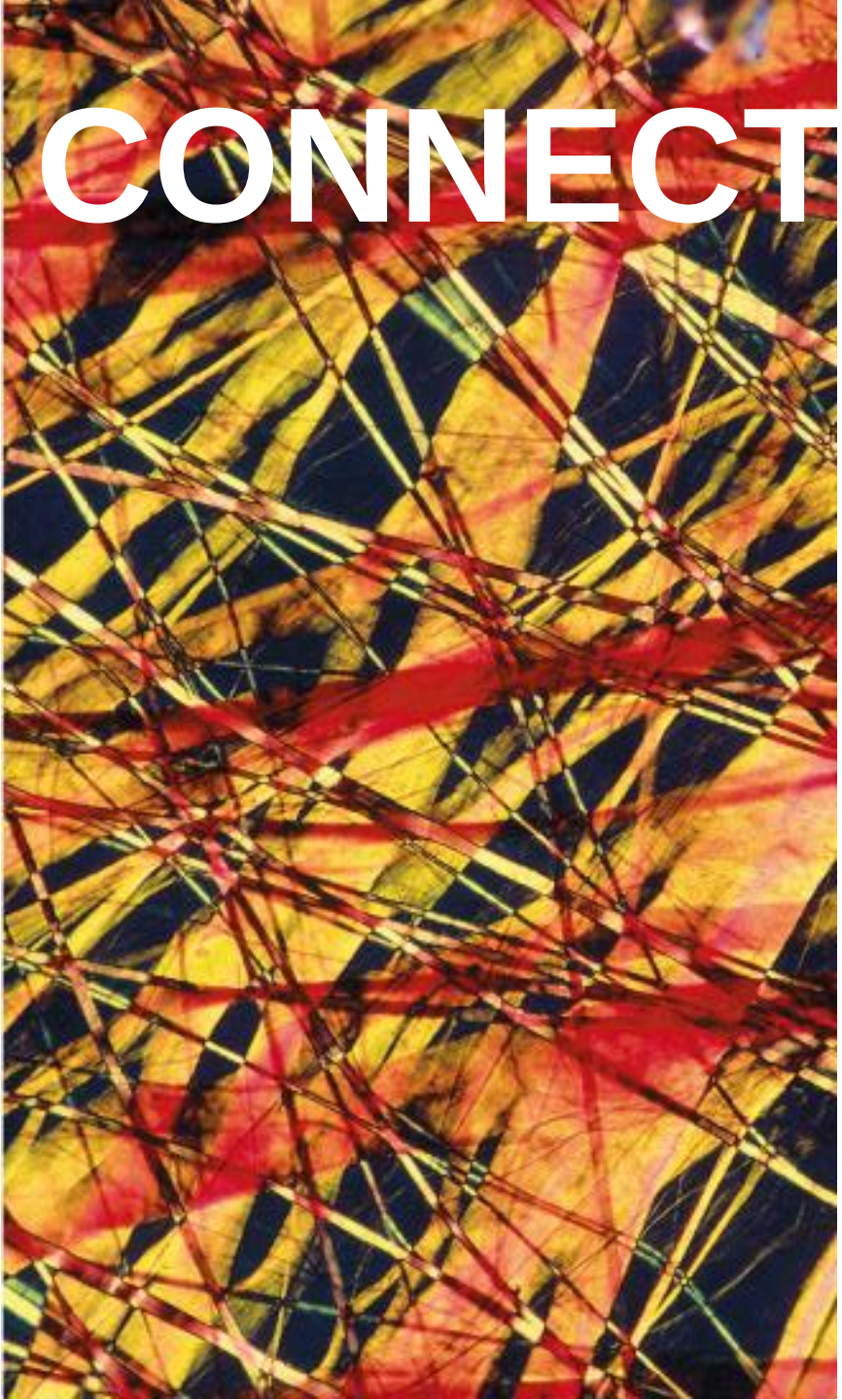
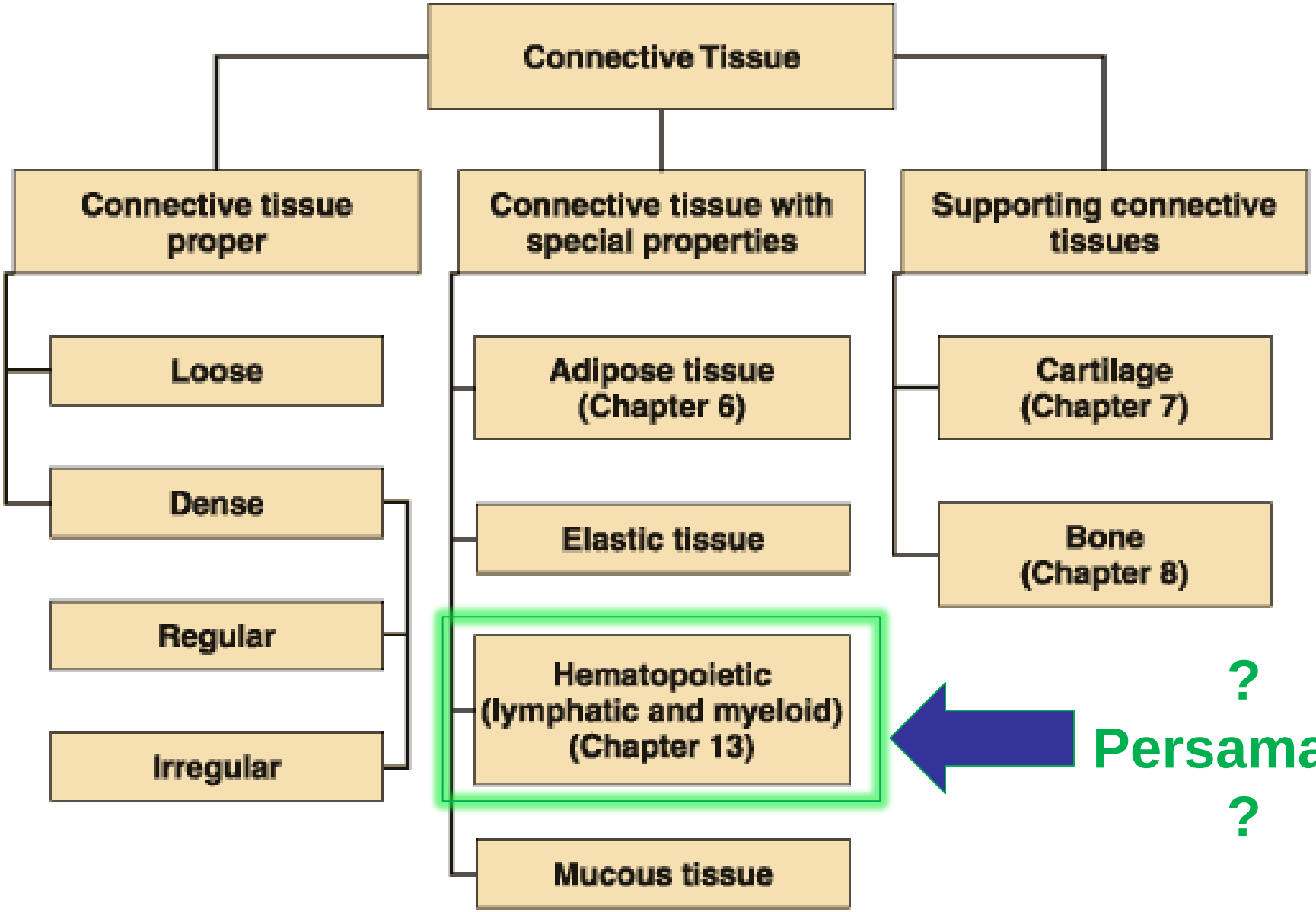


CONNECTIVE TISSUE

PART-2

dr.Indriati Dwi Rahayu, M.Kes
Anatomy Histology Department
Faculty of Medicine
Brawijaya University



For for 1st year

LYMPHATIC SYSTEM

(SYSTEMA LYMPHOPOIETICA)

FUNCTION

- ✓ **fluid** Drainage→ **fluid balance**
- ✓ Carry-immune cells & products, debris, foreign objects (ex : **drug), fat** (and fat-soluble material)
- ✓ **Protection** from evil influence of foreign material → Synthesis of lymphocyte & demolition antigen
- ✓ Support & programming T lymphocytes precursor proliferation in [timus]
- ✓ Filter the lymph & antibody formation

Immune System

NON-SPECIFIC

- Physical: skin, mucous, coughing, etc.
- soluble: - Biochemistry
  - Humoral immune system: the complement, interferon
- Cellular: Phagocytes: MN, PMN, **NK cel**

SPECIFIC:

- **Humoral: B cells → Antibodies**
- **Cellular: T cells**

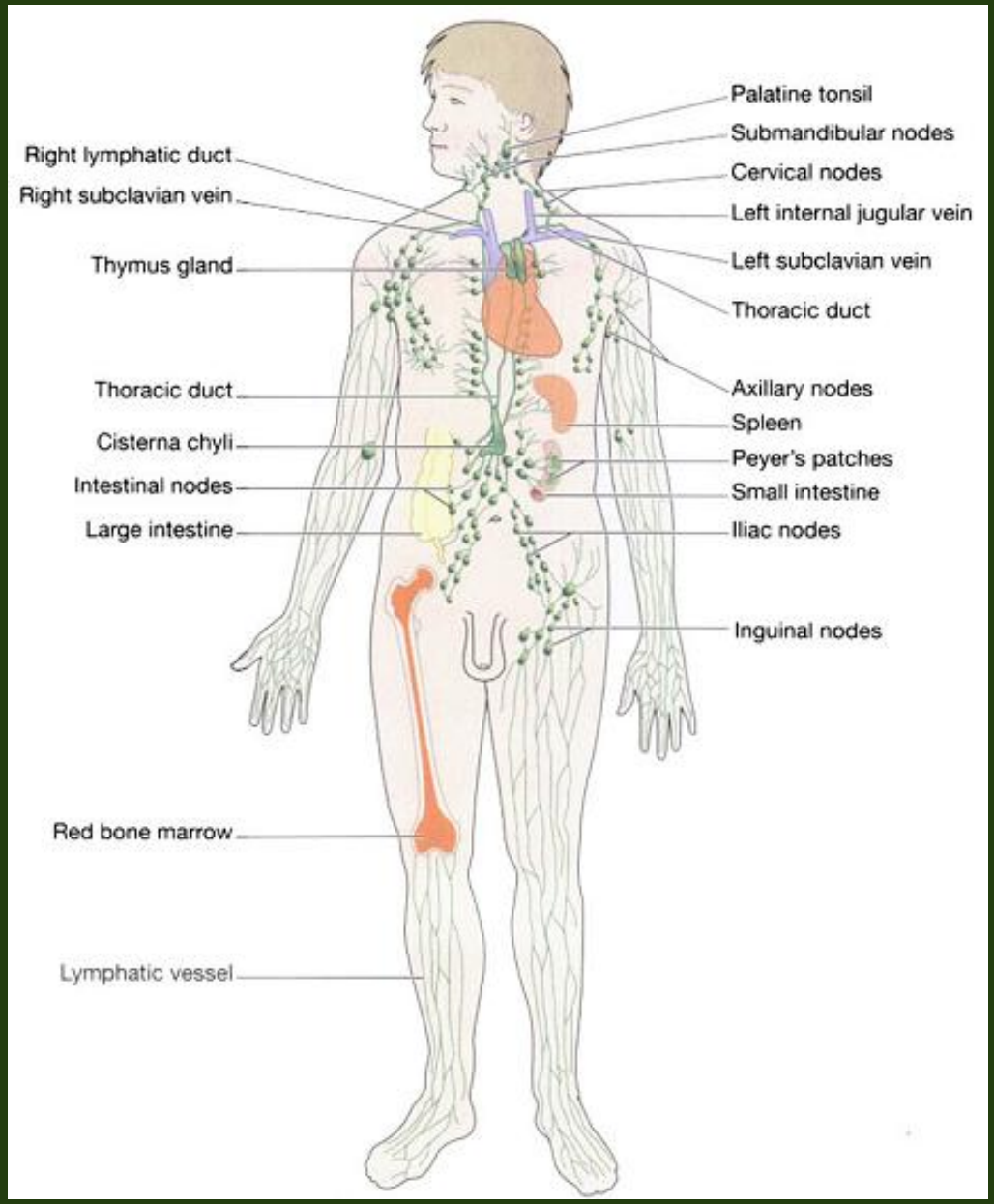
The lymphatic system consists of:

(1) vascular system;

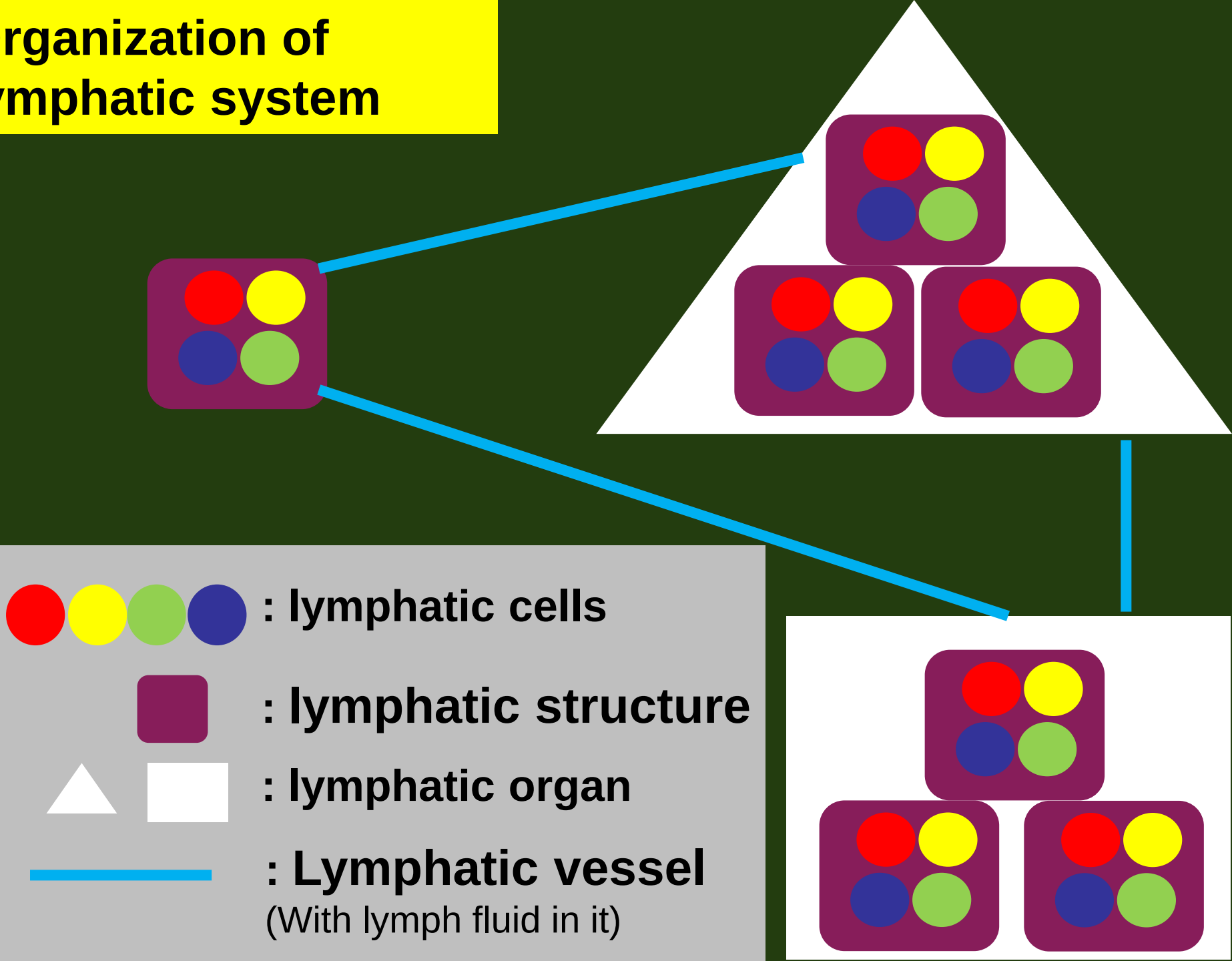
capillaries from various organs and network of lymph vessels → large vein

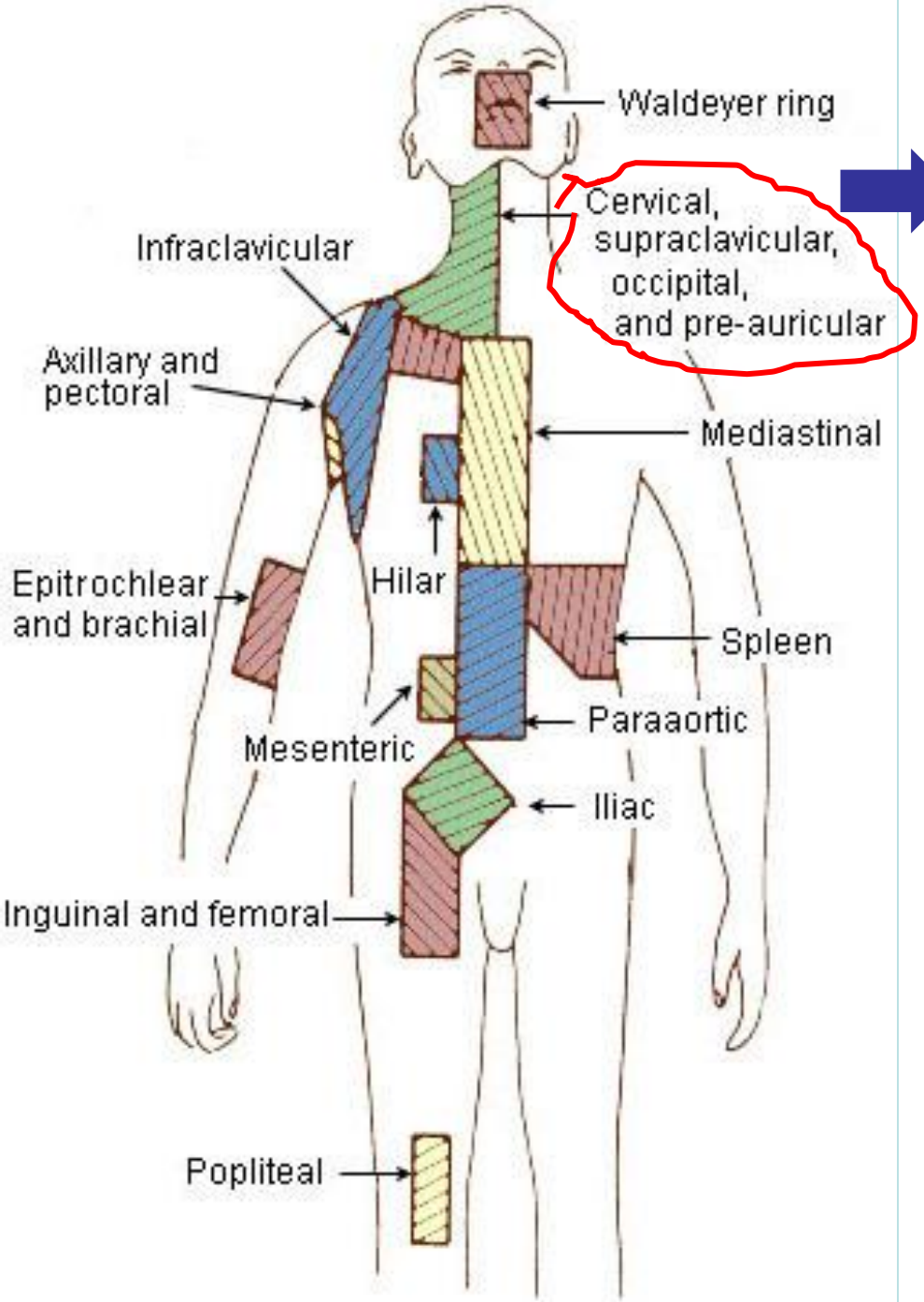
(2) lymph **fluid**

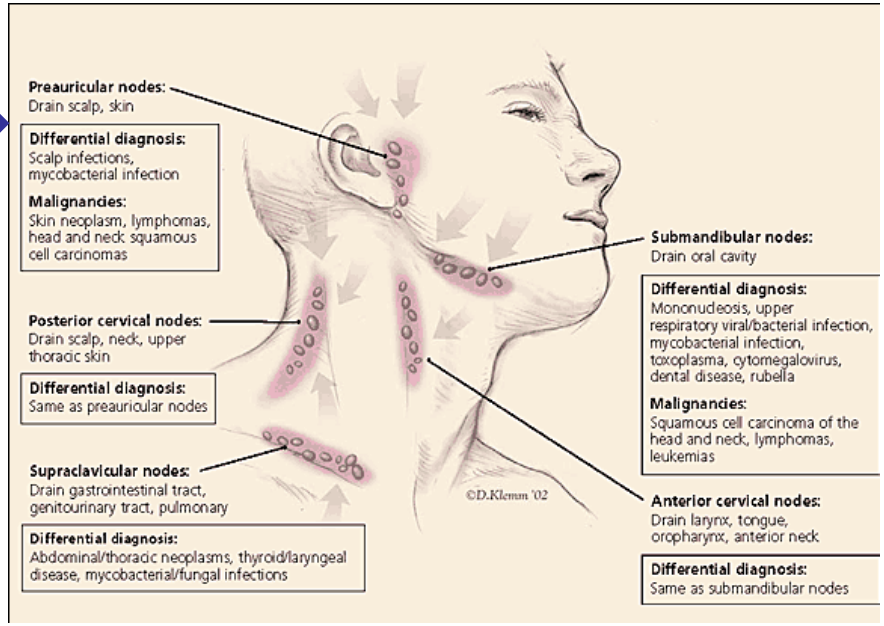
(3) lymph node / lymphoid organ : composed of lymphatic cells

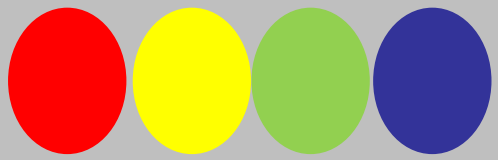


Organization of lymphatic system




Waldeyer ring
Cervical, supraclavicular, occipital, and pre-auricular
Infraclavicular
Axillary and pectoral
Mediastinal
Hilar
Epitrochlear and brachial
Spleen
Paraaortic
Mesenteric
Iliac
Inguinal and femoral
Popliteal


Preauricular nodes:
Drain scalp, skin
Differential diagnosis:
Scalp infections, mycobacterial infection
Malignancies:
Skin neoplasm, lymphomas, head and neck squamous cell carcinomas
Posterior cervical nodes:
Drain scalp, neck, upper thoracic skin
Differential diagnosis:
Same as preauricular nodes
Supraclavicular nodes:
Drain gastrointestinal tract, genitourinary tract, pulmonary
Differential diagnosis:
Abdominal/thoracic neoplasms, thyroid/laryngeal disease, mycobacterial/fungal infections
©D.Klemm '02
Submandibular nodes:
Drain oral cavity
Differential diagnosis:
Mononucleosis, upper respiratory viral/bacterial infection, mycobacterial infection, toxoplasma, cytomegalovirus, dental disease, rubella
Malignancies:
Squamous cell carcinoma of the head and neck, lymphomas, leukemias
Anterior cervical nodes:
Drain larynx, tongue, oropharynx, anterior neck
Differential diagnosis:
Same as submandibular nodes



: Sel2 limfatik

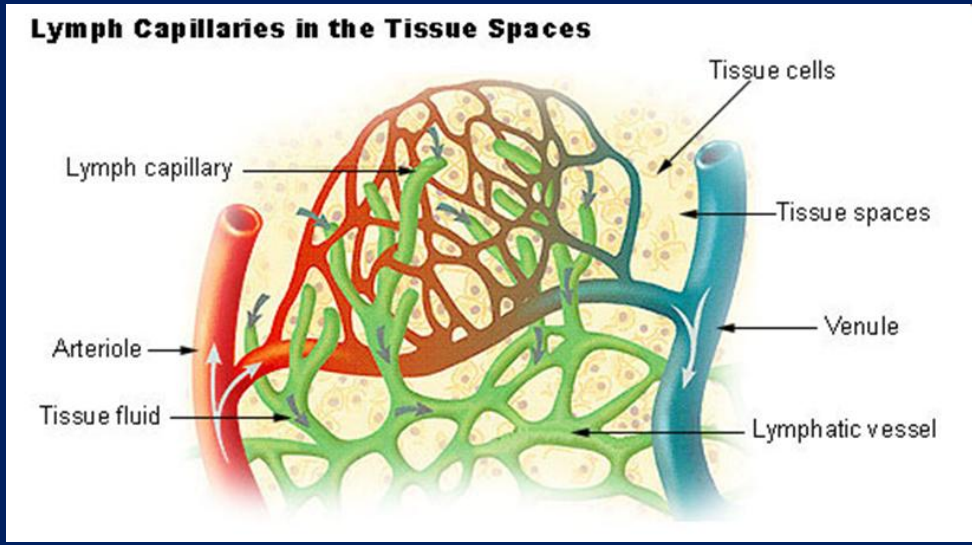
: Struktur limfatik

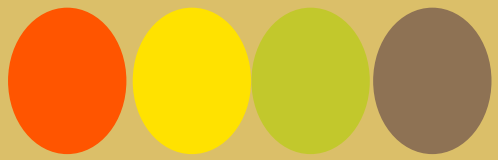
: Organ limfatik

: **Pembuluh limfatik**
(dgn cairan limfe di dalamnya)

