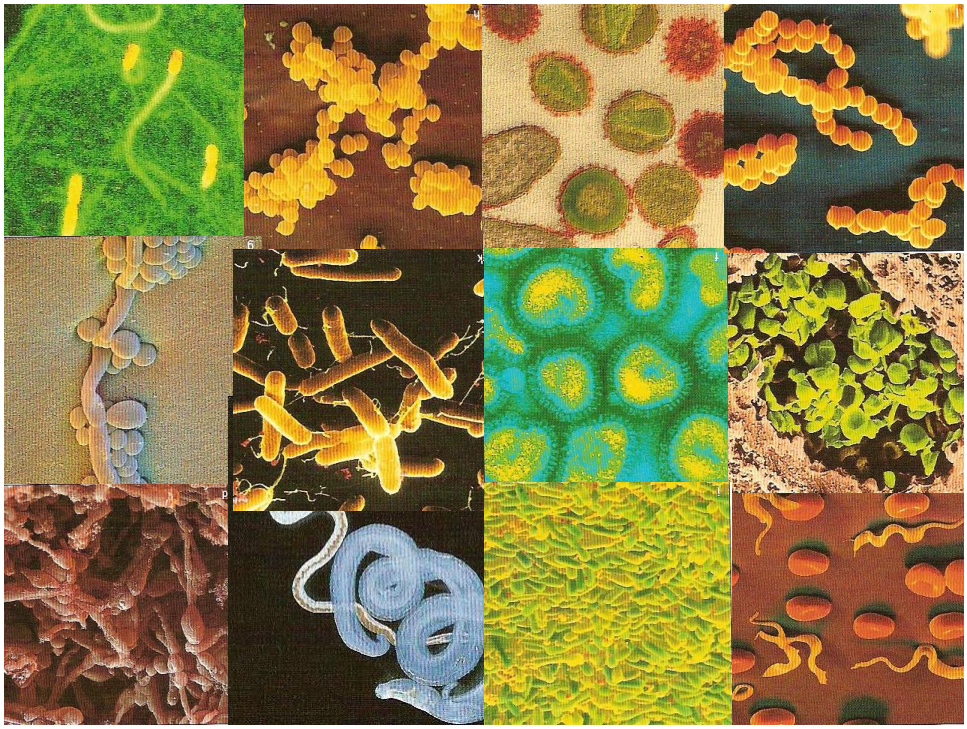
Introduction to Immunology

What is immunology?

- Immune (Latin- “immunus”)
  - To be free, exempt
  - People survived ravages of epidemic diseases when faced with the same disease again
- The study of physiological mechanisms that humans and other animals use to defend their bodies from invading organisms
  - Bacteria - Viruses
  - Fungi - Parasites - Toxins



Immunology lingo

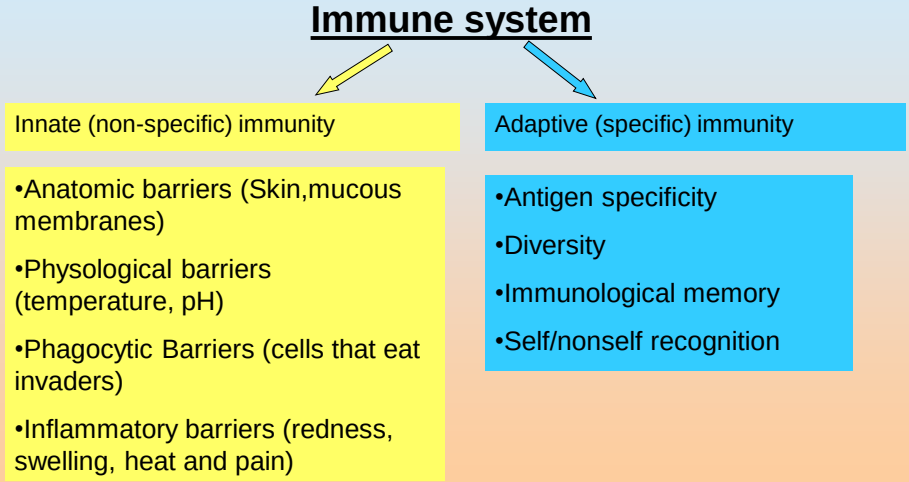
- **Antigen**
  - Any molecule that binds to immunoglobulin or T cell receptor
- **Pathogen**
  - Microorganism that can cause disease
- **Antibody (Ab)**
  - Secreted immunoglobulin
- **Immunoglobulin (Ig)**
  - Antigen binding molecules of B cells
- **Vaccination**
  - Deliberate induction of protective immunity to a pathogen
- **Immunization**
  - The ability ro resist ifection

