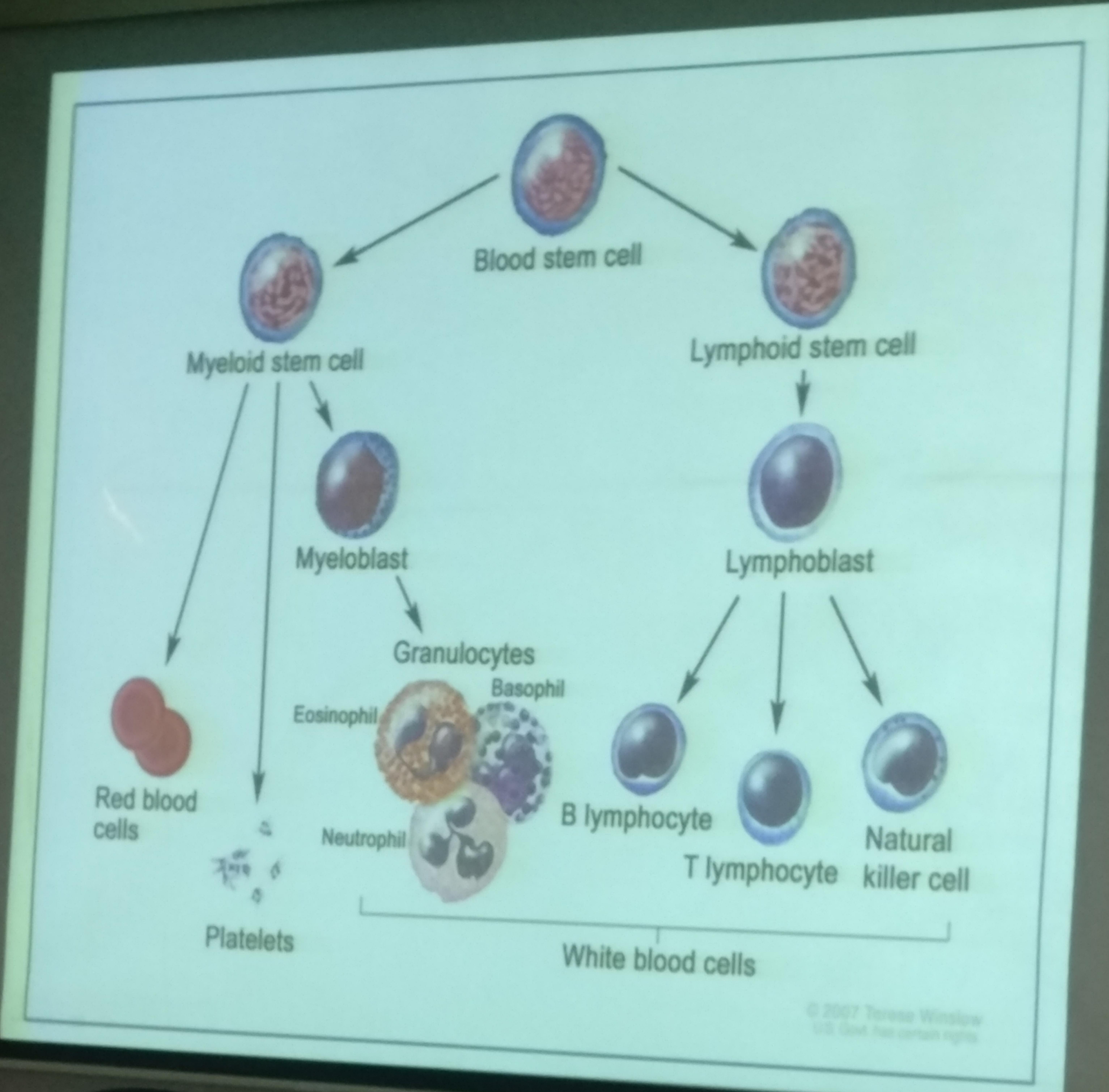


Antigen Specific Response

Myeloid cells

- Specialized for defense against pathogens
 - Neutrophils
 - Macrophages
 - Dendritic cells (DCs)
 - Monocytes
 - Eosinophils
 - Basophils
 - Mast cells
 - Platelets