1. SISTEM PEMBULUH

- Contains Lymph FLUID ;
  consist of :
  - ➢ Excess tissue fluid
  - ➢ Cellular debris
  - ➢ Lymphocytes
  - ➢ Fat (the gut)
- a closed tube syste
- move one direction → V.subclavia
- Will be further discussed at CVS

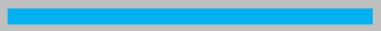




: Sel2 limfatik

: Struktur limfatik

: Organ limfatik



: Pembuluh limfatik

SEL2 SISTEM LIMFATIK

Lymphocyte

Sel Plasma

NK cell

APC

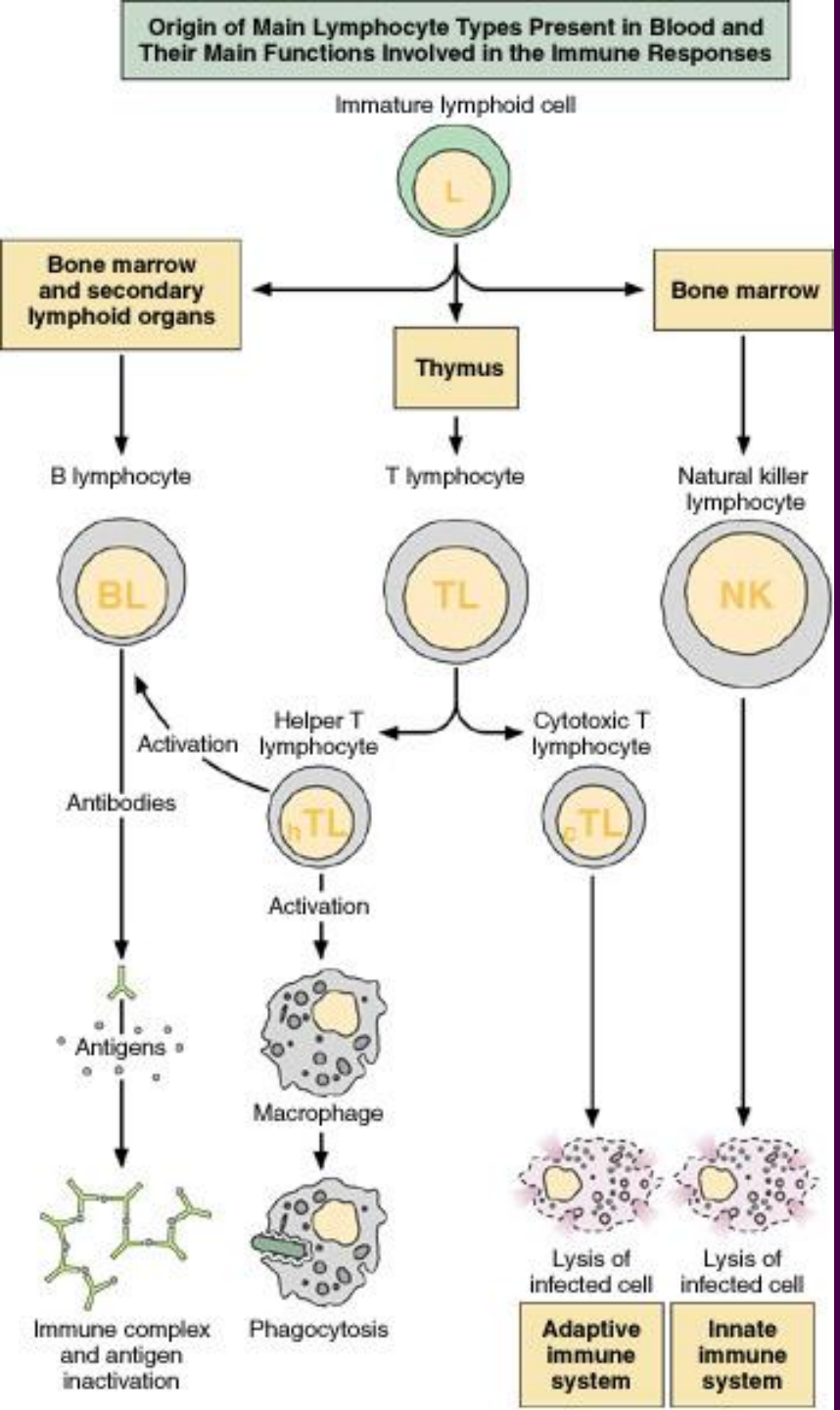
macrophage

Sel Retikuler

Lymphocyte | Sel Plasma | NK cell | APC | macrophage | Sel Retikuler

Lymphocyte

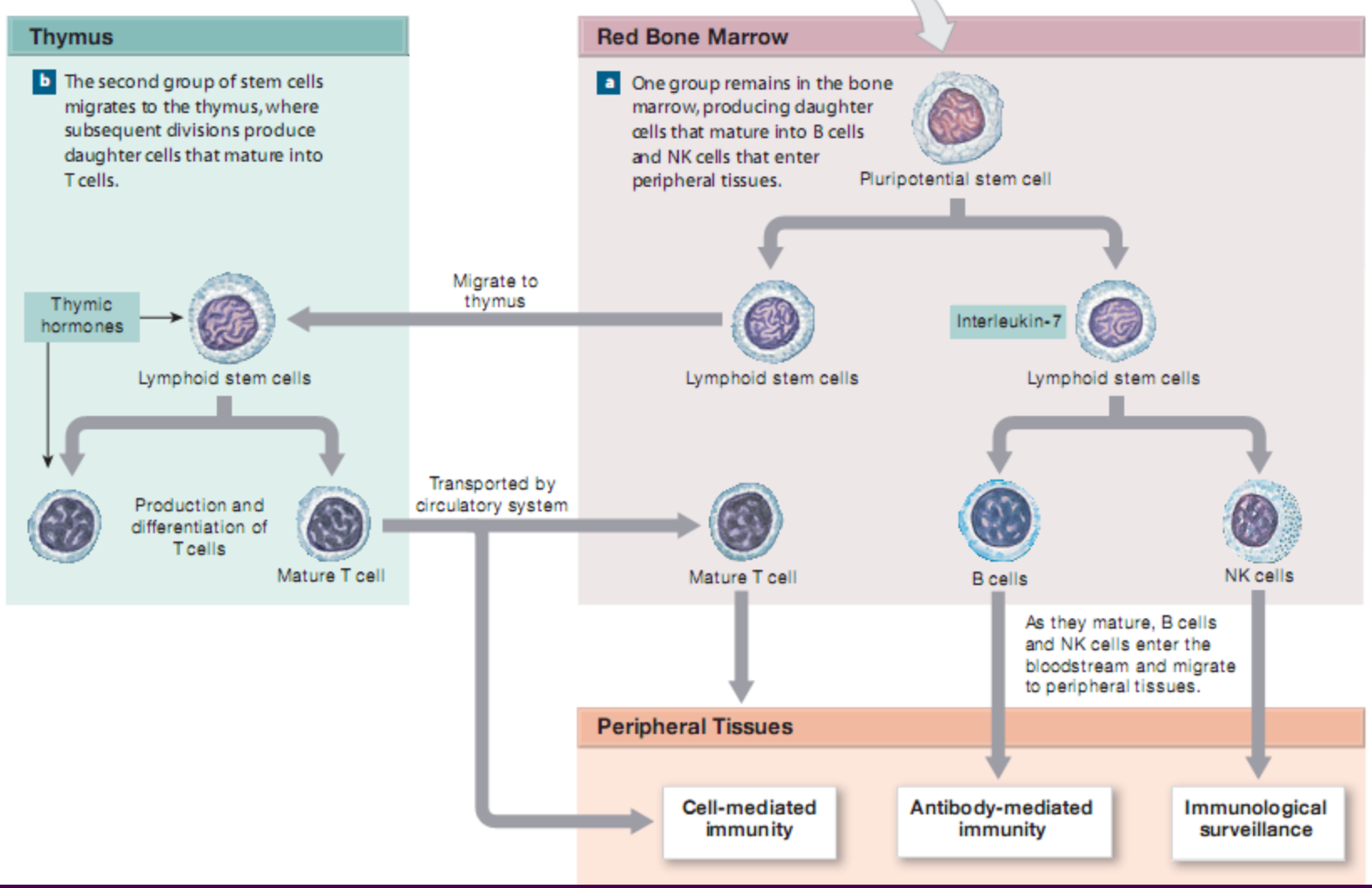
- can not phagocytosis
- In general there are two types:
  - T lymphocytes (T-lymphocytes / T cells)
  - B lymphocytes (B-lymphocytes / B cell)
- The B and T cells are the only cells that have the ability to selectively recognize a specific epitope (antigenic determinant)



Lymphocytes of Lymphoid Organ
(T-cell (%) : B-cell (%))

Thymus	
100	0
Bone Marrow	
10	90
Spleen	
45	55
Lymph Nodes	
60	40
Blood	
80	20

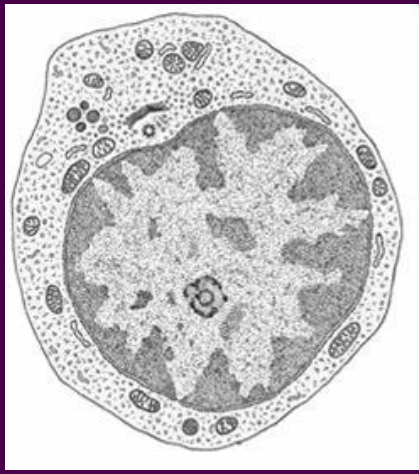
Figure 23.7 Derivation and Distribution of Lymphocytes Pluripotential stem cell divisions produce lymphoid stem cells with two different fates.



Lymphocyte | Sel Plasma | NK cell | APC | macrophage | Sel Retikuler

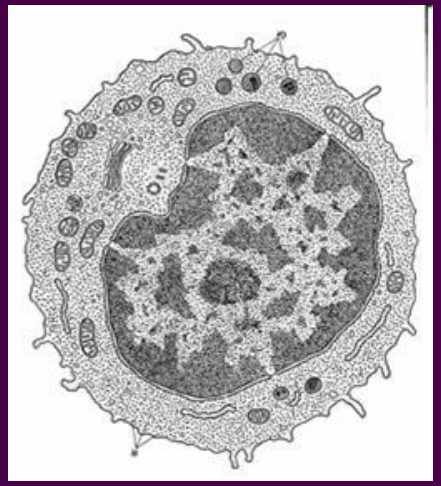
T cell

- responsible for cellular immunity
- require the help of macrophages or other APC to optimal response
- Cells Effectors:
  * T-helper
  * T-cytotoxic
  * Supressor T-cell



B Lymphocytes (B cell)

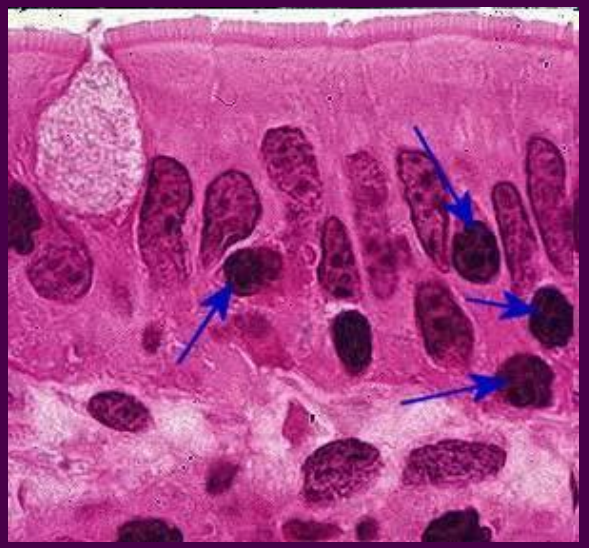
- Responsible for humoral immune
- Cells daughter:
  - Plasma cell
  - Memory cell



Lymphocyte | **Sel Plasma** | NK cell | APC | macrophage | Sel Retikuler

Plasma Cell

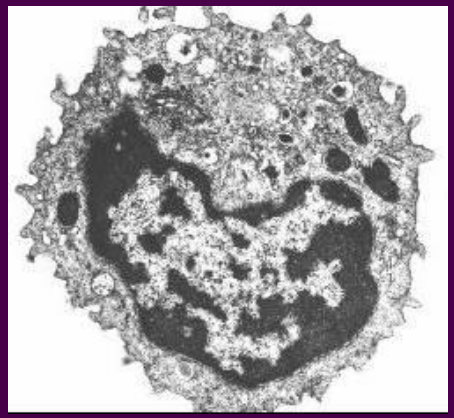
- is the result of B cell effector differentiation
- secrete immunoglobulin (Ig)
- microscopy: a clock face nucleus
- Present in all lymphatic tissue



Lymphocyte | Sel Plasma | NK cell | APC | macrophage | Sel Retikuler

Natural Killer cell

- = Lymphocyte granular
- No receptor
- Can be activated without specific stimulation (no memory)



Lymphocyte | Sel Plasma | NK cell | **APC** | macrophage | Sel Retikuler

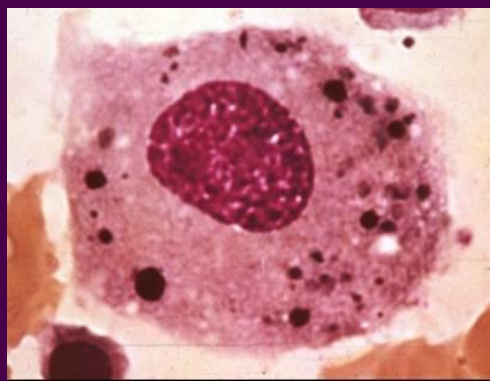
APC (Antigen Presenting Cell)

- → cells that display peptides associated with class II MHC molecules to CD4+ TH cells (komplek antigen → small component → presentation → express on the cell surface)
- Tipe :
  - Professional APC : constitutively express class II MHC molecules
    - = sel yg dpt menimbulkan aktivasi perkembangan limfosit
    - Tdd : Dendritic cell, macrophage, & B-lymph.
  - Nonprofessional APC : can be induced to express class II MHC molecules
    - =sel yg dpt distimulasi utk presentasi antigen dlm fungsi efektor
    - Ex : endothelial cells, astrocytes, epithelial cells, fibroblast

Lymphocyte | Sel Plasma | NK cell | APC | **macrophage** | Sel Retikuler

macrophage

- Phagocyte antigen complexes, strengthening antigenicity
- phagocyte Ag-Ab complex
- In vascular sinus wall
- spread in the lymphatic organs of the lymphatic tissue &
- scattered in loose connective tissue

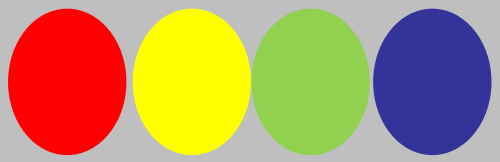


Sel-sel organ limfatik

Lymphocyte | Sel Plasma | NK cell | APC | macrophage | **Sel Retikuler**

Sel Retikuler

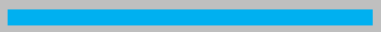
- stellata, prosesus beranyaman
- Type :
  - **Sel Retikuler mesenchymal (dendritic) → sbg APC**
  - Sel Retikuler epithelial → supportive. Di Thymus



: Sel2 limfatik

: Struktur limfatik

: Organ limfatik



: Pembuluh limfatik

NODULI LIMFATISI
(Lymphatic nodule)

GAMBARAN KHUSUS
(SPECIAL FEATURES)

- = kumpulan Lymphocyte2, berbentuk sferis
  → aggregat2 limfatik → sub unit fungsional
- didominasi sel B-helper

- <u>Nodulus primer</u>
  - saat prenatal
  - Germinal center [-]
  - Ag [-]

<u>Nodulus sekunder</u>

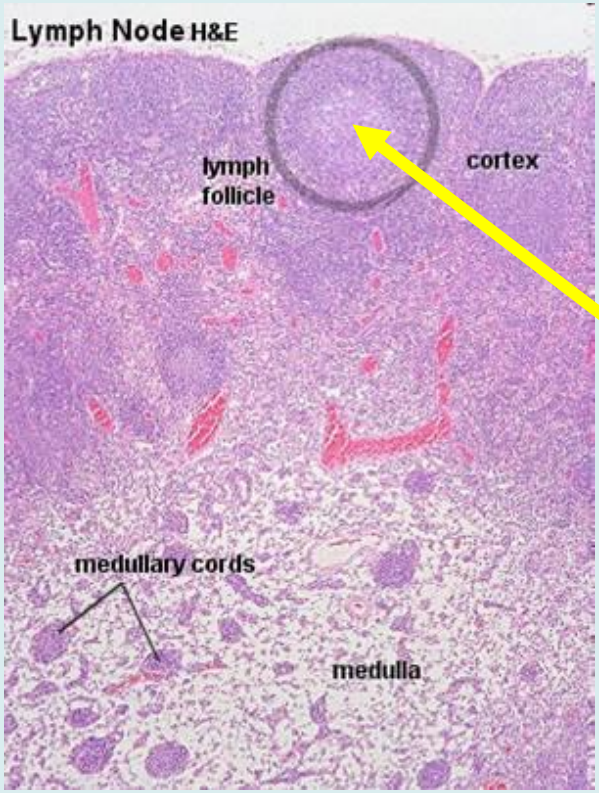
- setelah lahir
- = bentuk aktif dr nodulus primer oleh paparan Antigen
- Terdapat ***Germinal Centre***
- banyak limfoblast
- Sbg tempat sel memori

GERMINAL CENTRE

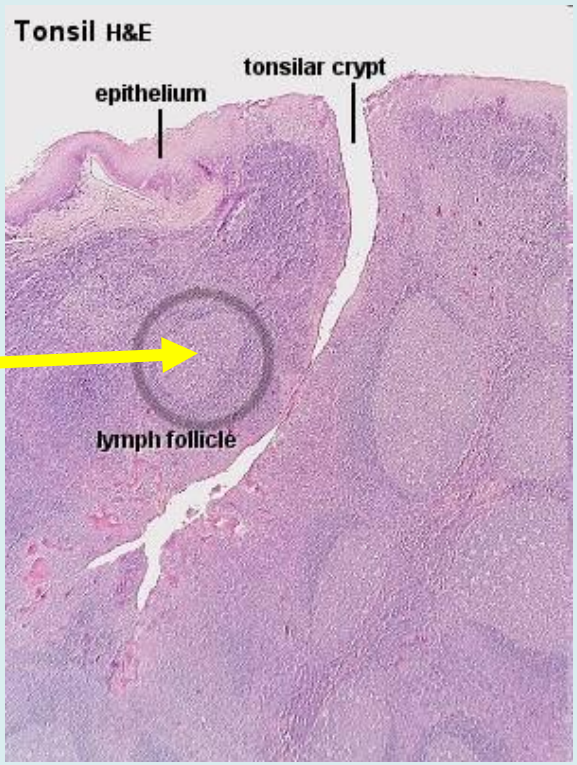
- Areas that look pale, are in the middle of an noduli limfatici(Lymphatic nodule)
- Consists of :
  - Lymphocyte; aktif proliferasi, p.u berukuran sedang. Limfoblast [+]

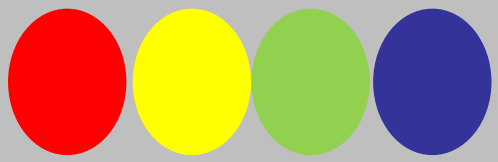
    P.u **B-cell**
  - Sel retikuler; relatif besar, dg prosesus panjang (➔Dendritic cell), inti pucat dan besar, sitoplasma basofil
  - Sel lain : macrophage, sel plasma

- timbul setelah lahir
- Hilang timbul sesuai stimulasi antigen
- [-] - s/d akan lahir
  - bila antigen [-]
  - thymectomy saat lahir



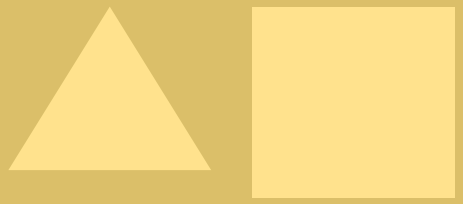
GERMINAL CENTRE



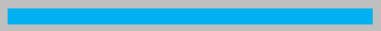


: Sel2 limfatik

: Struktur limfatik



: Organ limfatik



: Pembuluh limfatik

COMPONENTS OF Lymphatic ORGAN :

1. **Cells**

   predominantly : Lymphocyte T & B

   Other : - Sel plasma - Sel retikuler

   - APC - macrophage

2. **(structure) Lymphatic Tissue**

   a. Loose lymphatic tissue → Lymphocyte tidak tersusun rapat.

   b. Dense lymphatic tissue → Lymphocyte membentuk aggregat (→ lymphatic nodules/follicle)

3. **Organ Limfatik**

   Ex : Limfonodus, Lien, Timus

Klasifikasi jaringan & organ limfatik :

- **organ limfatik sentral (Primary) :**

  → pembentukan Lymphocyte tidak tergantung antigen

  → supply T-cell netral atau prekursor Lymphocyte B ke organ & jaringan perifer

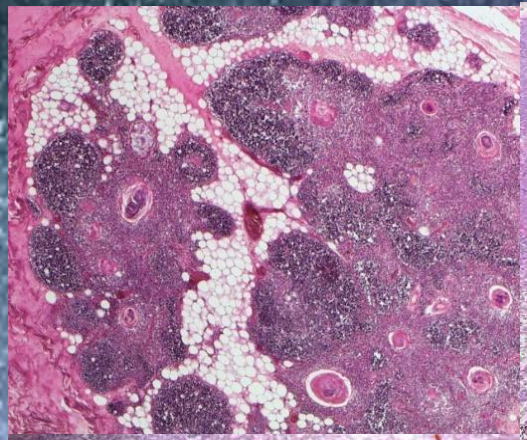
  Tdd : Timus dan sumsum tulang

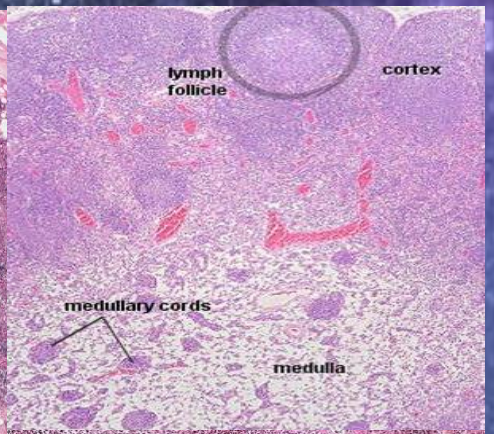
- **organ limfatik perifer (Secondary**):

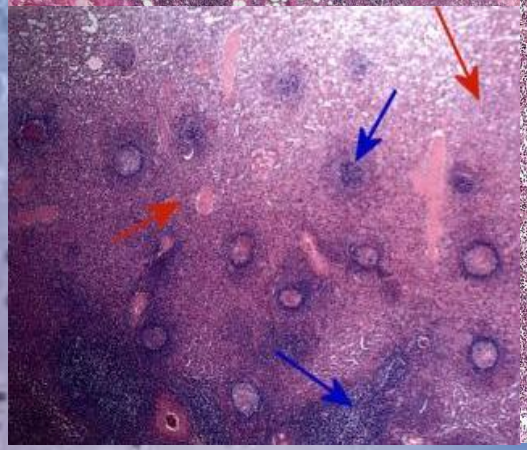
  → pembentukan Lymphocyte tergantung antigen → sel2 imunokompeten, bereaksi thd Antigen spesifik