Immune Response

- Biological body response either innate or adaptive immune system on exogenous agent to keep homeostasis ;
  1. to neutralize immunogen
  2. to eliminate tissue damage
  3. inhibiting excessive proliferations

KONAS PETRI,
Semarang, 2011

The immune system



Pierre Dönnes
pierre@bioinf.uni-sb.de

Andreas Hildebrandt
anhi@bioinf.uni-sb.de

Annette Höglund
annette@bioinf.uni-sb.de

Types of Immunity

- **Innate Immunity**
  - Host defense mechanisms that act from the start of an infection but do not adapt to a particular pathogen
  - Recognize “patterns’ of a.a., saccharides, etc..
  - Monocyte
  - Macrophage
  - Granulocyte :
    - Neutrophil
    - Eosinophil
    - Basophil
  - Epidermis
  - Submucous layer

- **Adaptive Immunity**
  - Response of an antigen specific B and T lymphocytes to an antigen
  - Immunological memory

Types of Immunity

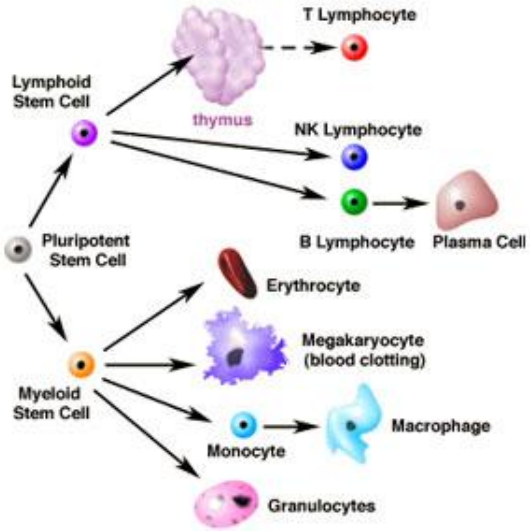
- **Humoral immunity**
  - Immunity that is mediated by antibodies
  - Can be transferred by to a non-immune recipient by serum
- **Cell Mediated Immunity**
  - Immune response in which antigen specific T cells dominate

Immunology cell histology

- Polymorphonuclear
  - Lobed nucleus
- Mononuclear
  - Non-lobed nucleus
- Granulocyte
  - Many granules seen in cytoplasm
- Neutral
  - Does not stain to acidic or basic compounds
- Acidic (red-pink)
  - Stains to acidic compounds (Eosin)
- Basic (blue-purple)
  - Stains to basic compounds

Cells of the Immune system

- Many cells of the immune system derived from the bone marrow
- Hematopoetic stem cell differentiation