Neutrophils

- In humans, about 100 billion neutrophils enter bloodstream each day from Bone marrow
- Major role → Resolution of microbial infections

Neutrophils

- Pathogen invade tissue by disrupting epithelium, inflammatory signals reach to neutrophils
- Neutrophils release reactive oxygen and cytotoxic granules which destroy the pathogens
- Neutrophils are also control T& B cell mediated immunity

Monocytes

- Develop in bone marrow, and released into blood for 72 hours then emigrate to different tissues where they differentiate into **macrophages** or **DCs**.
 - Classical monocytes → phenotype CD14+CD16- → inflammatory cells 92% → eliminate debris from vascular system
 - produce low levels of proinflammatory cytokines
 - high levels of anti-inflammatory factors
- Functions
 - Migrate to infection site & mature into macrophages or DCs
 - Phagocytose → digest pathogens or cellular debris
 - Create immunity by presenting APC to T cells

Macrophages

- Monocytes are precursor
- 2 types
 - Resident macrophages
 - Present in all tissues
 - Immunological surveillance, homeostasis, and tissue repair
 - Inflammatory macrophages
 - Circulatory & respond rapidly to injury or infection by signals
- Macrophages can be activated & adopt different functions
 - M1 (classically activated macrophages) → proinflammatory functions and participate in a host's defense
 - M2 (alternatively activated macrophages) → promote immune response & antagonize inflammatory response and its mediators




Dendritic Cells

- Monocytes → differentiate into DCs
- DCs → link between innate and adaptive immunity
 - Initiate and polarize immune response to antigens of pathogens
- Capable of capturing, processing, and presenting antigens to T cells
- Subtypes
 - Classical DCs → Specialized in processing & presenting antigens
 - Plasmacytoid DCs → Migratory cells that move to lymphoid organs (B & T cells) and regulate T cell responses at steady state
 - Specialized to respond to viral infection with massive production of IFN & also control T cell responses

Eosinophils

- Produced by bone marrow
- IL-5 → crucial role for production & maturation of eosinophil
- Eosinophils involved in parasitic infection & allergic diseases
- For parasites → present in the mucosa of GIT & initiate defense response when parasites attack by release of mucus, smooth muscles contraction, cytotoxic proteins to destroy parasites
- Eosinophils can help in immunity by initiating antigen in new responses



Basophils

- Also from bone marrow
- Basophils stay in circulation
- Basophils initiate response in allergic diseases
- Releasing histamine and synthesize LTC 4 causing symptoms of allergy

Mast Cells

- Mast cell reside in the tissues
(Tissue resident cell from bone marrow)
- Activated by stimuli & mediators (histamine TNA alpha, VEGF) → vascular permeability & edema
- Also activate other immune cell like NK cells & Eosinophil etc.
- Detect & activate immune system

Platelets

- Produced by Megakaryocytes from bone marrow
- Important in
 - Homeostasis
 - Wound healing
 - Inflammation
- Upon activation start coagulation to restore blood vessel integrity

T & B Lymphocytes

- Both recognize specific antigens of pathogen
- **B cells** → responsible for humoral immunity (antibodies)
- **T cells** → Cell mediated immunity
- (Helper, Cytotoxic, memory T-cells)

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B vs T Lymphocytes

- B cells can recognize the surface antigens of bacteria and viruses inside infected cells while
- T cells only recognize viral antigens outside the infected cells

Mediators

- Soluble mediators of immune system
 - Complement system
 - Cytokine
 - Chemokines
- Immune responses against pathogens
 - Against Bacteria
 - Against Fungi
 - Against Virus
 - Against Parasite