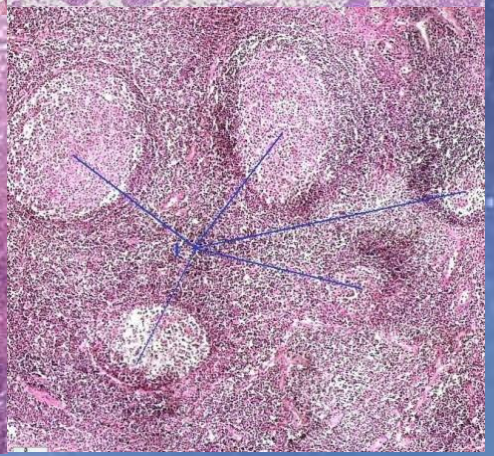
  Tdd : Limfonodus, lien, tonsil, aggregat limfatik tidak berkapsul

ORGAN LIMFATIK









KARAKTERISTIK :

* >> Lymphocyte

- kerangka anyaman serabut & sel retikuler

LIMFONODUS

Thymus

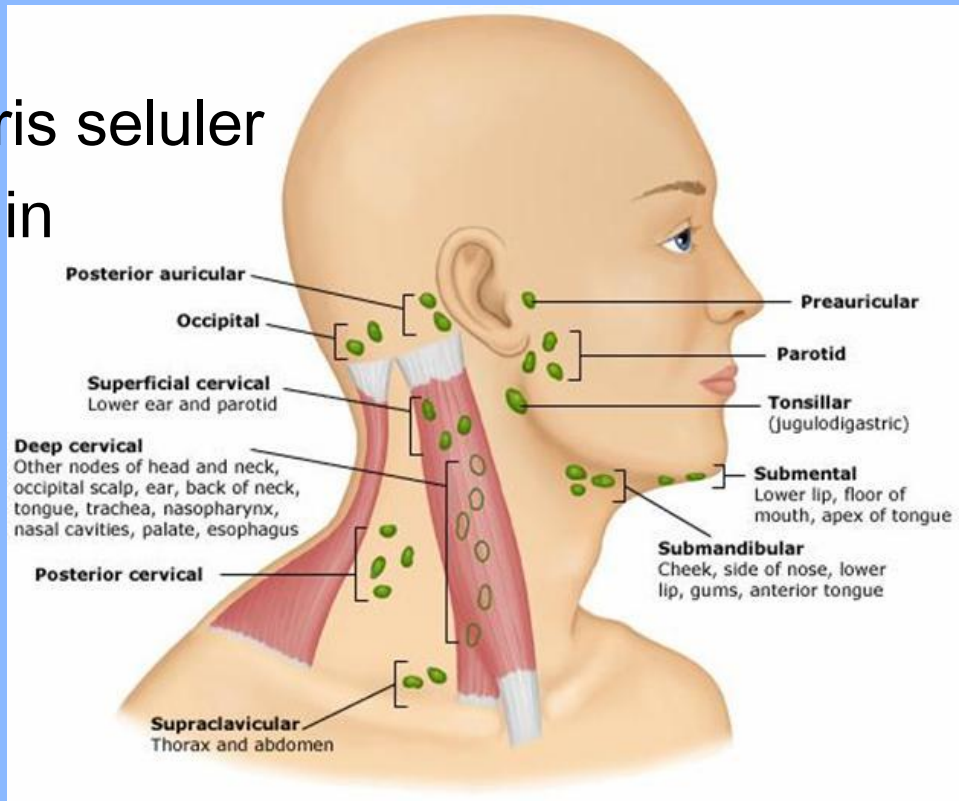
L I E N

TONSIL

AGGREGAT LIMFATIK TIDAK BERKAPSUL

LIMFONODUS

- → organ limfatik berkapsul terkecil & terbanyak
- tersebar dalam kelompok2 di sepanjang pembuluh limfe di leher, axilla, abdomen, pangkal paha, dan thorax
- fungsi :
  - sbg filter limfe
  - ‘menangani ‘ antigen & debris seluler
  - penambahan immunoglobulin

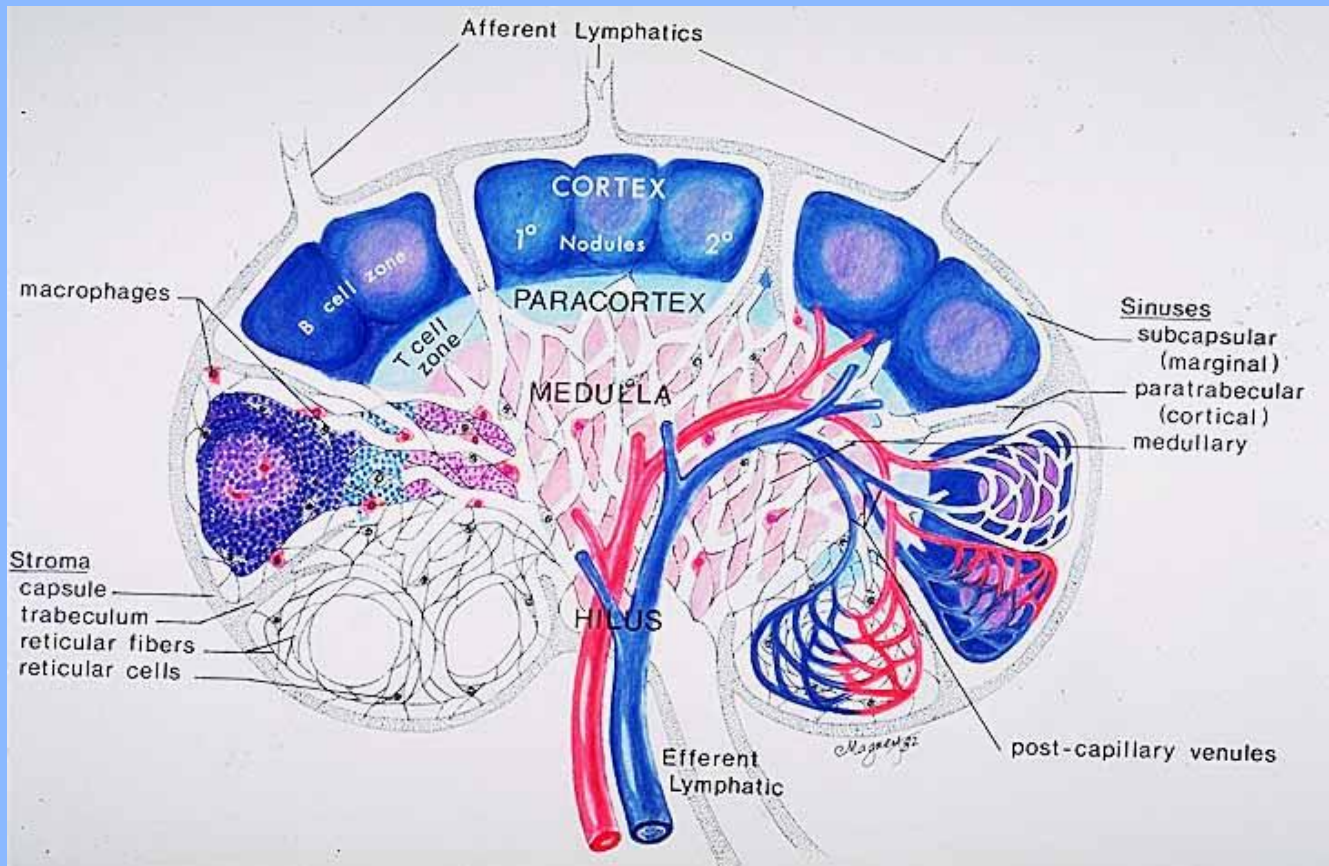


LIMFONODUS

LIMFONODUS

Struktur

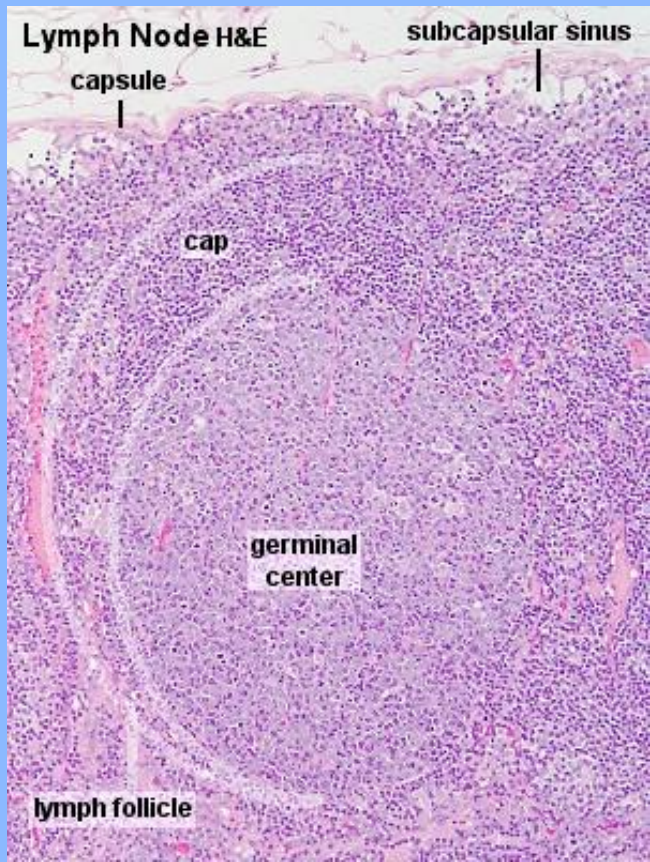
- bentuk seperti kacang
- Tdd **cortex dan medulla**
- Kapsul → trabekula → antara nodulus di cortex
- pembuluh darah & pembuluh limfe efferent di hilum
- Pembuluh limfe afferent melalui permukaan convex



LIMFONODUS

CORTEX :

- Lymphocyte tersusun padat → 1 lapis noduli limfatici sekunder
- germinal center [+]
- Lymphocyte tergantung di anyaman jaringan ikat retikuler



ALIRAN LIMFE

limfe pembuluh afferent

↓

sinus subcapsular

↓

sinus peritrabekular

↓

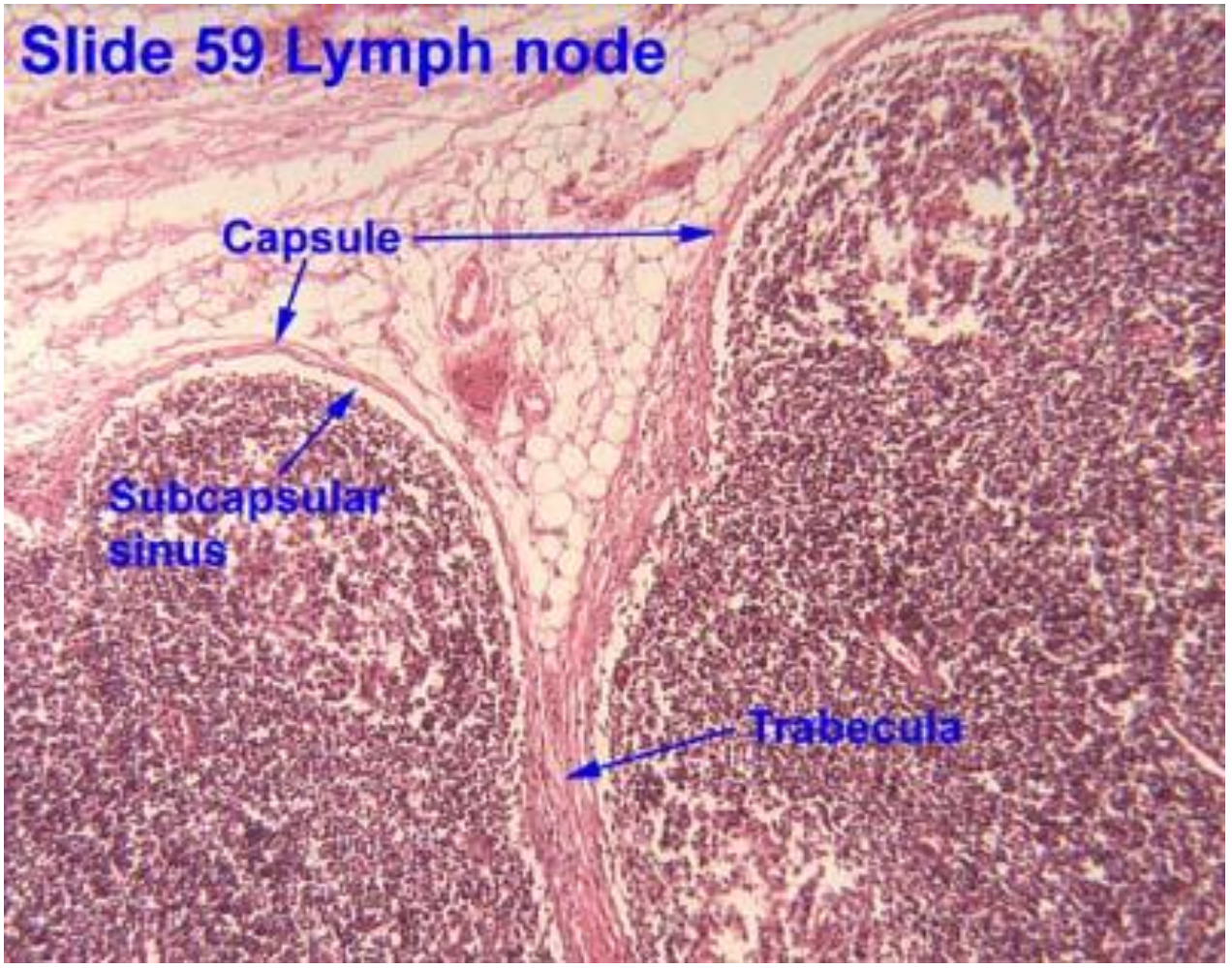
anyaman anastomose di sinus2 medullary

↓

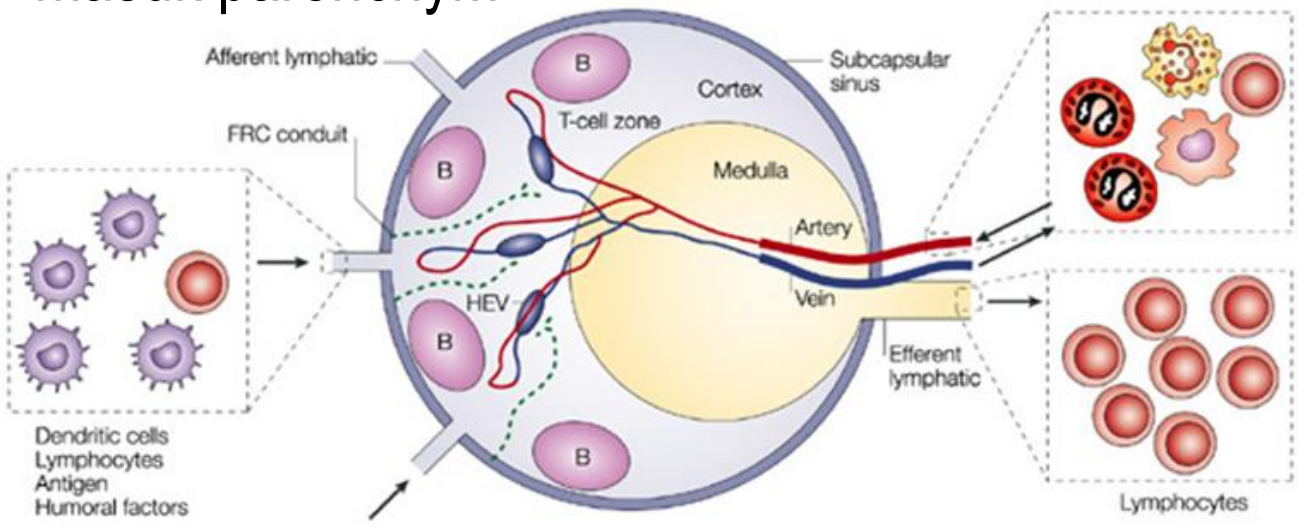
pembuluh limfe efferent

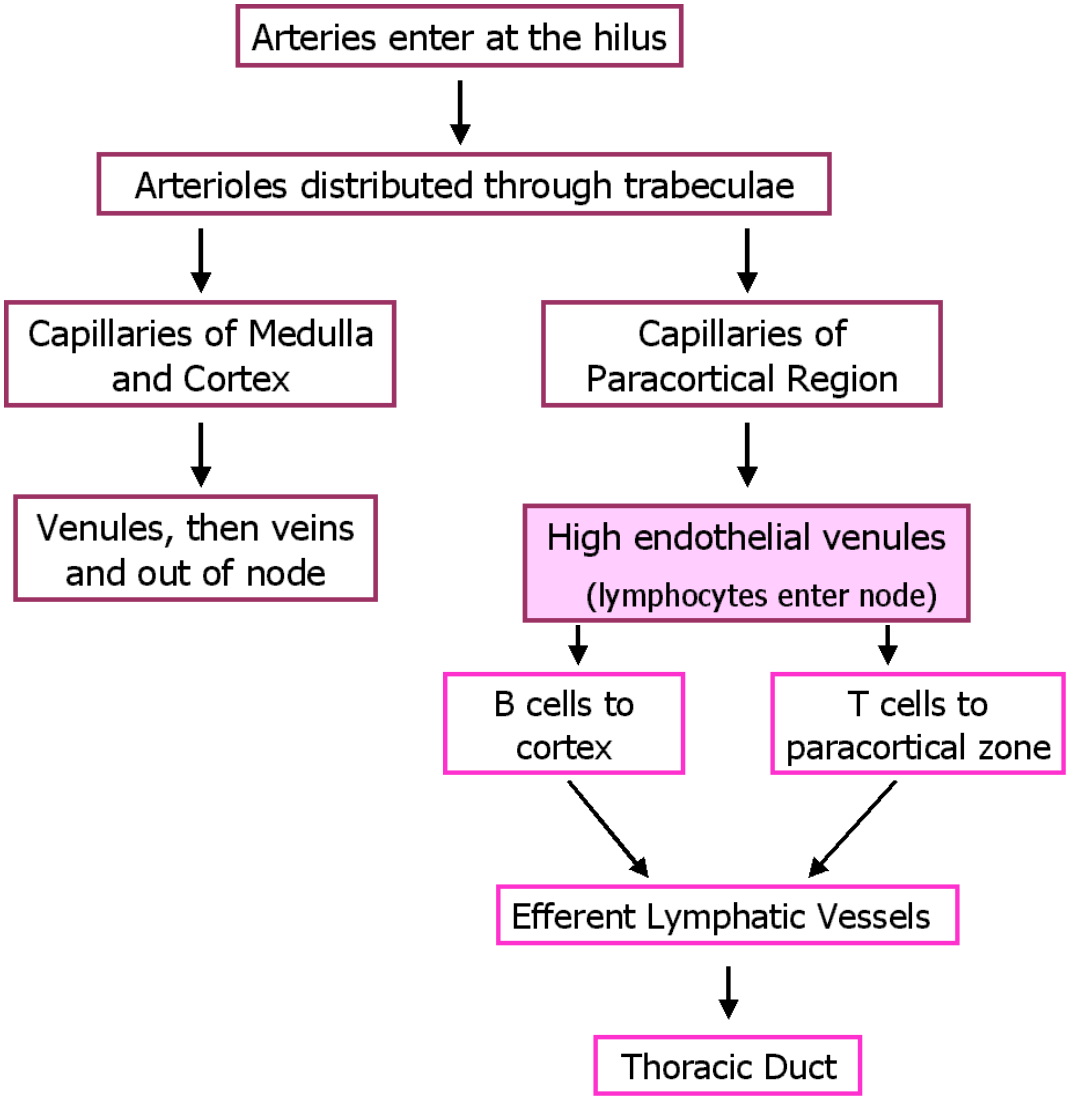
↓

hilum


Slide 59 Lymph node
Capsule
Subcapsular sinus
Trabecula

- **Penyaringan limfe**
  - limfe afferent membawa debris seluler & antigen →'ditangani' oleh macrophage & sel2 dendritik folikuler di sinus2
  - Lymphocyte mengalami : kontak dg APC & macrophage di sinus2
  - keluar dr sinus → masuk parenchym




Arteries enter at the hilus
Arterioles distributed through trabeculae
Capillaries of Medulla and Cortex
Capillaries of Paracortical Region
Venules, then veins and out of node
High endothelial venules (lymphocytes enter node)
B cells to cortex
T cells to paracortical zone
Efferent Lymphatic Vessels
Thoracic Duct

Cllinical correlation :

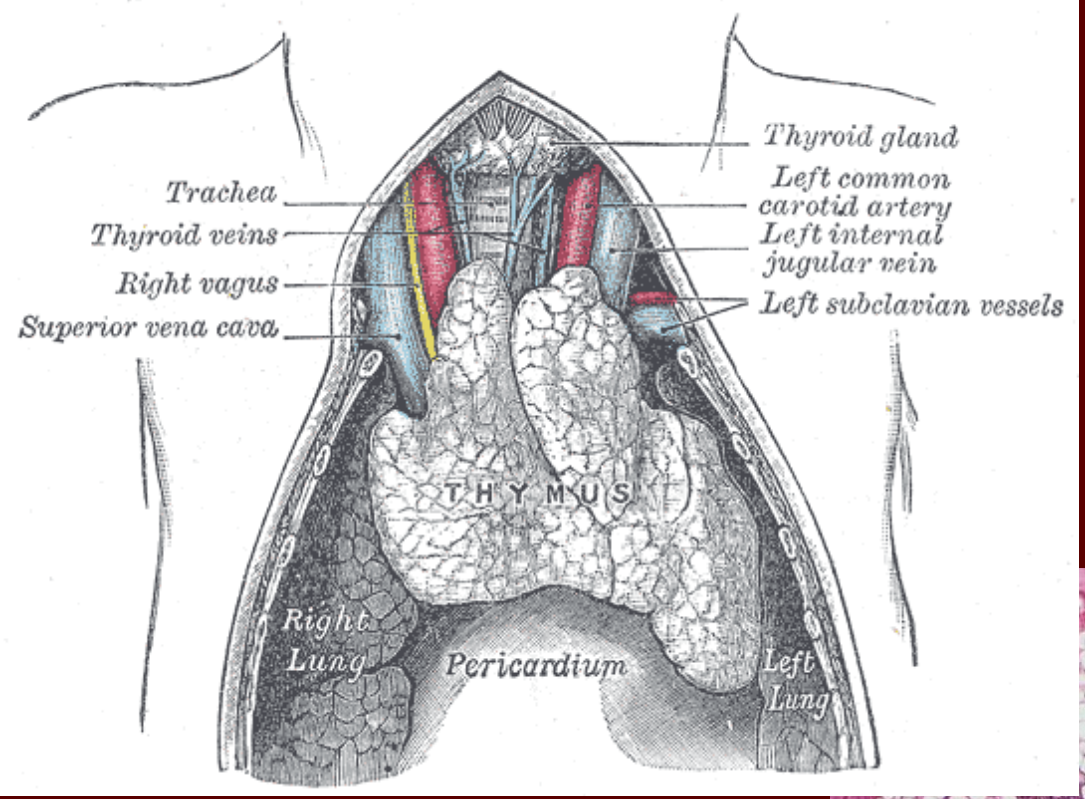
- Lymphadenopathy
- Lymphadenitis

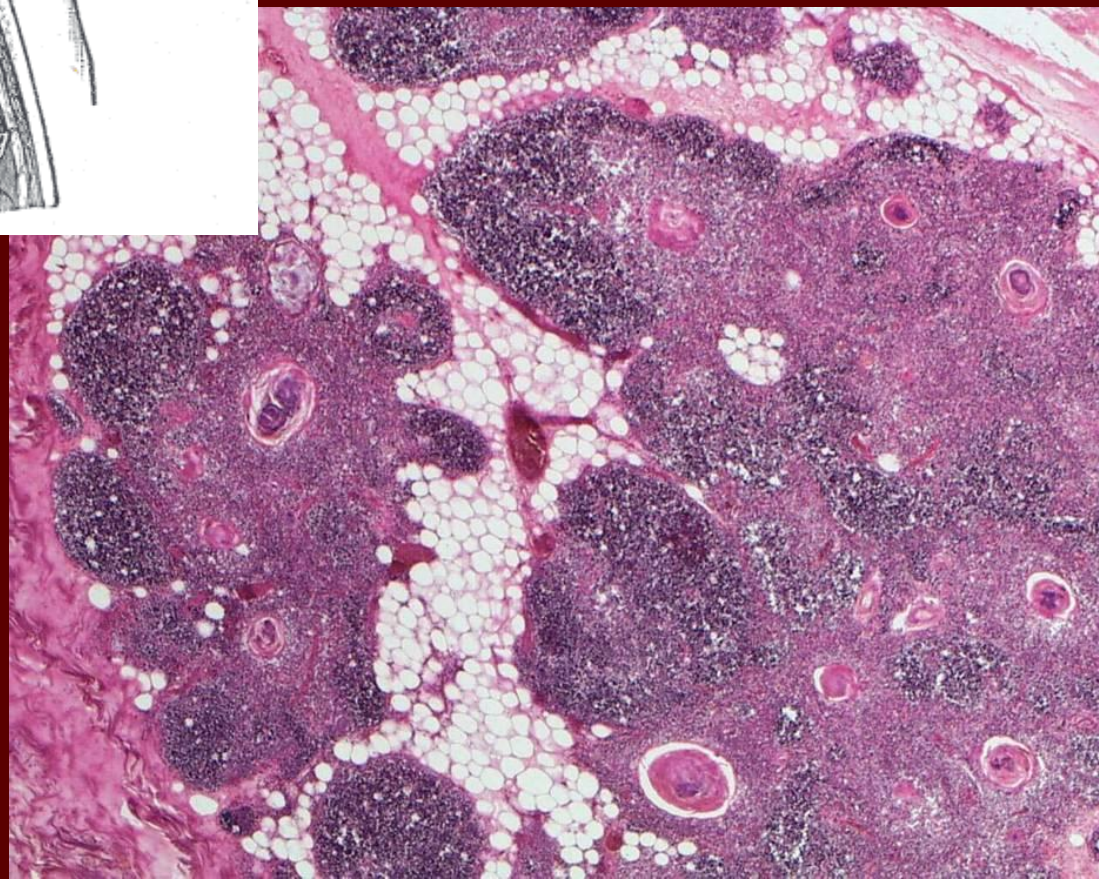
T I M U S *(Thymus)*

- Hanya membentuk prekursor sel T
- Temporer --mengalami involusi dg pertambahan umur