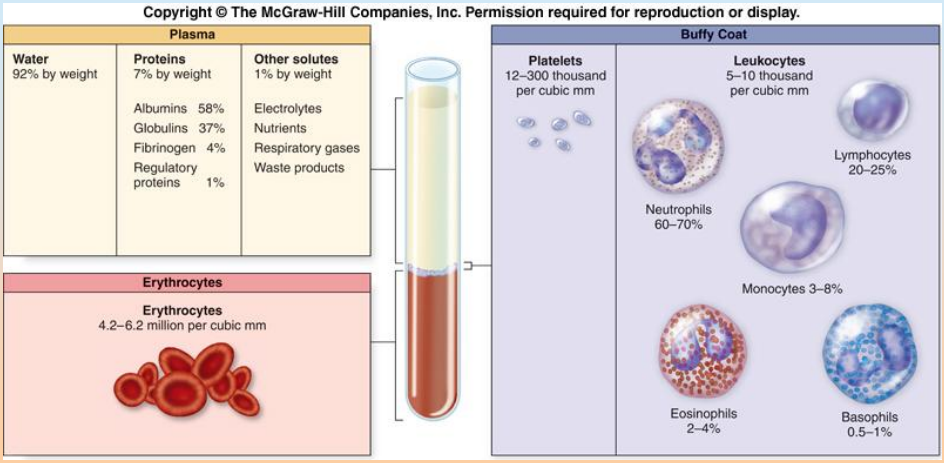


Components of blood

Serum vs. Plasma

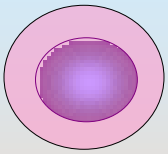
- Serum: cell-free liquid, minus the clotting factors
- Plasma: cell-free liquid with clotting factors in solution (must use an anticoagulant)

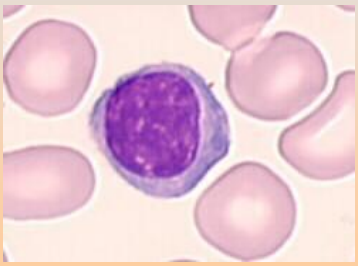
Components of blood



Lymphocytes

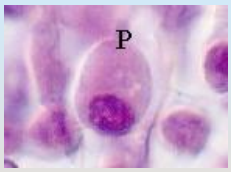
- Many types; important in both humoral and cell-mediated immunity
- B-cells produce antibodies
- T- cells
  - Cytotoxic T cells
  - Helper T cells
- Memory cells

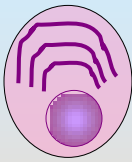


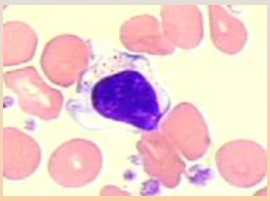


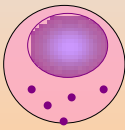
Lymphocytes

- Plasma Cell (in tissue)
  - Fully differentiaited B cells, secretes Ab
- Natural Killer cells
  - Kills cells infected with certain viruses
  - Both innate and adaptive
  - Antigen presentation



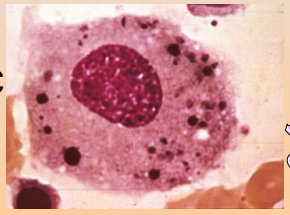






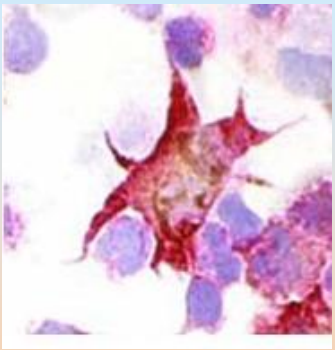
Monocytes/Macrophage

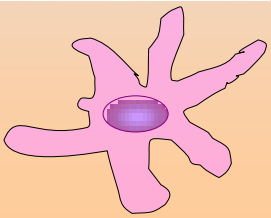
- Phagocytosis and killing of microorganisms
  - Activation of T cells and initation of immune response
- Monocyte is a young macrophage in blood
- There are tissue-specific macrophages
- Antigen Presentation



Dendritic Cells

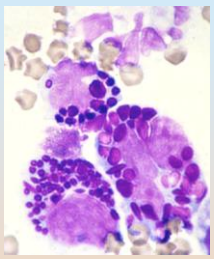
- Activation of T cells and initiate adaptive immunity
- Found mainly in lymphoid tissue
- Function as antigen presenting cells (APC)
- Most potent stimulator of T-cell response

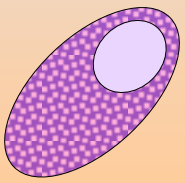




Mast Cells

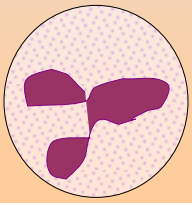
- Expulsion of parasites through release of granules
- Histamine, leukotrienes, chemokines, cytokines
- Also involved in allergic responses



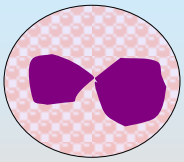


Neutrophil

- Granulocyte
  - Cytoplasmic granules
- Polymorphonuclear
- Phagocytosis
- Short life span (hours)
- Very important at “clearing” bacterial infections
- Innate Immunity