- Berat : 35 gr (puber) → 25 gr (umur 25 thn) → 15 gr (umur 60 thn)

ANATOMI : Thymus





Histofisiologi timus

- pembentukan T-Lymphocyte

  (prekursor dibentuk di sum-sum tulang) → cortex timus (= thymocyte)

- Thymocyte :

  - proliferasi thymocyte → Lymphocyte T

  - kebanyakan akan mengalami apotosis → difagositosis oleh macrophage

  - p.u tidak bisa bereaksi terhadap antigen

- “pemrograman’ :

  → penyusunan ulang gen reseptor antigen

  → kemampuan mengenali antigen

  → menghilangkan sel2 prematur yang teraktivasi & menjadi Antigen “self”’

- sel matur → medulla → venule postkapiler/pembuluh limfatik efferent → menempati daerah T-dependent di organ limfatik sekunder → differensiasi menjadi T-cell fungsional

- *Blood-timus barrier*
  - tersusun dari :
    1. sel endothelial (+ occluding junction)
    2. Basal lamina endothel
    3. jaringan ikat
    4. Basal lamina sel retikuler epithelial
    5. sel retikuler epithelial (+desmosom)
  - hanya di cortex
  - memisahkan thymocyte yang sedang proliferasi dg aliran darah, untuk mencegah masuknya materi antigenik → mempertahankan supply sel induk ‘naïve’ yang siap diprogram

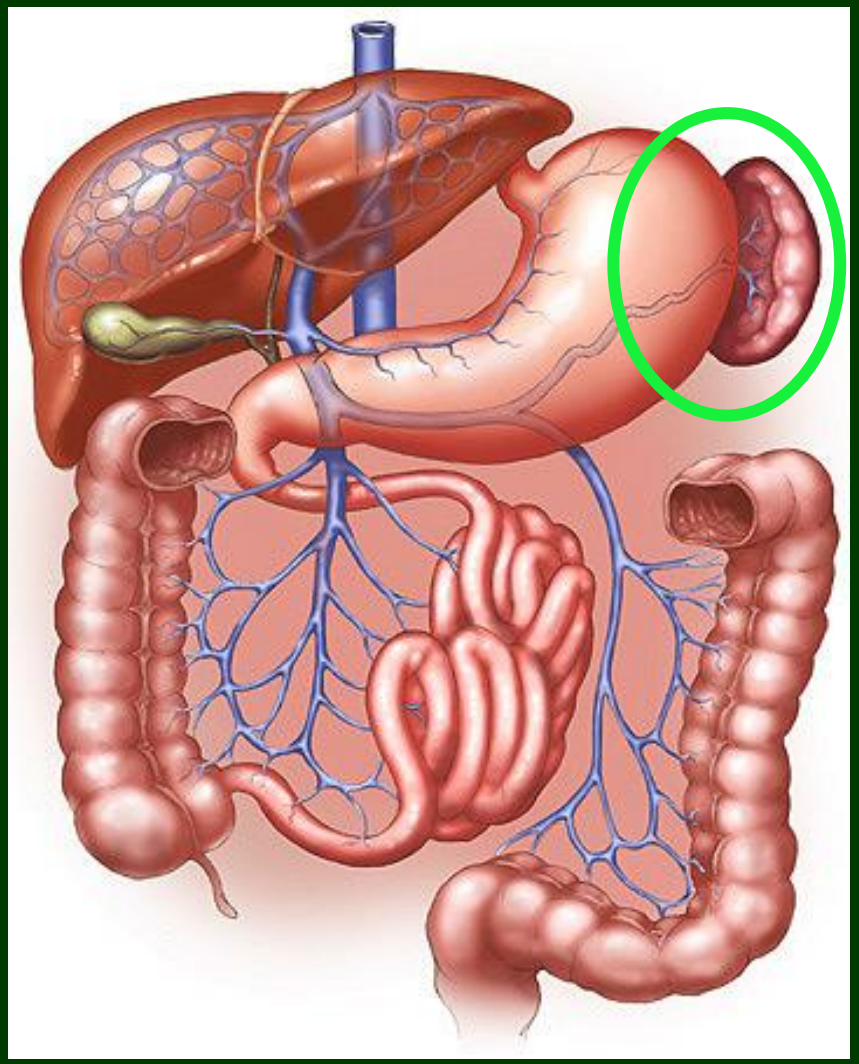
L I E N

fungsi :

- tempat pembentukan Lymphocyte teraktivasi
- pertahanan thd benda asing
- tempat destruksi RBC tua
- penyimpanan darah
- berperan dalam metabolisme besi
- Sbg organ hematopoiesis fetal.

ANATOMI

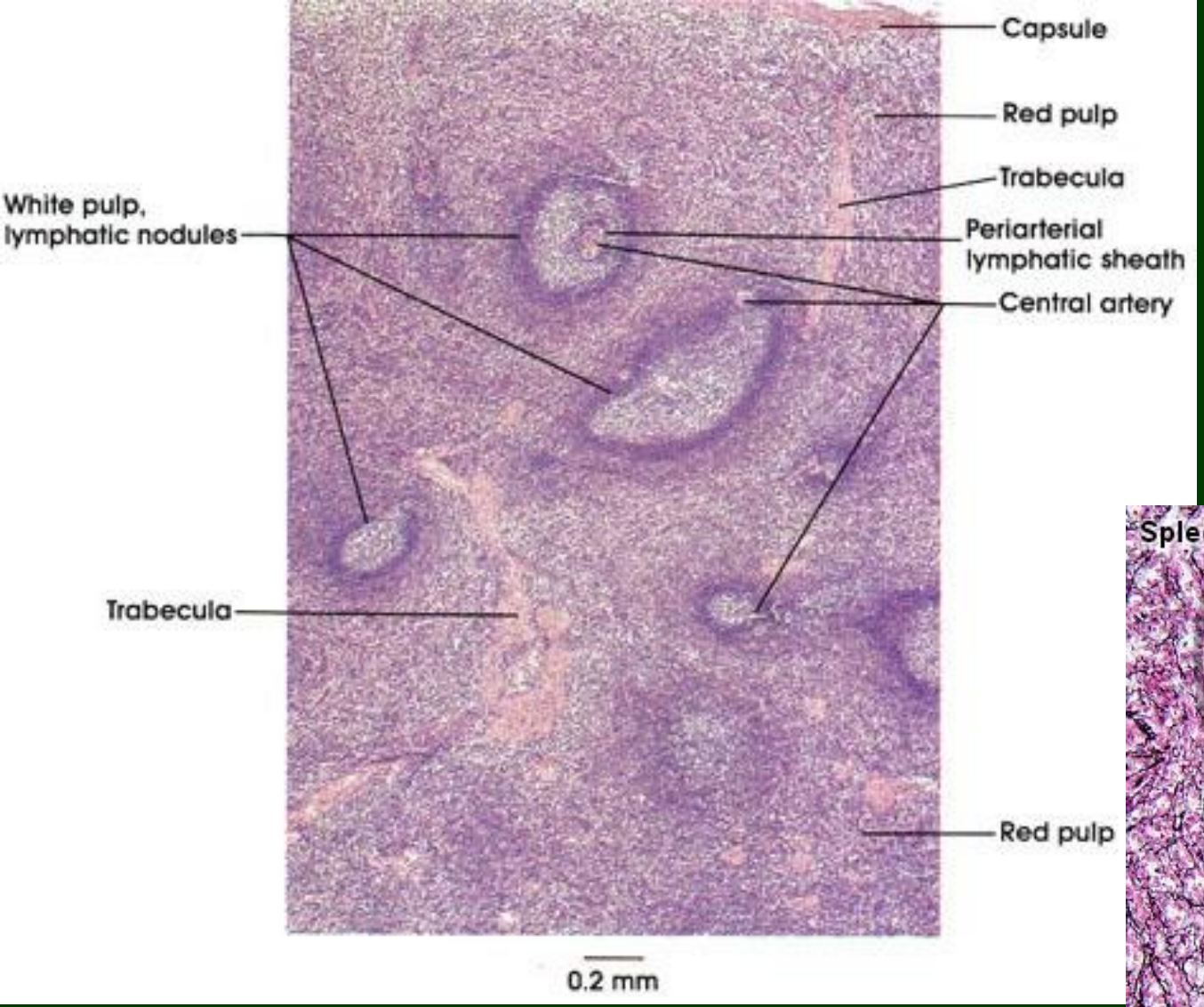
- Di hipokhondrium; dg sedikit sampai epigastrium.
- Antara fundus gaster – diafragma

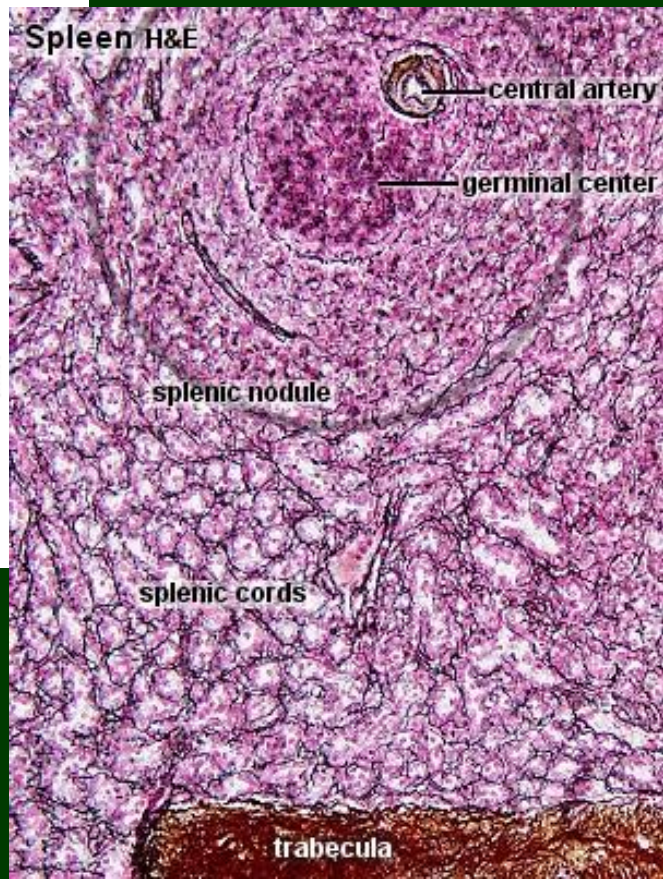


Struktur

- kapsul jaringan ikat padat → trabekula → splenic pulp
- Pulpa :
  - ✓ white pulp (pulpa putih; *pulpa alba*): * *Noduli Limfatici (Corpusculum Malpighi), PALS*
  - ✓ Red pulp (Pulpa merah; *pulpa rubra*):
  - ✓ Marginal zone :
    - Membentuk penghubung antara pulpa merah dan pulpa putih
    - Jaringan limfatik longgar
    - Banyak : * **macrophage** aktif, Antigen darah
      - – Antigen → difagositosis, dijerat oleh sel dendritik (**APC**)
      - – Berfungsi mengkonsentrasikan Antigen → dipresentasikan ke **Lymphocyte**
- pembuluh limfe afferent [-], HEV [-]

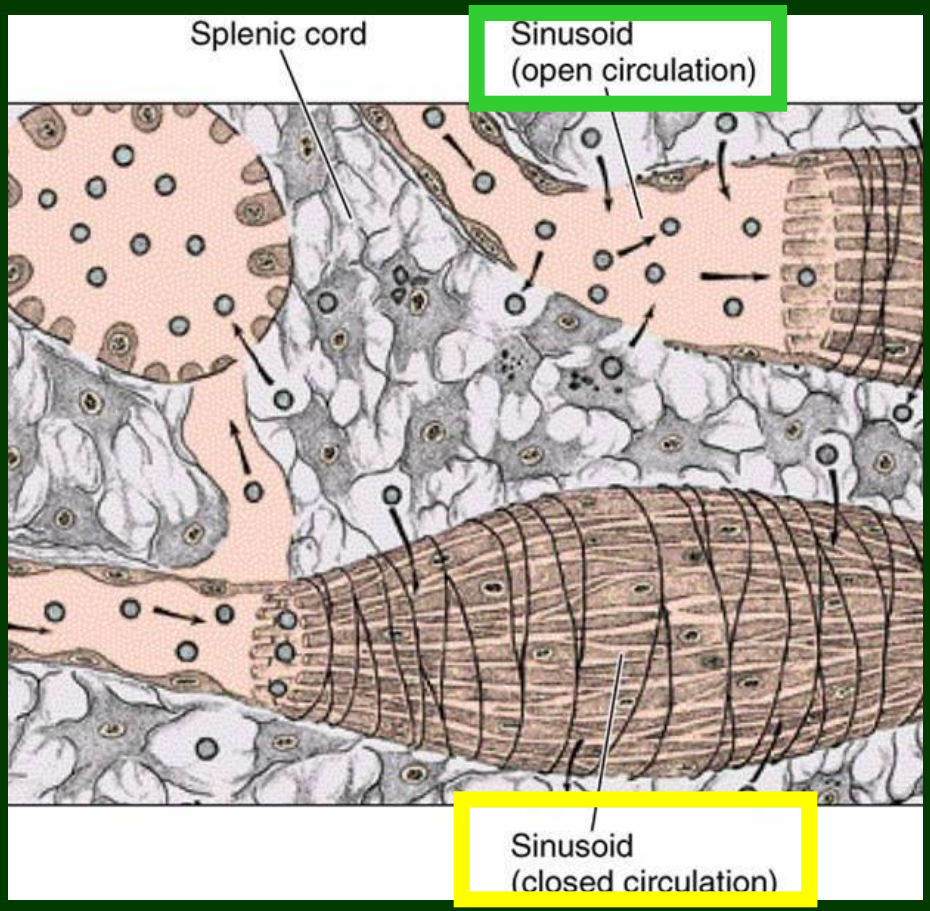
LIEN


Capsule
Red pulp
Trabecula
White pulp,
lymphatic nodules
Periarterial
lymphatic sheath
Central artery
Trabecula
Red pulp
0.2 mm

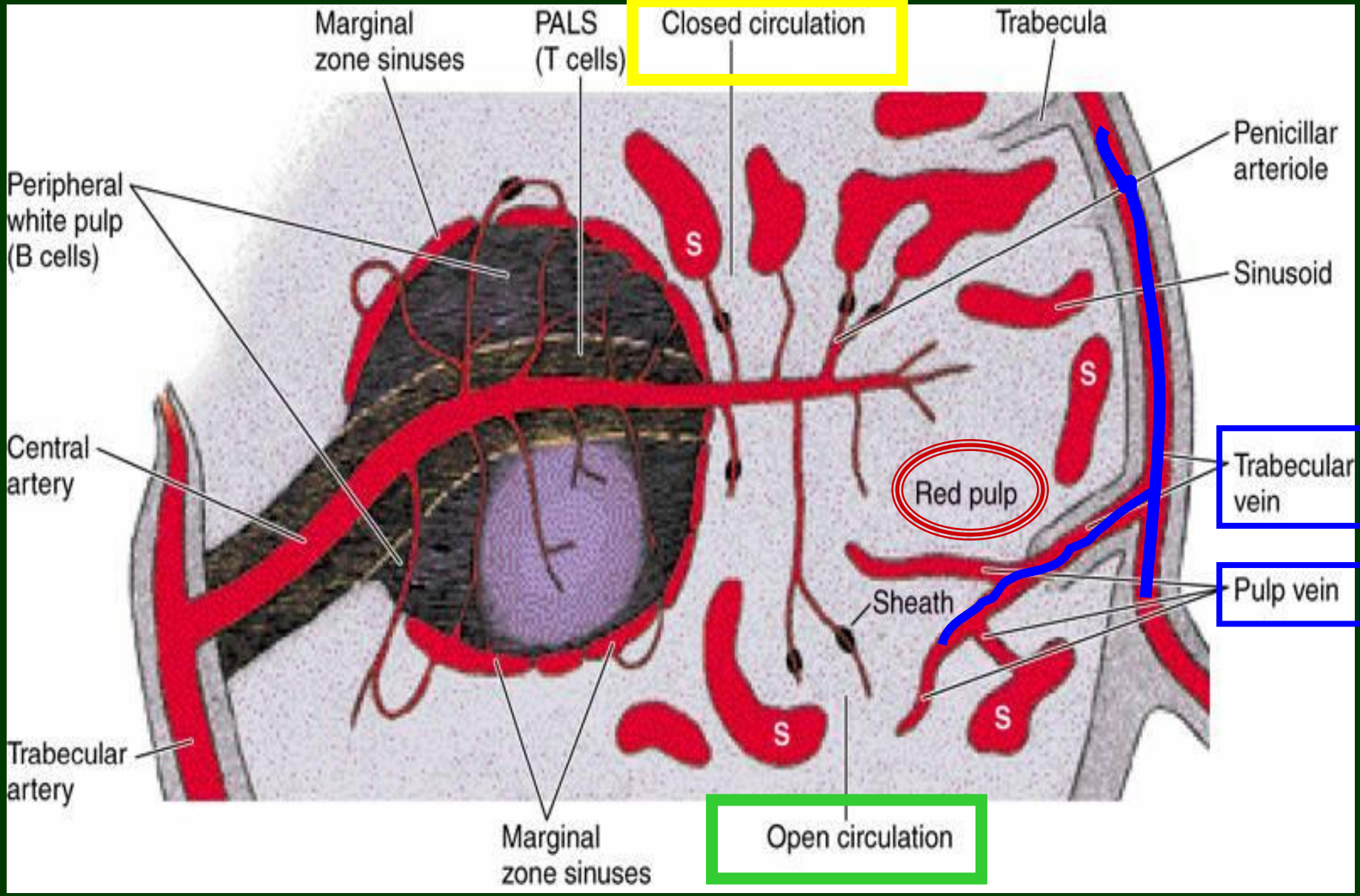

Spleen H&E
central artery
germinal center
splenic nodule
splenic cords
trabecula

Mekanisme aliran darah mencapai sinus

- Closed theory
  - Dinding kapiler berlanjut sebagai dinding sinusoid
- Open theory
  - Ujung kapiler di Billroth cord → darah keluar, disaring oleh cord → dinding sinusoid (via fenestrae)



LIEN : sirkulasi

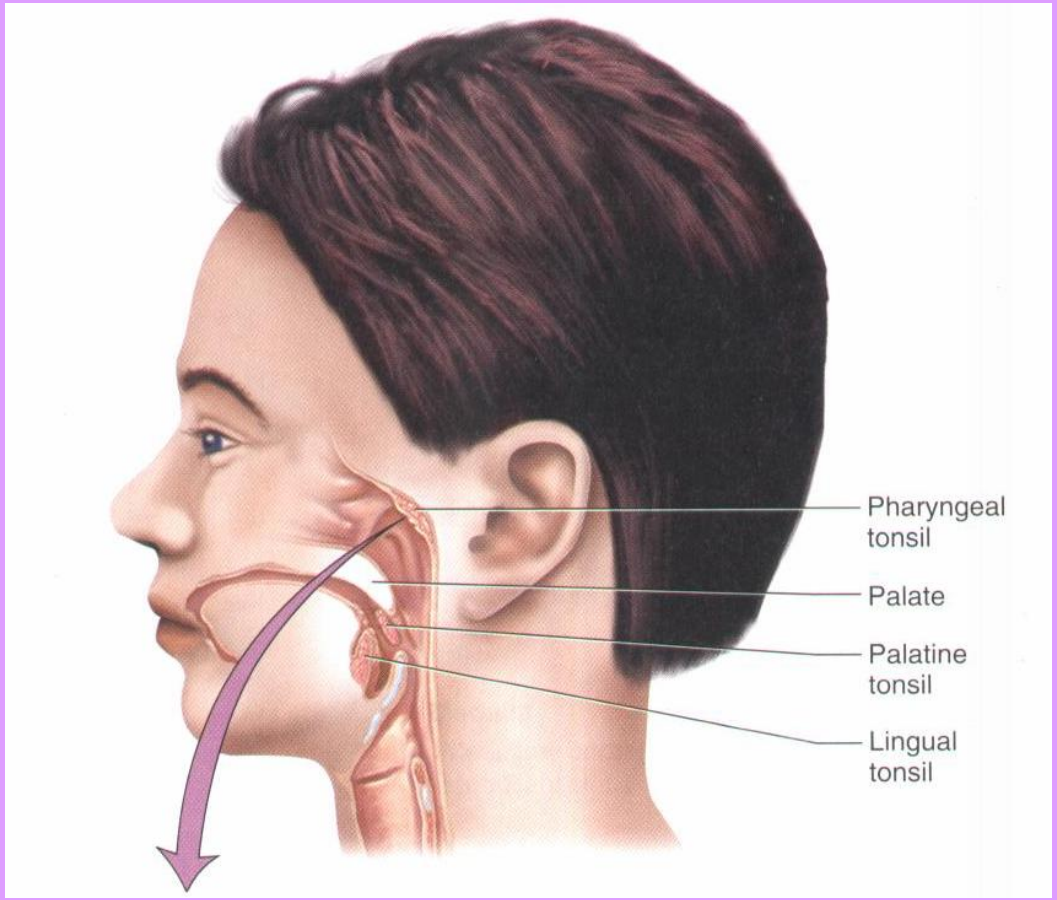


TONSIL

Macam :

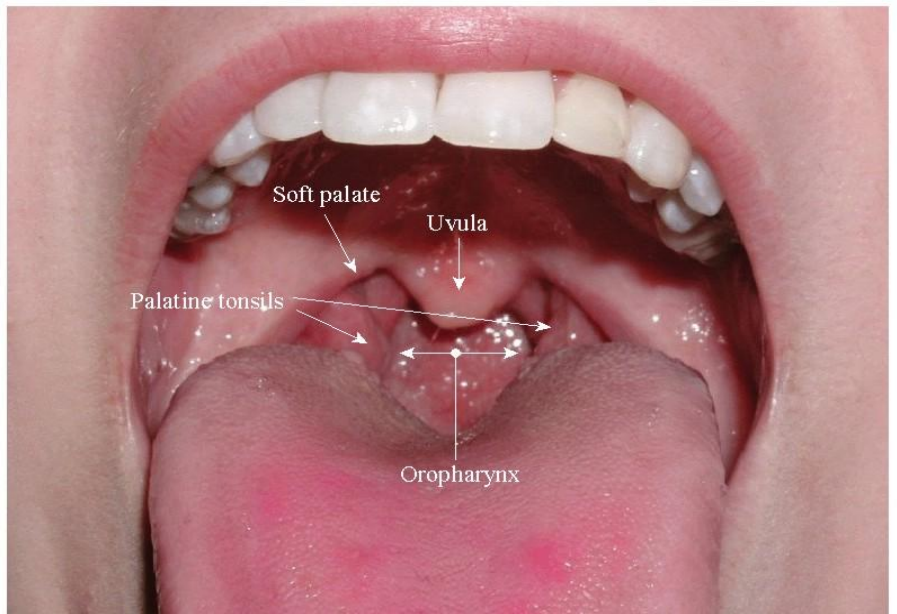
- T.palatina (D-S)
- T.pharyngeal
- T.lingual

Ring of Waldeyer



Tonsila palatina/faucial

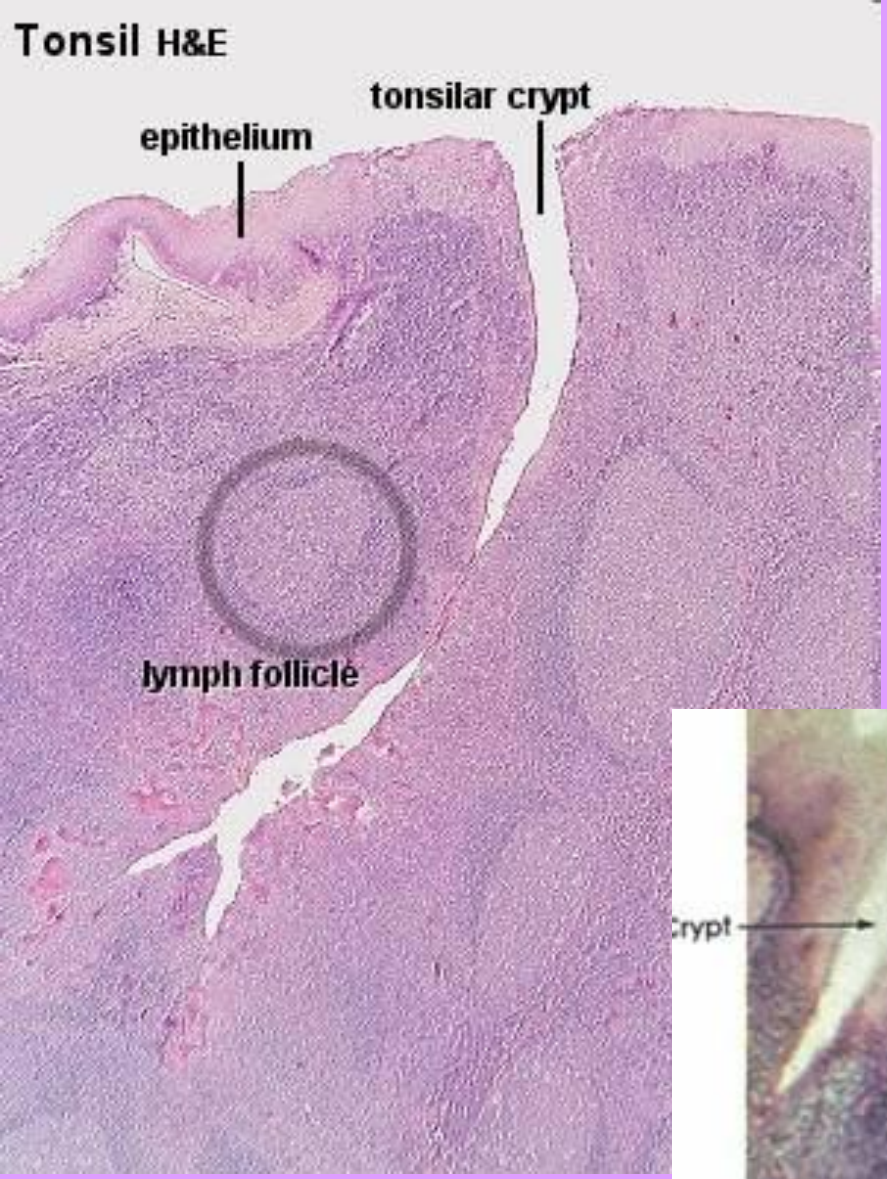
- 2 buah, di dinding lateral oropharynx, di bawah palatum molle
- ditutupi epithel squamous complex dg kornifikasi
- mengandung noduli limfatisi, p.u dengan germinal center
- crypte 10-20 → mengandung sel epithel yg desquamasi, Lymphocyte, dan bakteri
- kapsul jaringan ikat padat : tebal, parsial → berfungsi sebagai barrier untuk mencegah penyebaran infeksi



Tonsila pharyngeal

- tunggal, midline nasopharyx posterior
- kapsul lebih tipis
- crypte [-]
- kapsul jaringan ikat tipis, parsial
- bila hipertrofi → adenoid

TONSIL


Tonsil H&E
tonsilar crypt
epithelium
lymph follicle

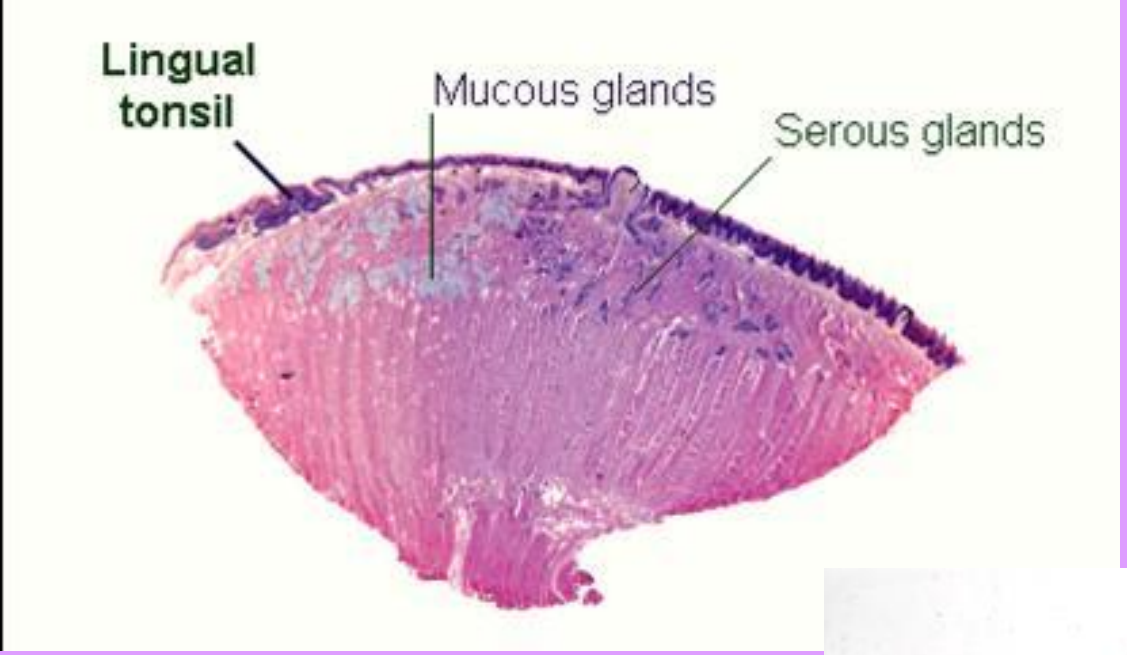

Crypt
Stratified squamous epithelium
Lymphoid nodule
Lymphocytes
0.2 mm

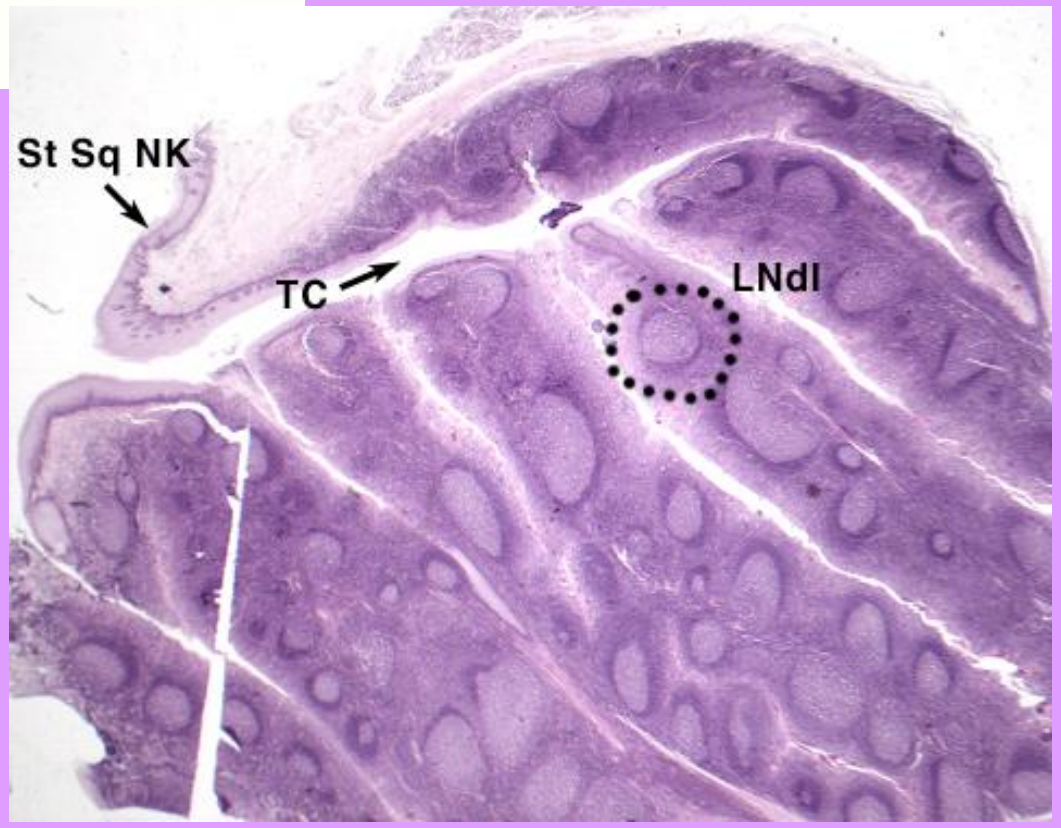
Tonsila lingualis

- lebih kecil, jumlah lebih banyak
- di pangkal lidah, belakang papilla circumvalata
- ditutupi epithel squamous complex dg sedikit kornifikasi
- germinal center [+]
- Kapsul tidak jelas

(Juncq,Paulsen)

TONSIL

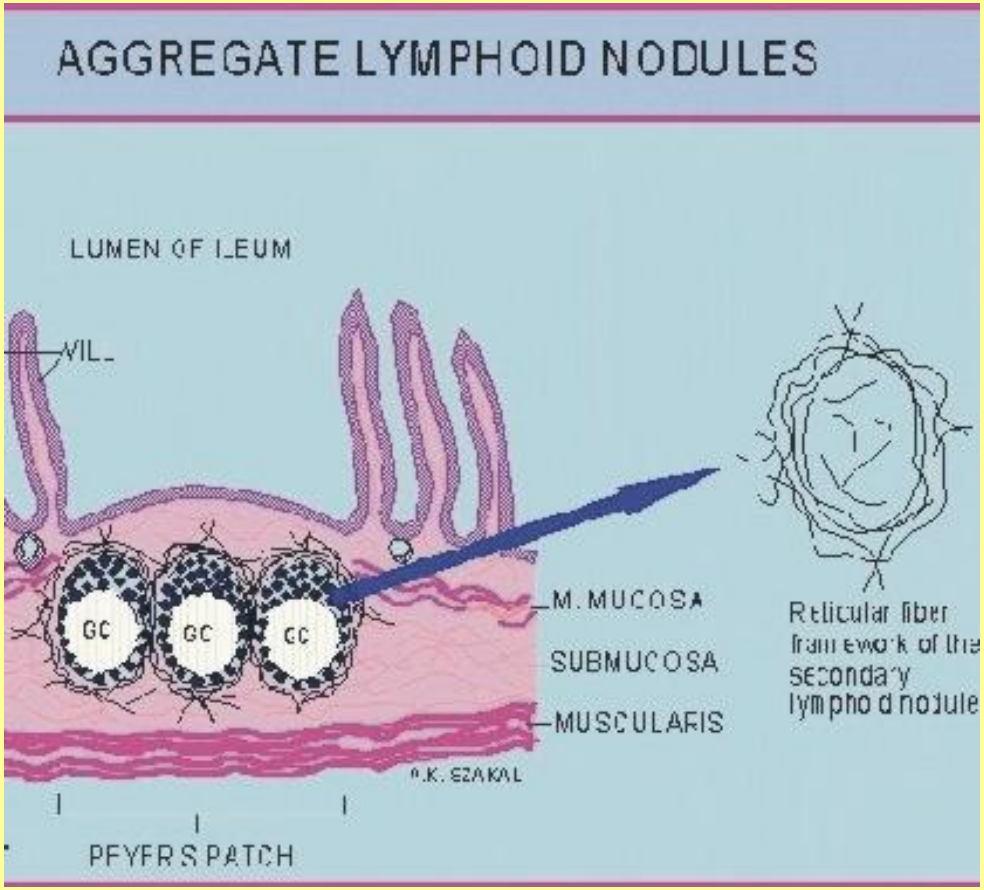




- Cllinical correlation :
- Tonsilitis

AGGREGAT LIMFATIK TIDAK BERKAPSUL

- mrpkn noduli limfatisi dalam kelompok kecil atau soliter
- contoh :
  - Berkelompok : Peyer's patches di IT
  - Soliter : → tersebar di mukosa GIT, UT, UG
- dapat diselubungi selapis sel retikuler pipih
- kapsul jaringan ikat [-]



AGGREGAT LIMFATIK TIDAK BERKAPSUL

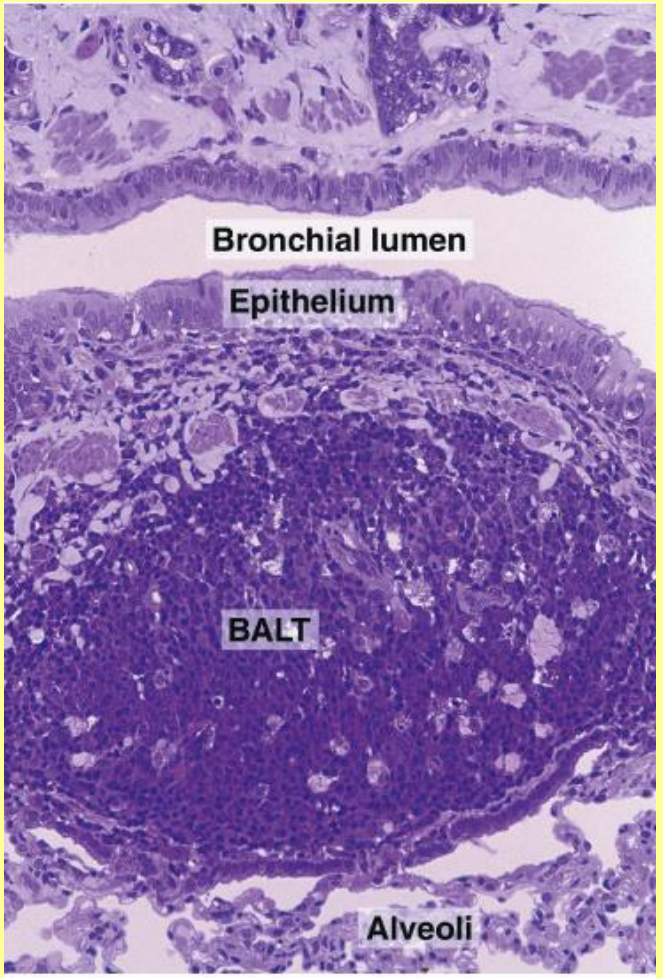
- → MALT (Mucosa Associated Lymphatic Tissue).
  - BALT (Bronchial Associated Lymphatic Tissue).
  - GALT (Gut Associated Lymphatic Tissue).
  - SALT (Skin Associated Lymphatic Tissue).

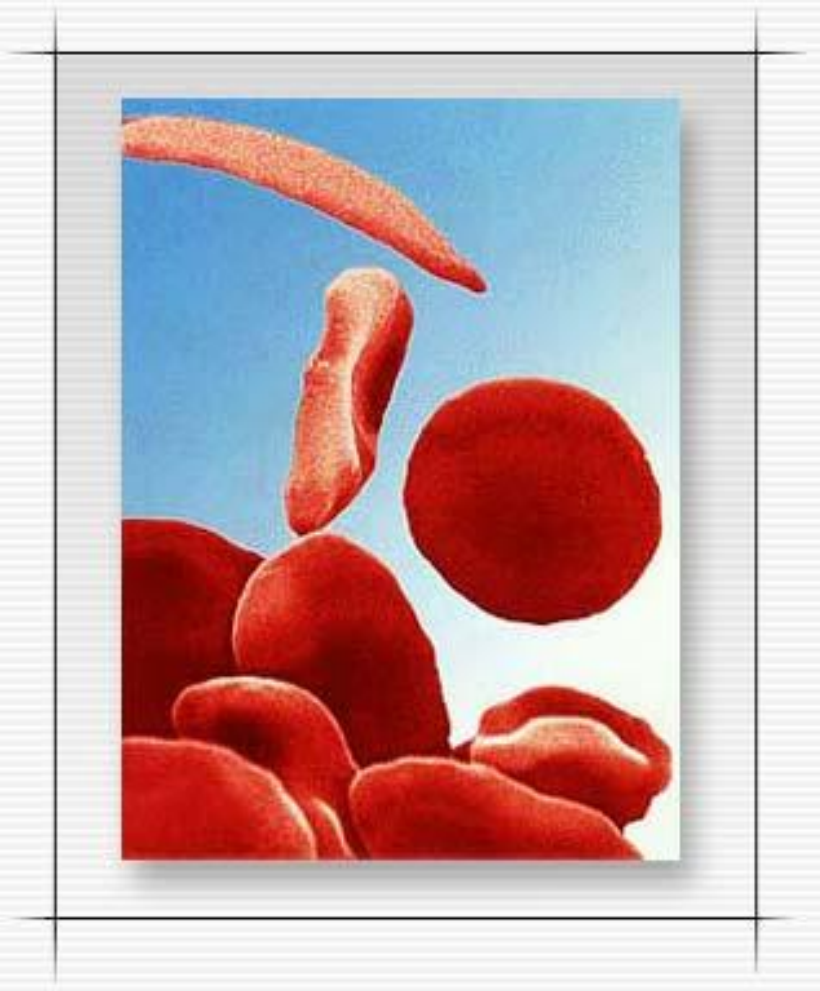
AGGREGAT LIMFATIK TIDAK BERKAPSUL

– GALT (Gut Associated Lymphatic Tissue).

AGGREGAT LIMFATIK TIDAK BERKAPSUL

– BALT (Bronchial Associated Lymphatic Tissue).





BLOOD

dr. Indriati Dwi Rahayu

GENERAL PROPERTIES

THE CELLS

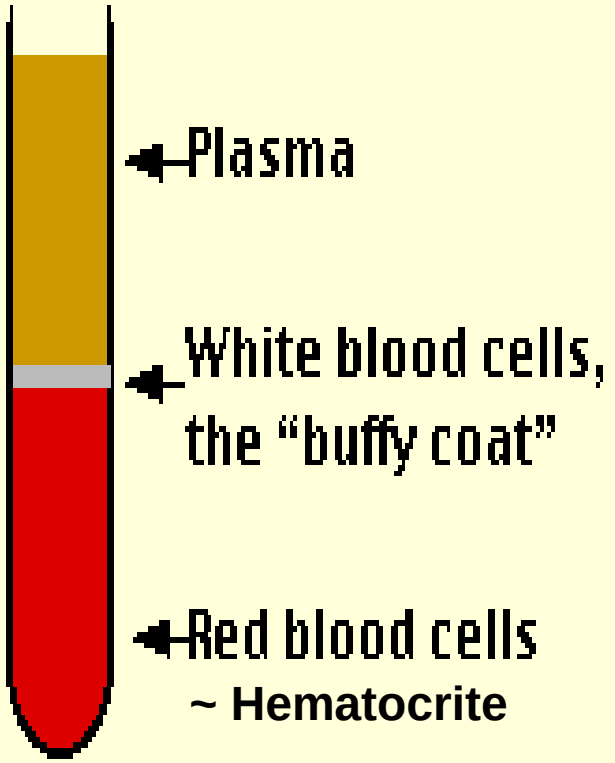
HEMATOPOIESIS

General Properties

- Special connective tissue
- Total volume: ± 5 L, ± 8 % body weight
- Composition :

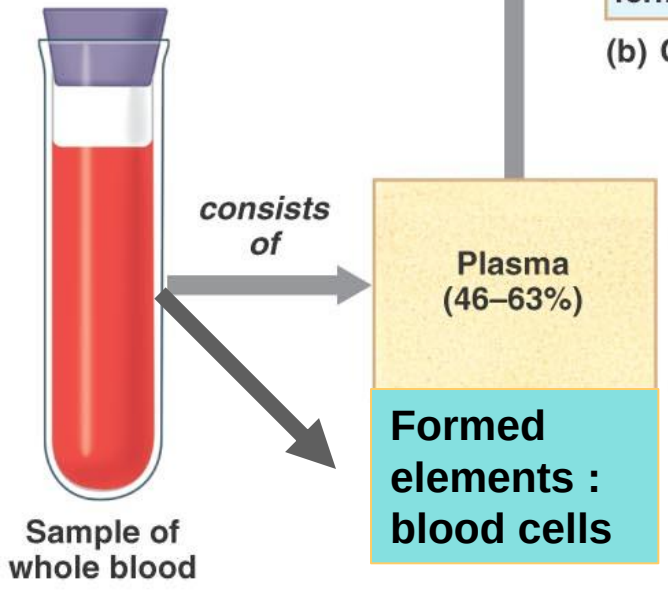
  √ **plasma** : the liquid in which the formed elements, protein, & hormon are suspended

  √ formed element: **blood cells**



STAINING : Wright, Giemsa, Romanowsky, Leishman

Composition of PLASMA



PLASMA COMPOSITION	
Plasma proteins	7%
Other solutes	1%
Water	92%
Transports organic and inorganic molecules, formed elements, and heat	

(b) Components of plasma

PLASMA PROTEINS	
Albumins (60%)	Major contributors to osmotic pressure of plasma; transport lipids, steroid hormones
Globulins (35%)	Transport ions, hormones, lipids; immune function
Fibrinogen (4%)	Essential component of clotting system; can be converted to insoluble fibrin
Regulatory proteins (<1%)	Enzymes, proenzymes, hormones

OTHER SOLUTES	
Electrolytes	Normal extracellular fluid ion composition essential for vital cellular activities Ions contribute to osmotic pressure of body fluids Major plasma electrolytes are Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, HCO_3^-, HPO_4^-, SO_4^{2-}
Organic nutrients	Used for ATP production, growth, and maintenance of cells; include lipids (fatty acids, cholesterol, glycerides), carbohydrates (primarily glucose), and amino acids
Organic wastes	Carried to sites of breakdown or excretion; include urea, uric acid, creatinine, bilirubin, ammonium ions

Fig 20.1

- **PLASMA**
  - ±55 % blood, homogen
  - slightly base
  - Composition:
    - ±90 % water
    - ±10 % dissolved substance:
      1. Anorganic salt : 0.9 %. Ex : Na, K, Ca
      2. Organic subs. : 2,1 %. Ex : As.amino, glukosa, peptida, hormon, lipid
      3. Protein plasma : 7 %. Ex; **Albumin**, Globulin (α,β,γ) Fibrinogen, prothrombin

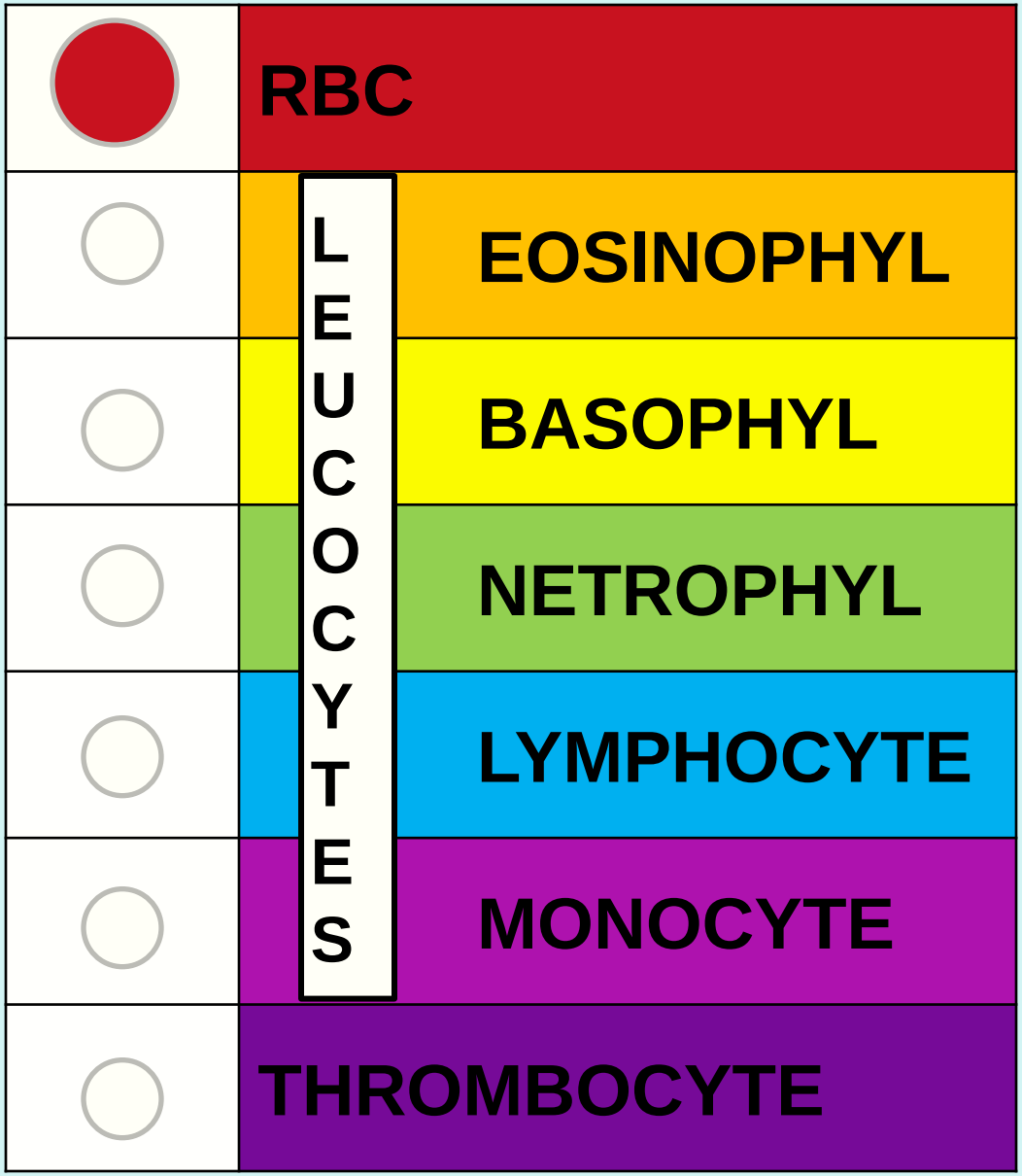
SOLID COMPONENT → ± 45 % : blood cells

General properties

THE BLOOD CELLS

HEMATOPOIESIS

THE BLOOD CELLS



!