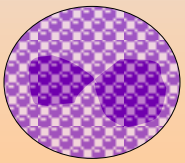
Eosinophils



- Kills Ab-coated parasites through degranulation
- Involved in allergic inflammation
- A granulocyte
- Double Lobed nucleus
- Orange granules contain toxic compounds

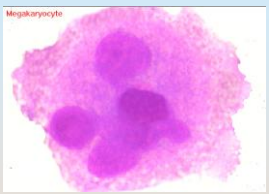
Basophils

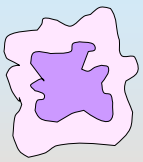
- Might be “blood Mast cells’
- A cell-killing cells
  - Blue granules contain toxic and inflammatory compounds
- Important in allergic reactions

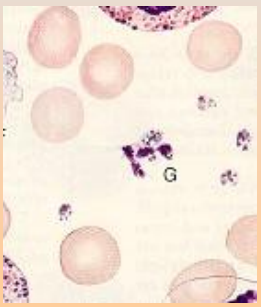


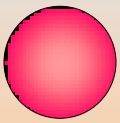
Other Blood Cells

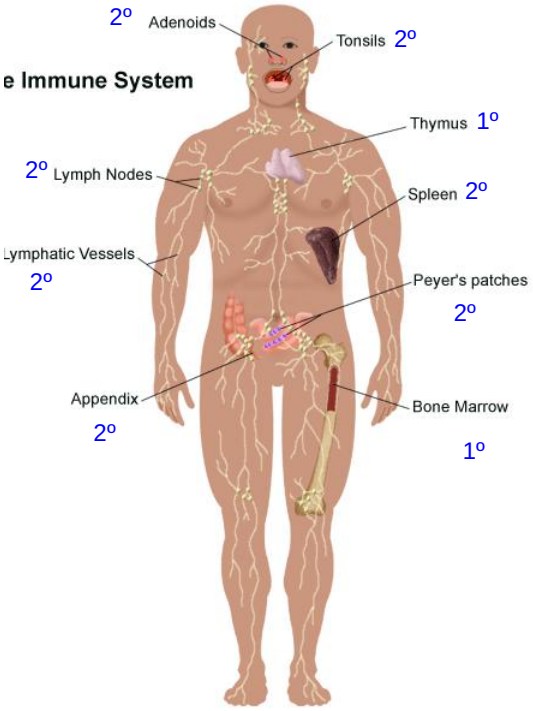
- Megakaryocyte
  - Platelet formation
  - Wound repair
- Erythrocyte
  - Oxygen transport