NORMAL VALUE

FUNCTION

STRUCTURE

CLINICAL CORRELATION

KOMPONEN PADAT → 45 %

1. Red Blood Cell

- Normal value: 4 - 6 X 10^6 /µL
- Life span : 120 hr → lien dan sum2 tulang
- **hematocrit** is an estimate of the volume of packed erythrocytes per unit volume of blood. The normal value is 40–50% in men and 35–45% in women.

- FUNCTION :
    * O2 transpor (by Hemoglobin)
    * acid-base (by Hemoglobin)
    * reaction catalisator (by enzym carbonic anhidrase)

HEMOGLOBIN

* Type :
    1. Hb A1 : 97 %
    2. Hb A2 : 2 %
    3. Hb F : 1 %. (in neonatus 80%)
    4. Hb S : abnormal Hb A → Sickle cell anemia

- **STRUCTURE** :

  * Φ : 7 – 8 µm, (fresh preparation : yellow greenish color)

  * biconcave ; central: *central pallor*

  * (matur) : nucleus & organella : (-)

  * Isotonic sitoplasma; contain Hb

  * Plasmalemma : membran protein integral:

    Inner → Spectrin

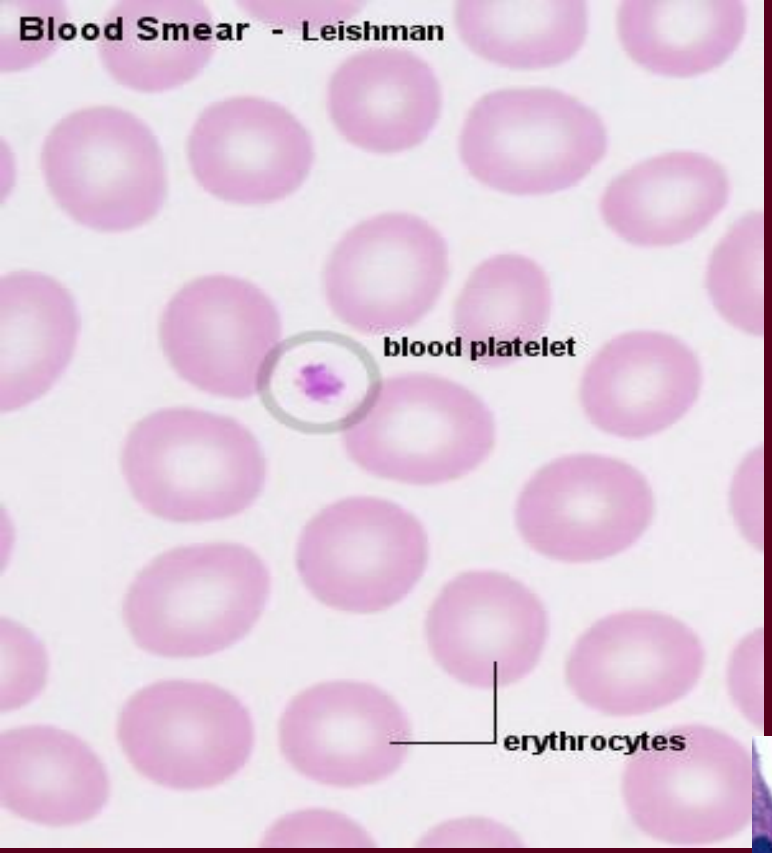
    Outer → contain antigen

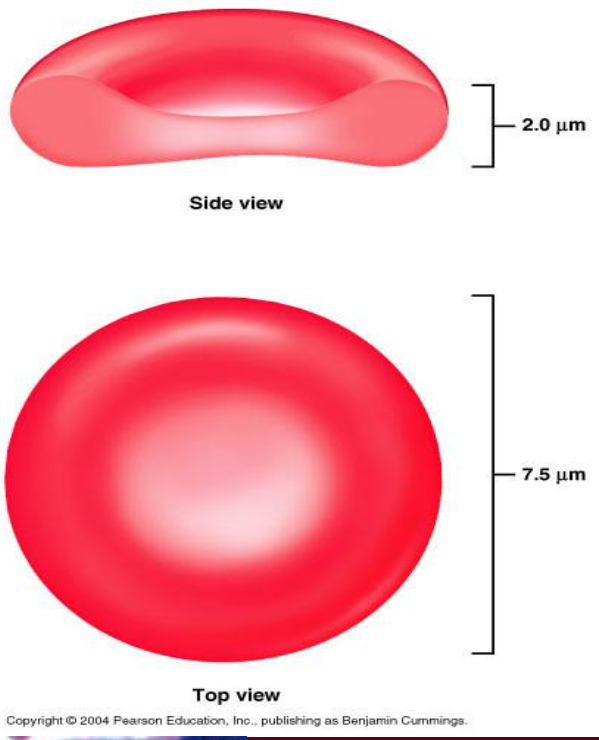
  * flexible

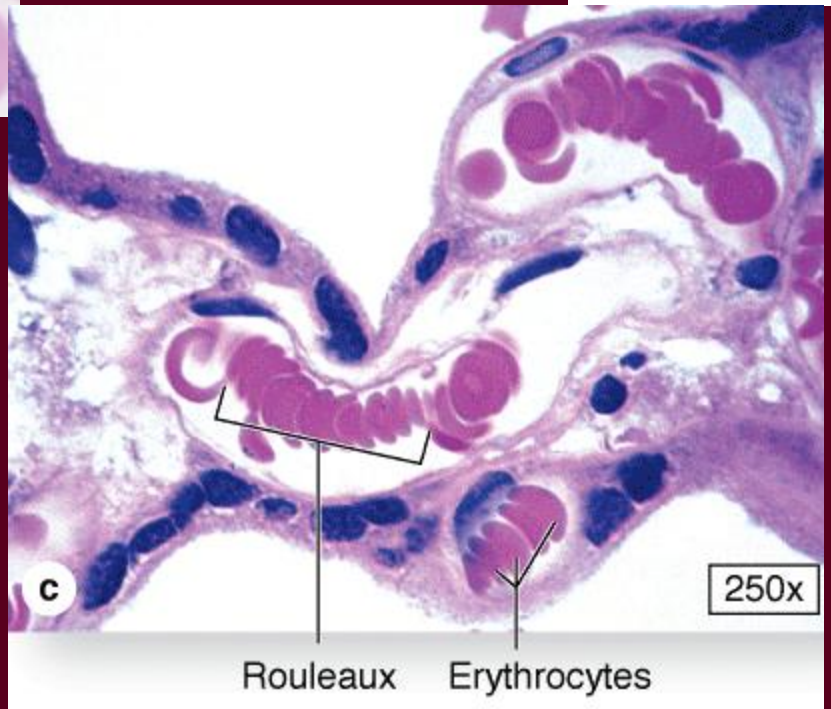
- Tendetion to adhere

  → *Rouleaux formation*

(temporary)


Blood Smear - Leishman
blood platelet
erythrocytes


2.0 µm
Side view
7.5 µm
Top view
Copyright © 2004 Pearson Education, Inc., publishing as Benjamin Cummings.


c
250x
Rouleaux
Erythrocytes

- Structure abnormalities

  * Anisositosis : RBC in various size

  * Macrositer : Ø > 9 µm

  * Micrositer : Ø < 6 µm

  * *Cabot ring = Howell Jolly body* : nuclear fragment (> 1 %)

    Staining : *Brilliant Cresyl Blue* to see RER & ribosome inside the reticulocyte

  * *Shadow/Ghost blood* : pale, round/Spheroid, . E.c hemolysis.

  * *Crenated* : E.c. hypertonic

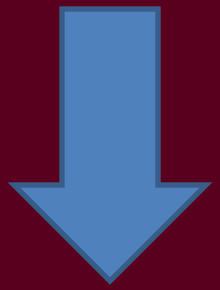
  * Spherocytosis : Spheroid erythrocyte

CLINICAL CORRELATION

Anemia : Hb ↓

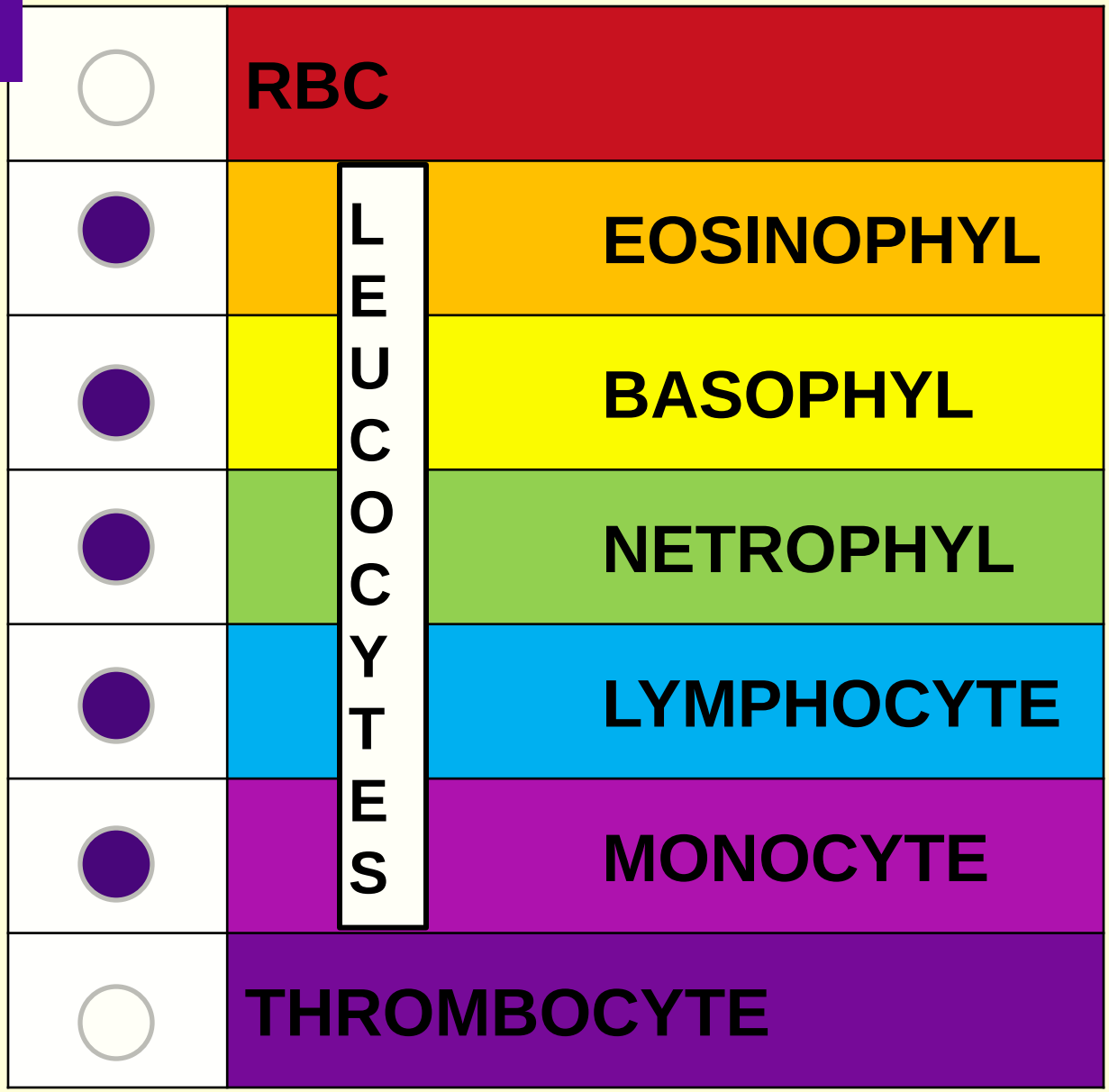
may be caused by :

- **loss** of blood (hemorrhage);
- **insufficient production** of erythrocytes
- **accelerated destruction** of blood cells.



Bad oxygenation

BLOOD CELLS



- NORMAL VALUE
- FUNCTION
- STRUCTURE
- CLINICAL CORRELATION

2. LEUCOCYTE

- normal VALUE: 6000 – 10.000 / µL
- classification based on:
    - ~ diameter
    - ~ nuclear shape
    - ~ nuclear- cytoplasm Ratio
    - ~staining

- General characteristic:

  - “real” cell→ nucleus & organella [+]

  - amoeboid Motion& diapedesis [+]

  - Function in connective tissue. Blood flow only as a means of transportation

  - in the permanent preparations : larger size

  - azurophilic granules with lytic enzymes

- classification with special staining → diff.count (hitung jenis)
- Main type : **granulocyte & agranulocyte**

- **Granulocyte**
  * = PMN (polymorpho nuclear)
  * organellS: [mature] lobed nucleus, Golgi, mitokondria, free ribosome, RER
  * specific granules dan azurophilic granules;
  * TERDIRI DARI : Eosinophil, Basophil, Netrophil

- **Agranulocyte**
  * mononuclear ; unsegmented
  * azurophilic granule ONLY
  * TERDIRI DARI : Lymphocyte, Monocyte

Leukocytosis

- An **increase** in the number of circulating leukocytes occurs as a normal protective reaction in a variety of pathological conditions, especially in response to infections.
- Pathological leukocytosis : leukocyte count more than 11 x 10^9/1 (11. 000/mm3)

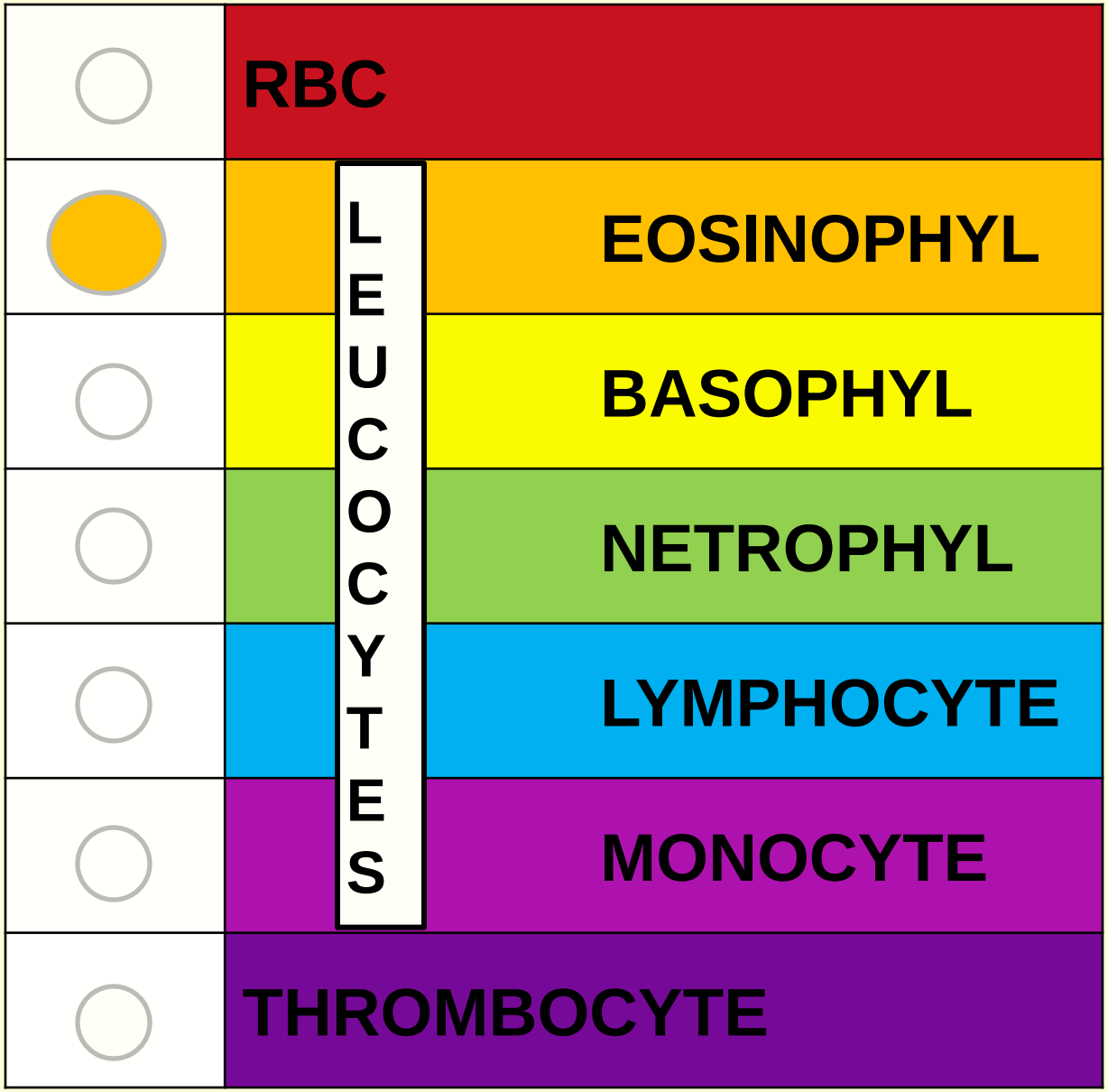
Leukopenia

the total blood leukocyte count : less than 4 x 10^9/1 (4000/mm3).

Granulocytopenia (neutropenia)

This is a general term used to indicate an abnormal reduction in the numbers of circulating granulocytes (polymorphonuclear leukocytes), commonly called neutropenia because 40 to 75% of granulocytes are neutrophils. A reduction in the number of circulating granulocytes occurs when production does not keep pace with the normal removal of cells or when the life

BLOOD CELLS



NORMAL VALUE

FUNCTION

STRUCTURE

CLINICAL CORRELATION

- *Eosinophil* :

  - % WBC : 1-4 %

  - Characteristic :

    * >> in circulation on allergic reaction & parasitic infection

    * diapedesis movement [+]

    * phagocytic ability is limited, esp Ag-Ab complex

    * responsive to steroids

    (= Thorn test)

STRUCTURE :

- Φ : (circulation) : 9 µm
  (tissue) : 14 µm

- Cytoplasm :

  * larger granules, refractile, uniform

  * granules contain special lisozym + azurophilic

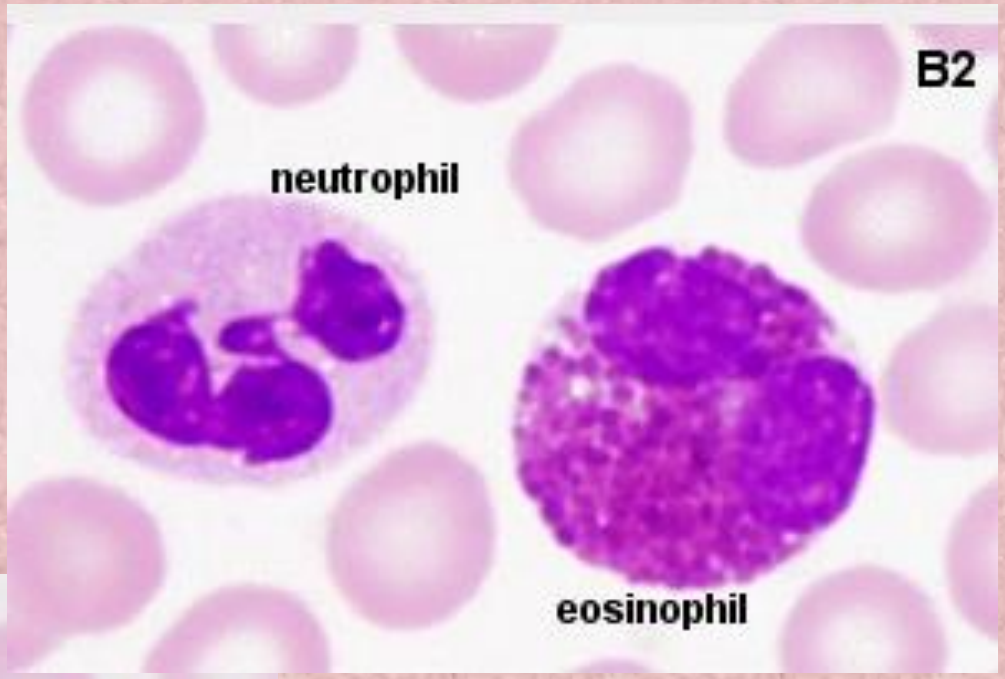
- Nucleus :

  - dense chromatin

  - lobes: 2, often covered with granules

-Functions:

* Response to parasitic infection
* Modulation in the inflammatory process
* Inactivation of leucotrienes & histamine


B2
neutrophil
eosinophil


Blood Smear - Leishman
eosinophil

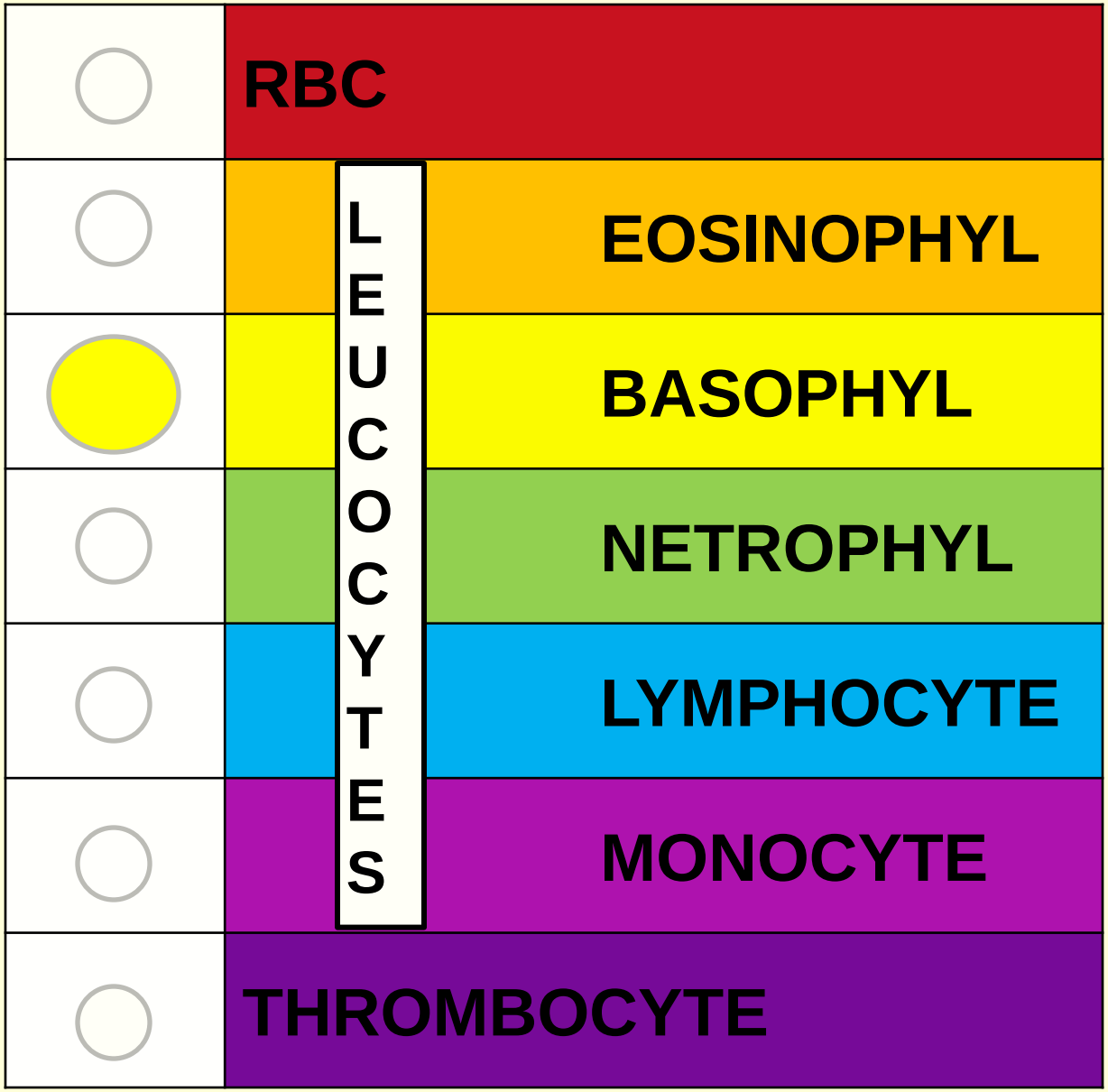
CLINICAL CORRELATION:

Eosinophilia : associated with allergic reactions and helminthic (parasitic) infections.

Corticosteroids can produce a rapid decrease in the number of blood eosinophils, probably by interfering with their release from the bone marrow into the bloodstream

Eosinopenia

sel2 DARAH



NORMAL VALUE

FUNCTION

STRUCTURE

CLINICAL CORRELATION

- *Basophil* :

  - % WBC : 0-1 %

  - characteristic :

    * Similar to mast cells, except its ultrastructure

    * The amuboid motion& phagocytosis ability is limited

  - Function :

    - in the immediate hipersensitivity;
    - secrete inflammation mediator

- Structure :

  * Φ :10-12 μm (smaller than netrophil)

  * Cytoplasm :

    - less dense

    - vary granules size , dark specific granules

    - Granules contain heparin, histamine

  * Inti :

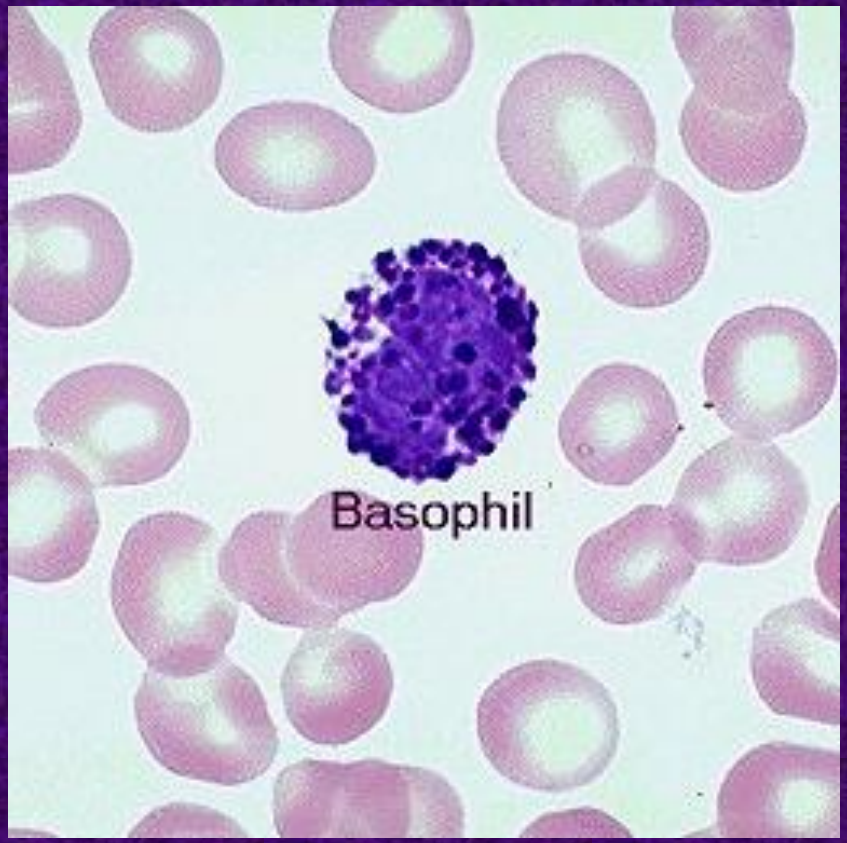
    dense chromatin, pale

    3 lobes, S shape, often covered with granules

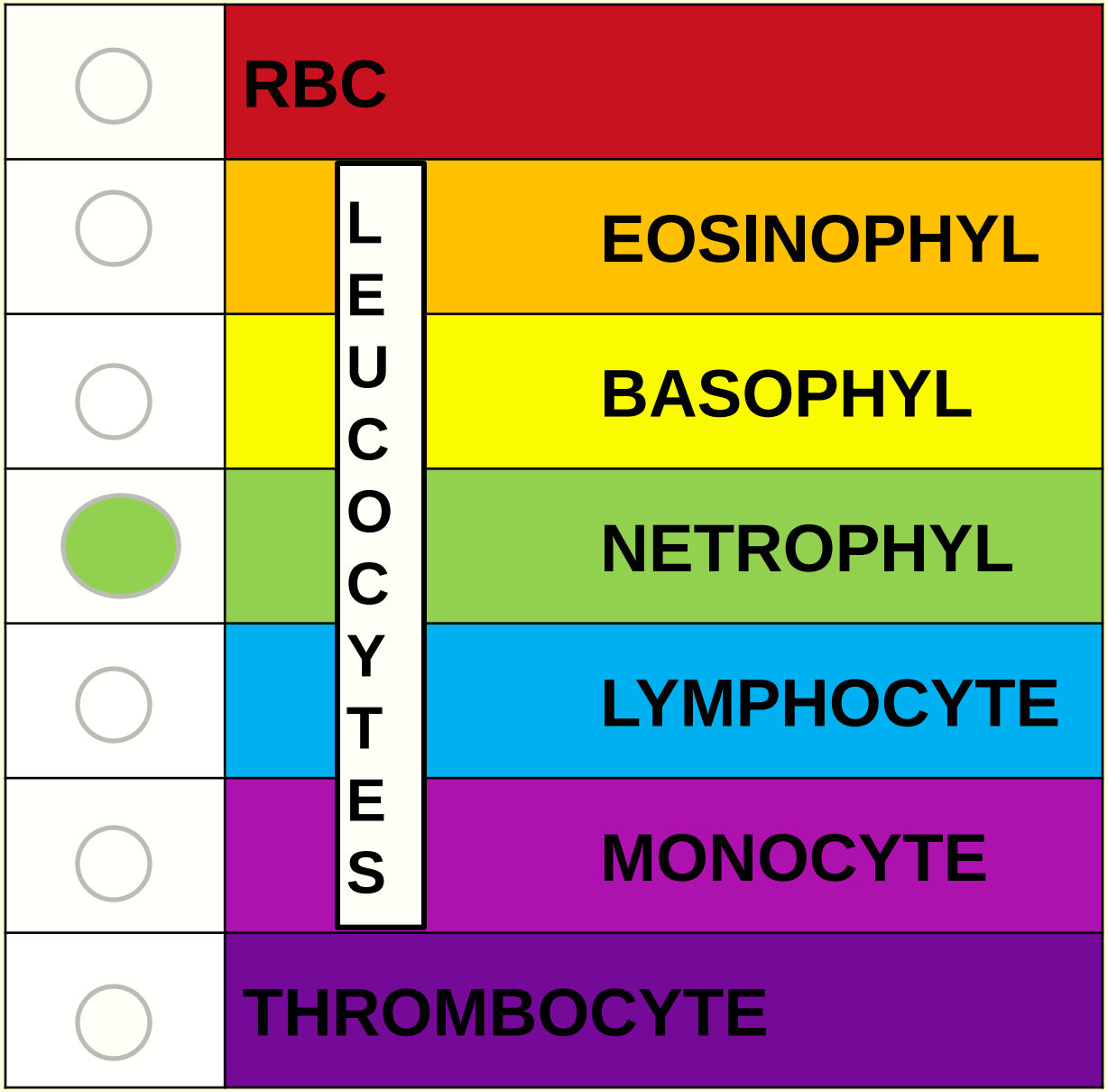
CLINICAL CORRELATION

- anaphylactic shock
- cutaneus basophil hypersensitivity :

  extravascular accumulation due to inflammatory process



BLOOD CELLS



NORMAL VALUE

FUNCTION

STRUCTURE

CLINICAL CORRELATION

Netrofil :

- dominant, 60-70 %
- Can not mitosis
- Role: first line cellular defense: Phagocytosis

- karakteristik :

> Amuboid movement → out from blood vessels

→ ~ macrophage active = microphage

> The ability of mitosis [-]

> 2 types of granules (specific & azurophilic)

> Classification (according Schiling): :

~ Segmented neutrophils (57%)

Increased: shift to the right

- Nonsegmented neutrophils (stab) (4%)

Increased : shift to the left

STRUCTURE

- Φ: (circulation): 12 µm
  (tissue): 20 µm
- cytoplasm:
  - Color: salmon-pink
- Specific granules + Granules Azurofilik
  - >> glycogens

nucleus:

- dense chromatin
- Multilobus
- types:

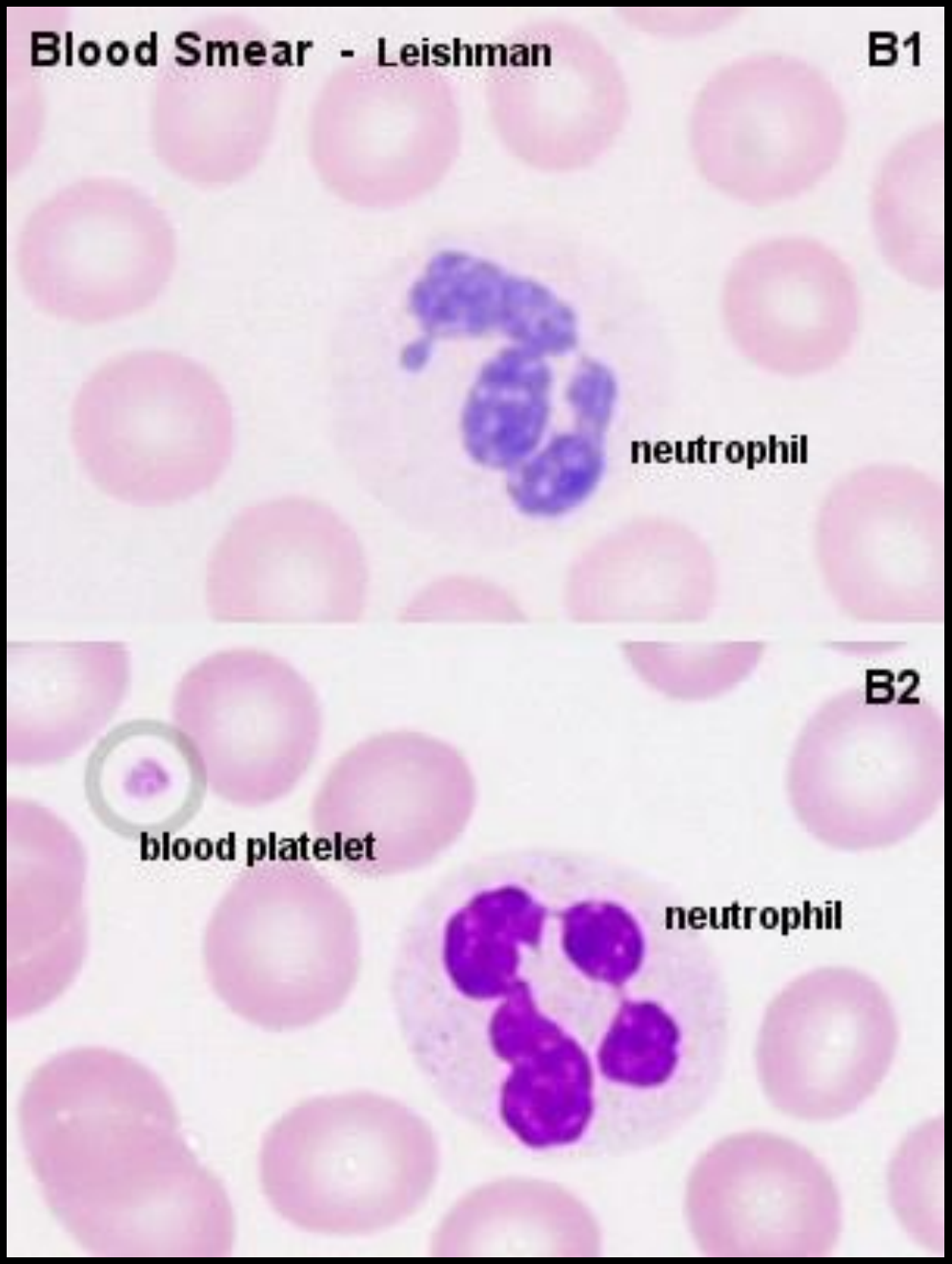
  * Hipersegmented (> 5) → old

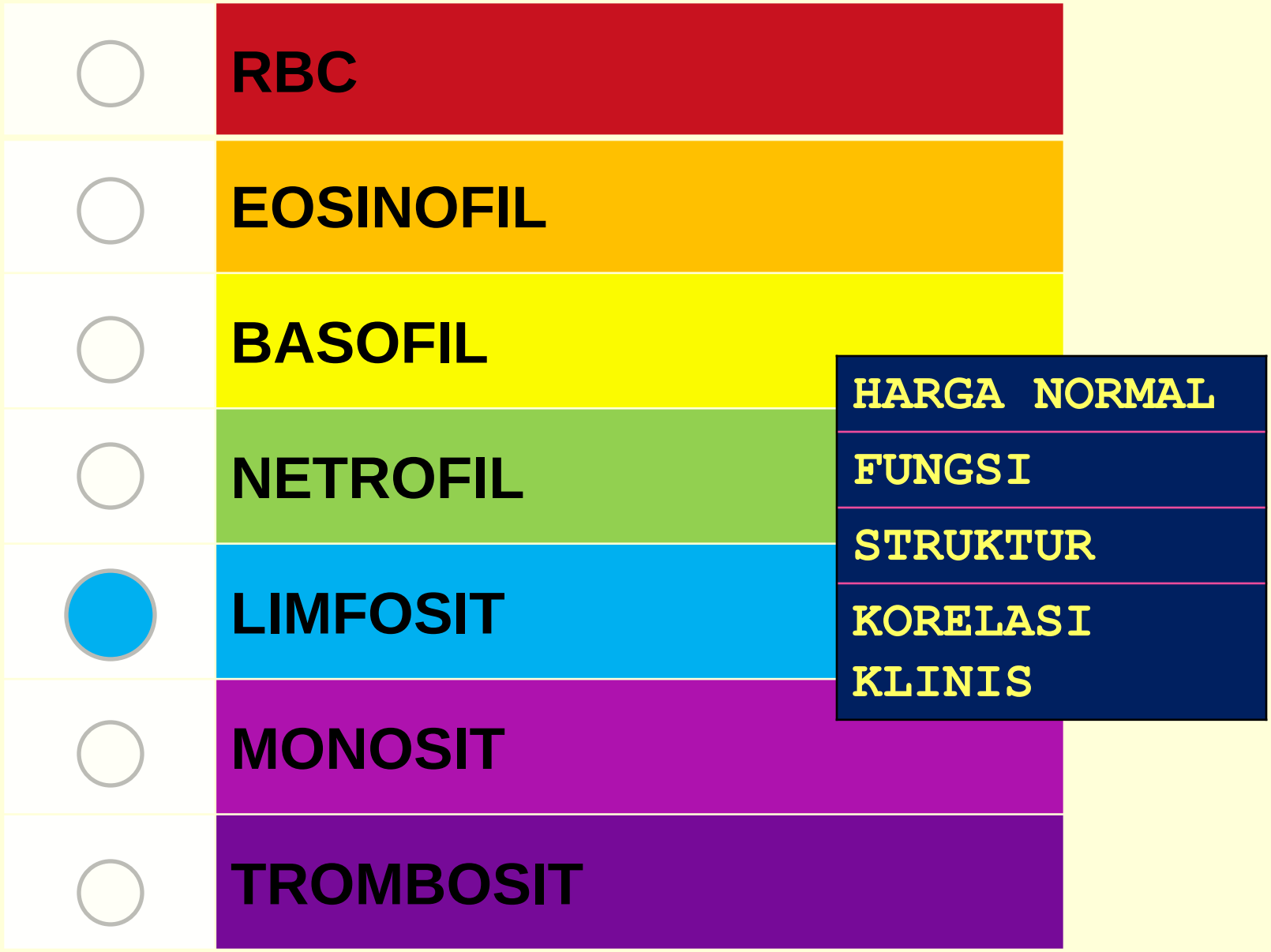
  * segmented

  * stab

  [women] drumstick = Barr body, is

  inactive X chromosome (attached to the nucleus)


Blood Smear - Leishman
B1
neutrophil
B2
blood platelet
neutrophil


RBC
EOSINOFIL
BASOFIL
NETROFIL
LIMFOSIT
MONOSIT
TROMBOSIT
HARGA NORMAL
FUNGSI
STRUKTUR
KORELASI KLINIS

Lymphocyte :

- % wbc :20 – 25 %
- outside the blood vessels:of the lymphatic organs & connective tissue
- can be recirculating
- divided into two classes: lymphocytes T (most) & B
- Role: according to cell type.
  T cells: role in cellular immunity
  B cells: role in humoral immunity; differentiate into plasma cells;→ produce immunoglobulins
- ! ! CAN NOT phagocytosis

❖ Structure :

* Φ: small 6 – 8 µm → predominate in the blood

Med-large :9-18 µm

❖ Nucleus :