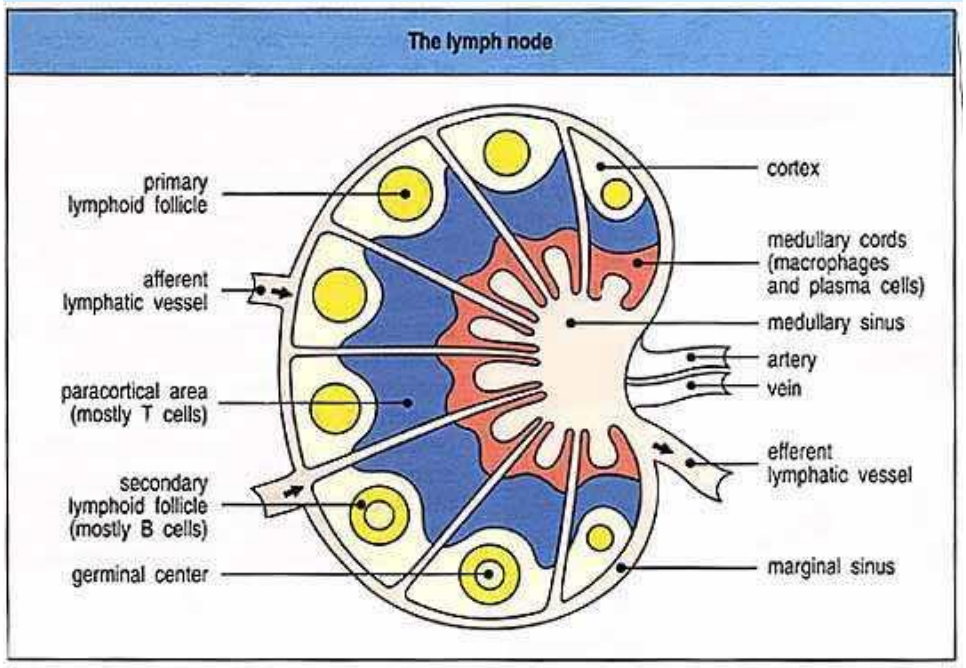






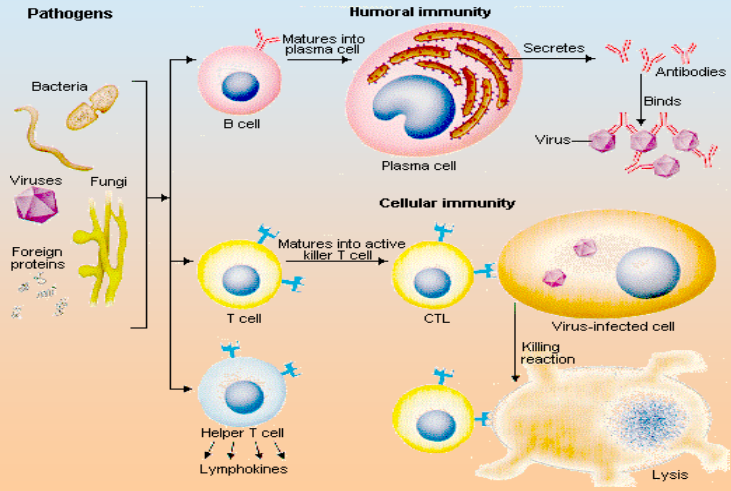
Major Tissues

- Primary Lymph tissues
  - Cells originate or mature
- Secondary Lymph Tissues



Humoral and cellular immunity

(antibody mediated or cellular)



Pierre Dönnes
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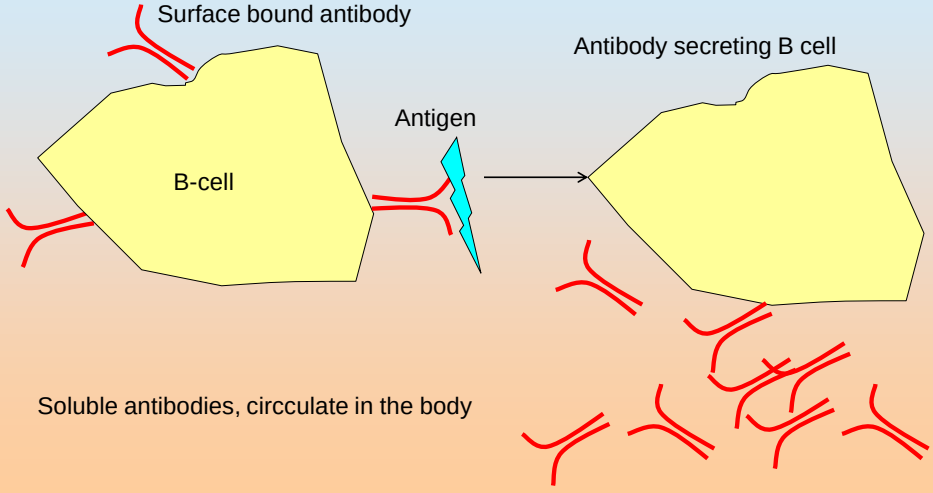
annette@bioinf.uni-sb.de

B cells



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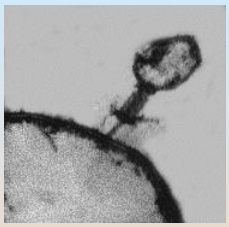

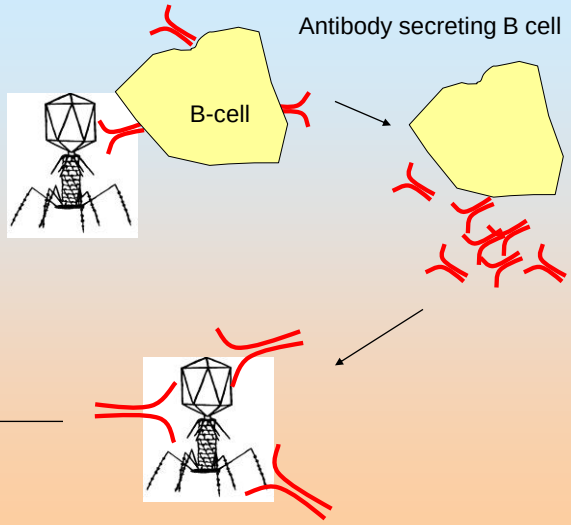

Pierre Dönnes
pierre@bioinf.uni-sb.de
Andreas Hildebrandt
anhi@bioinf.uni-sb.de
Annette Höglund
annette@bioinf.uni-sb.de

T cells

- Two types:
  - Helper T cells (Th): activates other cells
  - Cytotoxic T cells (Tc): can kill other cells
- T cells can only recognize antigens associated with certain molecules (MHC)

Pierre Dönnes
pierre@bioinf.uni-sb.de
Andreas Hildebrandt
anhi@bioinf.uni-sb.de
Annette Höglund
annette@bioinf.uni-sb.de

Presentation of antigens to T cells

- Proteins (peptides) from inside the cell are presented by MHC I molecules to Tc cells.
- Proteins (peptides) from the outside of cells are presented by MHC II molecules to Th cells.
- MHC I on almost all cells
- MHC II on specialized antigen-presenting cells

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anhi@bioinf.uni-sb.de
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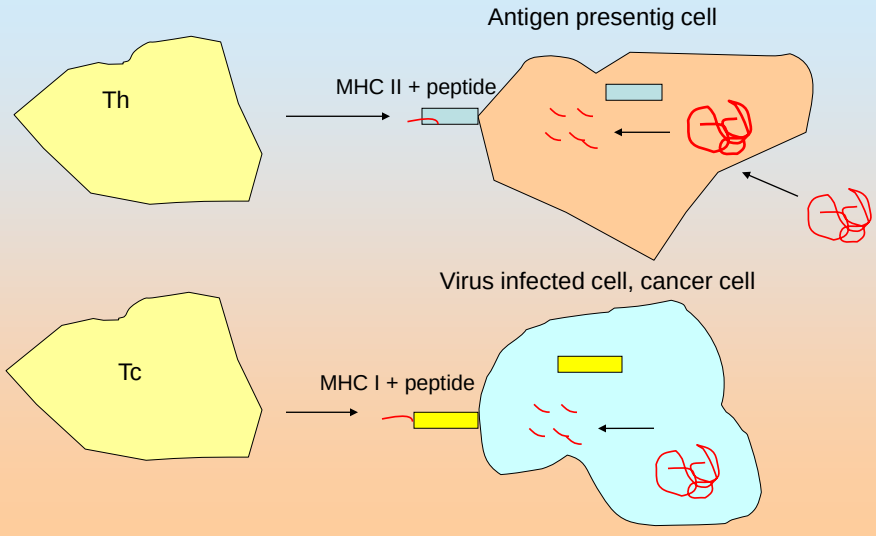

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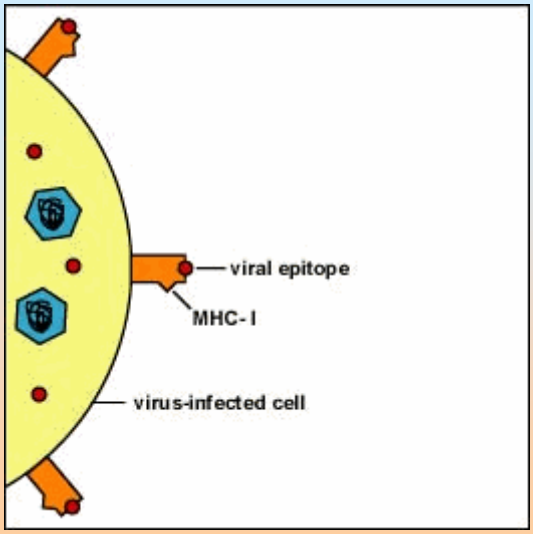

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