[small] : - Round / flat, with 1 indentation

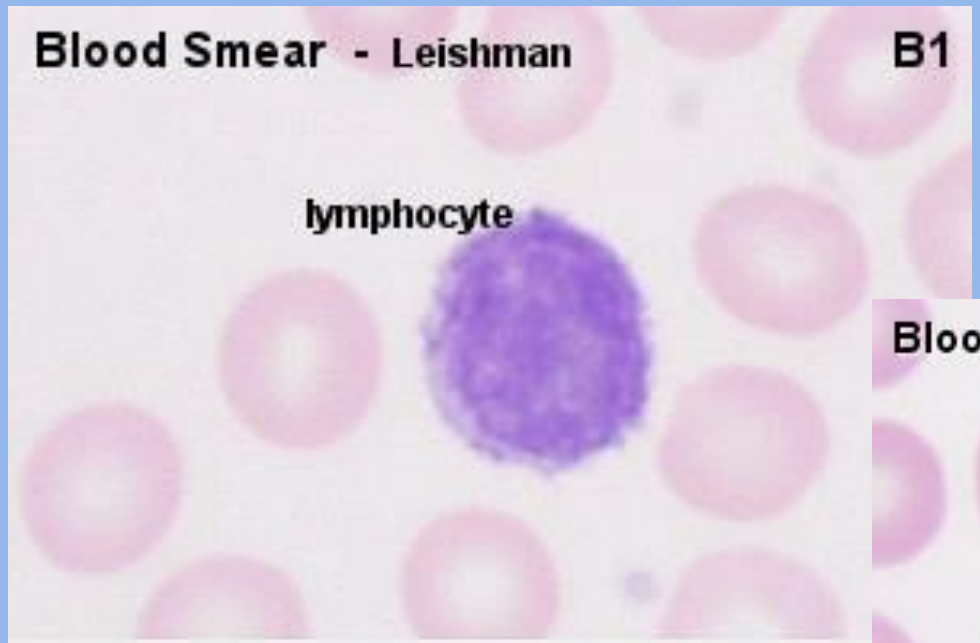
- solidHeterochromatis

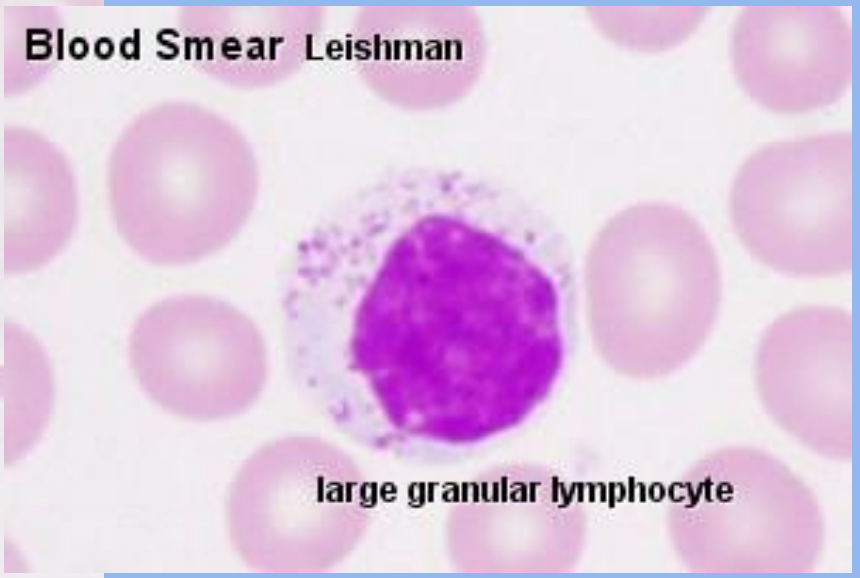
- Color: blue to purplish black

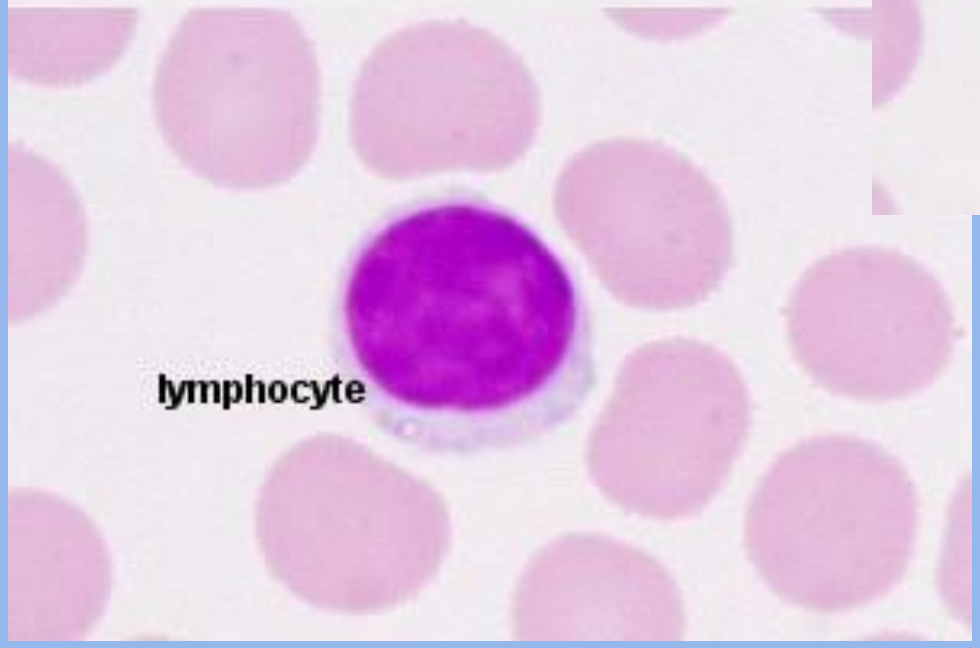
[med-large] : larger

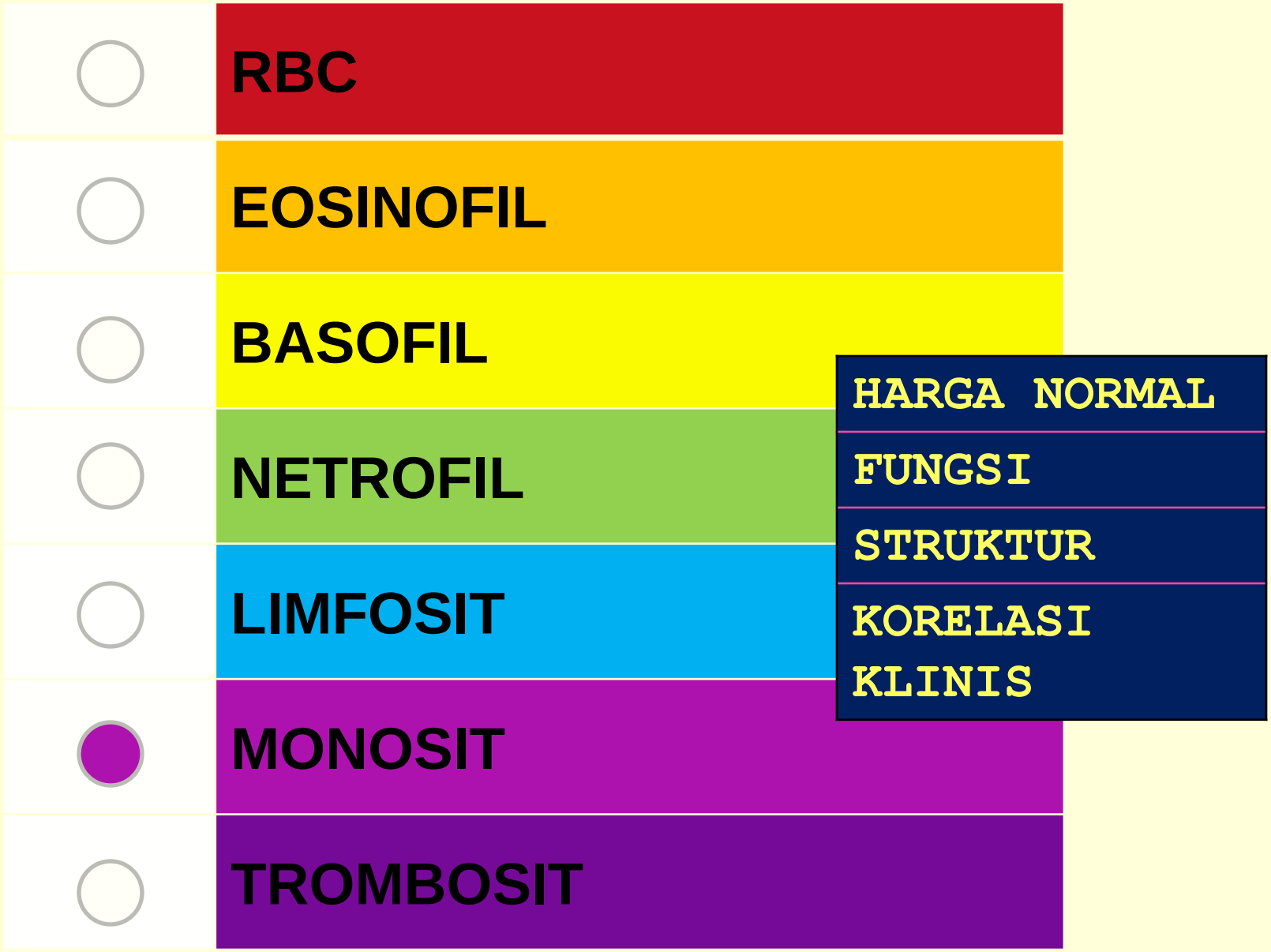
less heterocromatis

color : reddish purple


Blood Smear - Leishman
B1
lymphocyte


Blood Smear Leishman
large granular lymphocyte


lymphocyte


RBC
EOSINOFIL
BASOFIL
NETROFIL
LIMFOSIT
MONOSIT
TROMBOSIT
HARGA NORMAL
FUNGSI
STRUKTUR
KORELASI KLINIS

Monocyte (large mononuclear leucocyte) :

- % WBC : 3 – 8 %
- Characteristic :
  - ✓In circulation
  - ✓Outside circulation i → phagocytosis
  - ✓recirculation capability [-]
  - ✓ pseudopodia movement like octopus, with their nucleus in the front
- Role :
  - Generation of **mononuclear-phagocyte system** cells in tissues;
  - phagocytosis and digestion of protozoa and virus and senescent cells

The monocyte-macrophage system consists of the body's complement of monocytes and macrophages. Some macrophages are mobile whereas others are fixed. These include:

- histiocytes in connective tissues
- microglia in the brain
- Kupffer cells in the liver
- alveolar macrophages in the lungs
- sinus-lining macrophages (reticular cells) in the spleen, lymph nodes and thymus gland
- mesangial cells in the glomerulus of nephrons in the kidney
- osteoclasts in bone.

Structure :

- Φ: (circulation) : **12-15** µm (tissue) : 20 µm

-Cytoplasm : * color : greyish blue

* >> Granule azurofilik

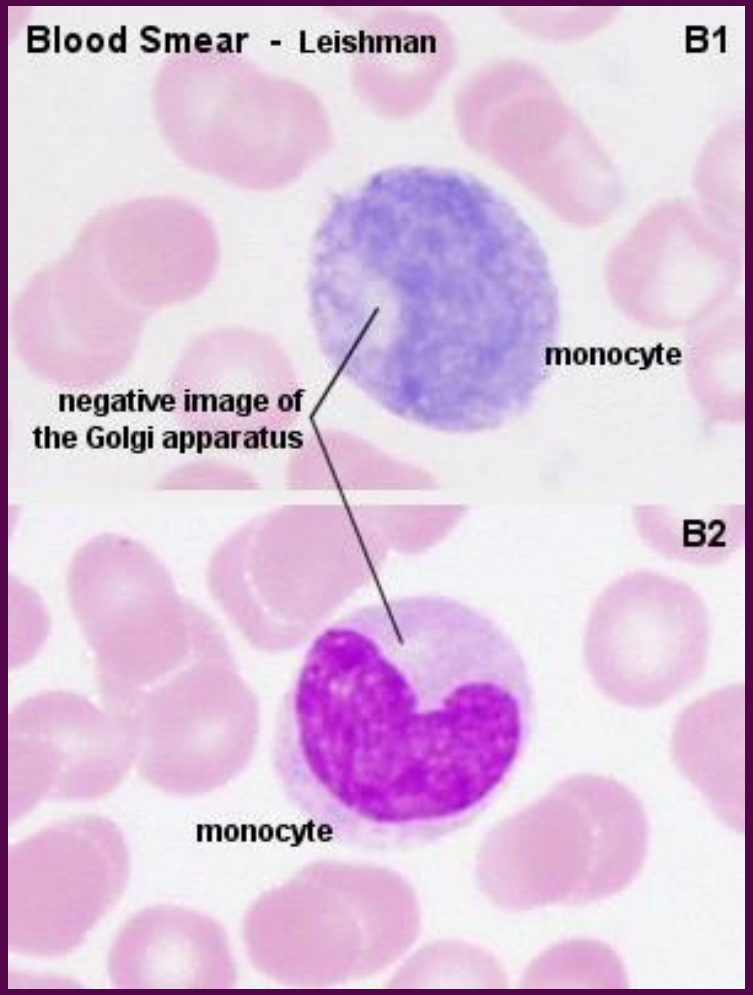
*

- Nucleus : * kidney shape, eccentric

* More pale (chromatin is more subtle)

* 2-3 nucleoli

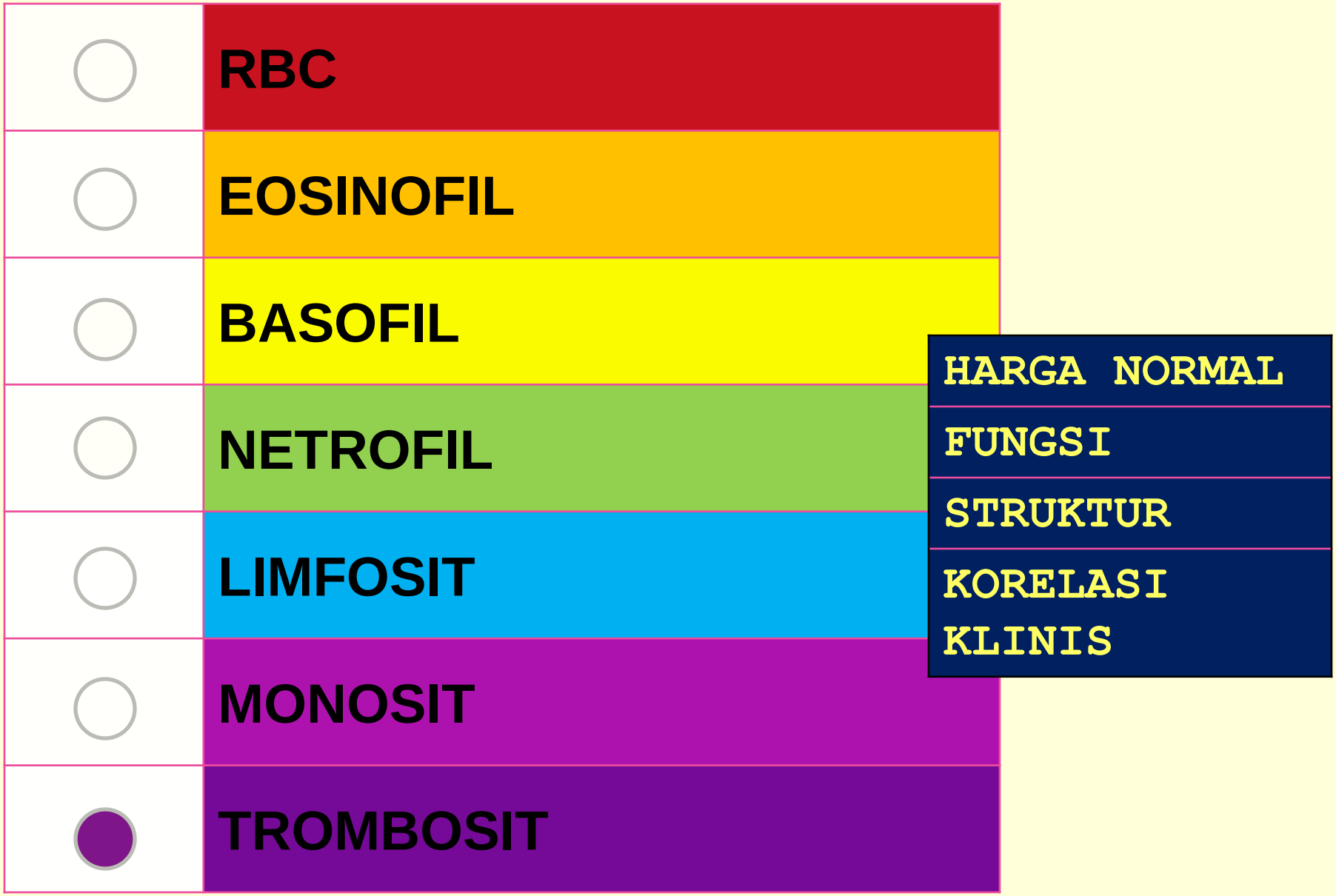
* Color: reddish purple


Blood Smear - Leishman
B1
monocyte
negative image of
the Golgi apparatus
B2
monocyte

CLINICAL CORRELATION

- **Monocytopenia**

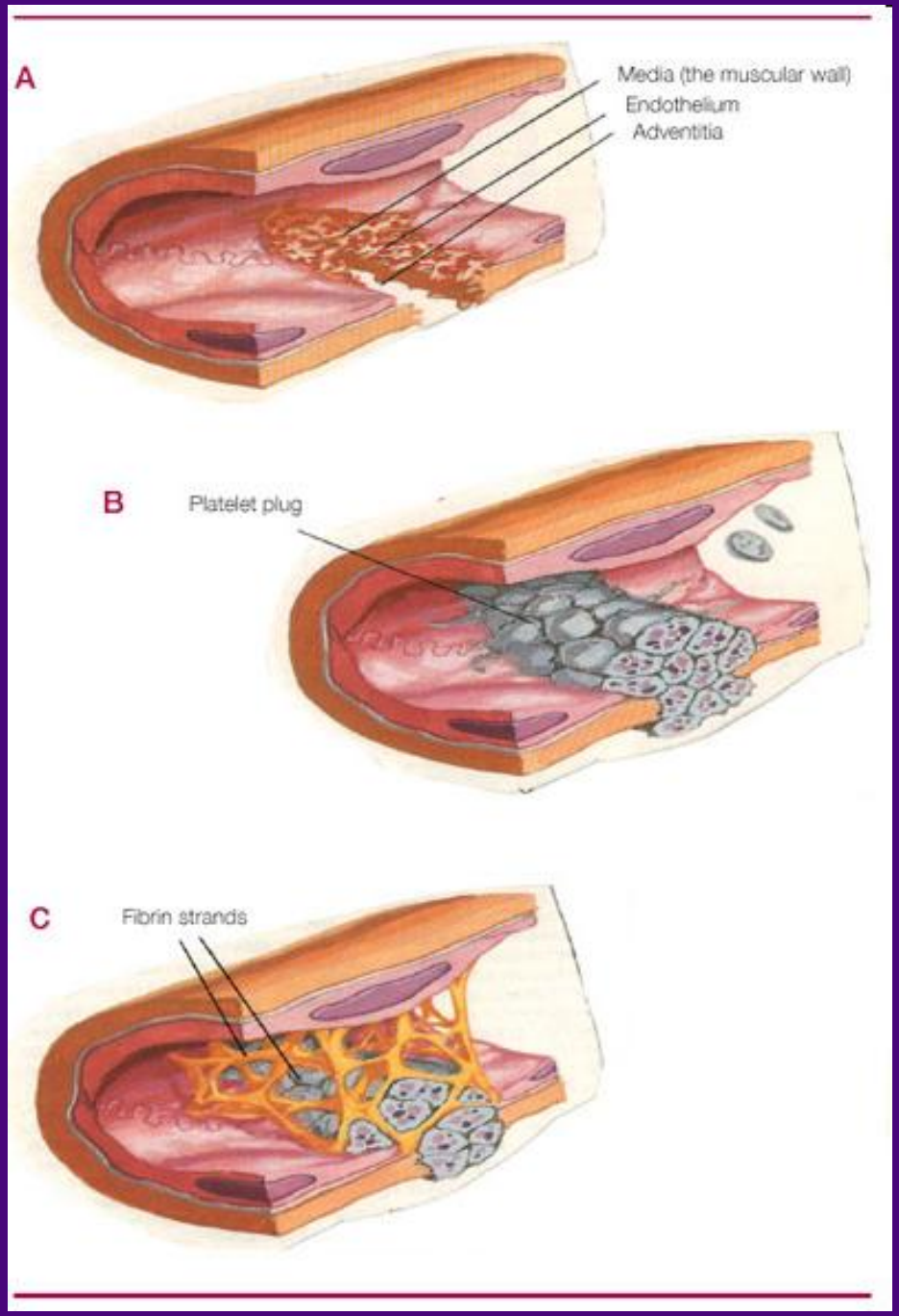
- **Monocytosis**

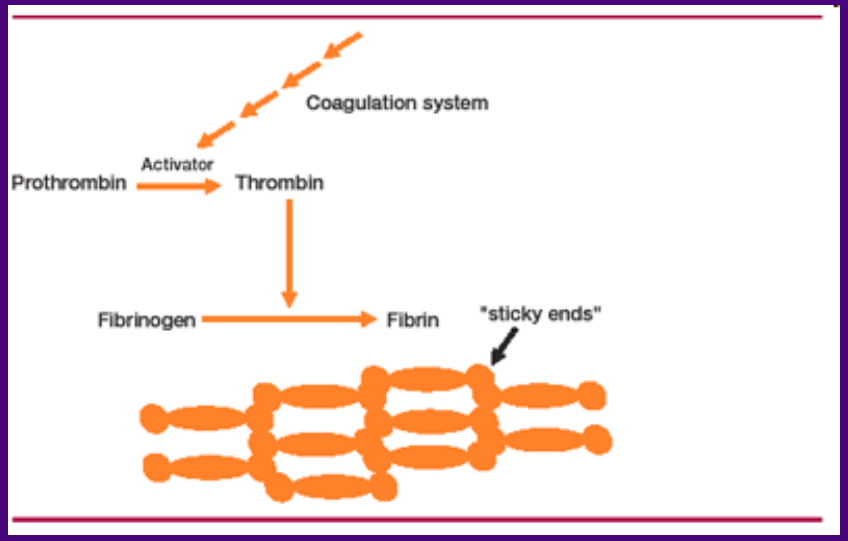

RBC
EOSINOFIL
BASOFIL
NETROFIL
LIMFOSIT
MONOSIT
TROMBOSIT
HARGA NORMAL
FUNGSI
STRUKTUR
KORELASI KLINIS

PLATELET (thrombocyte=thromboplastid)

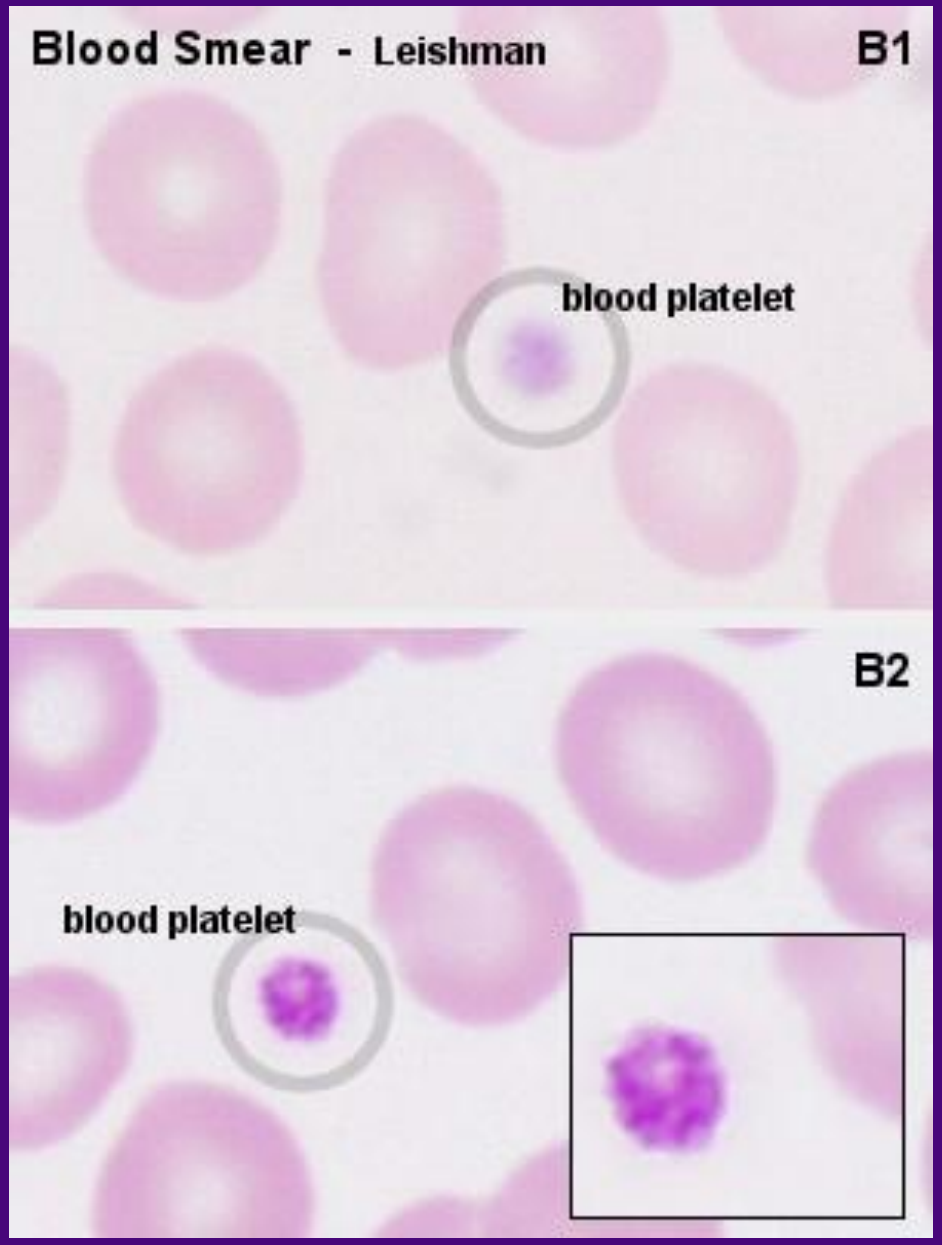
- FROM megakarocyte “budding’ in the bone marrow
- Σ Normal : 200.000-400.000/Ml, lifespan : 8 days
- Function : CLOT FORMATION

- P**rimary aggregation**—Discontinuities in the endothelium, → platelet aggregation → **platelet plug**
- **Secondary aggregation**—Platelets in the plug release an adhesive glycoprotein and ADP. → increasing the size of the platelet plug.
- **Blood coagulation -- cascade**, giving rise to a polymer, **fibrin → thrombus.**


A
Media (the muscular wall)
Endothelium
Adventitia
B
Platelet plug
C
Fibrin strands


Coagulation system
Activator
Prothrombin
Thrombin
Fibrinogen
Fibrin
"sticky ends"

- **Structure** :
  - Ø : 2-5 µm; in group (in the preparation)
  - disc like Shapes, biconvex
  - in fresh prep: no color
  - membrane surface: glycocalyx for adhesion
  - edge: hyalomere, pale blue color. There is a marginal bundle
  - central: dense granulomere, There are mitokhondria, glycogen granules, and purple granules.


Blood Smear - Leishman
B1
blood platelet
B2
blood platelet

CLINICAL CORRELATION

THROMBOCYTOPENIA

This is defined as a blood platelet count below 150 x 10^9/1 (150 000/mm3) but spontaneous capillary bleeding does not usually occur unless the count falls below 30 x 10^9/1 (30 000/mm3).

THROMBOCYTOSIS

.

INTRODUCTION

CELLS

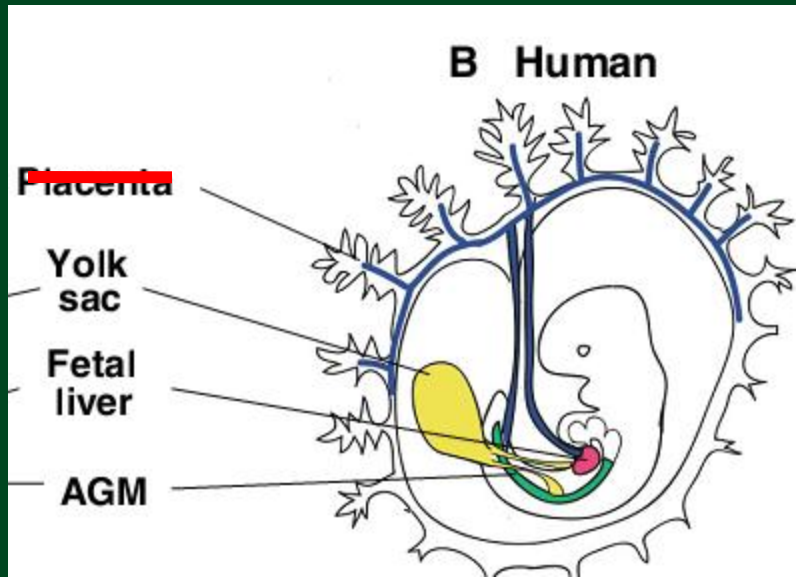
HEMATOPOIESIS

HEMATOPOIESIS

= synthesis process of blood cells

Consist of proliferation and differentiation of haematopoiesis stem cells

- Start : in yolk sac → fetal liver, spleen, and adult bone marrow
- From blood island → hemangioblast
- occurs initially at day 15



- Berproliferasi, membentuk 2 jalur diferensiasi (2 stem cell):

  * *Jalur Myeloid* → RBC, granulosit, monosit, Platelet

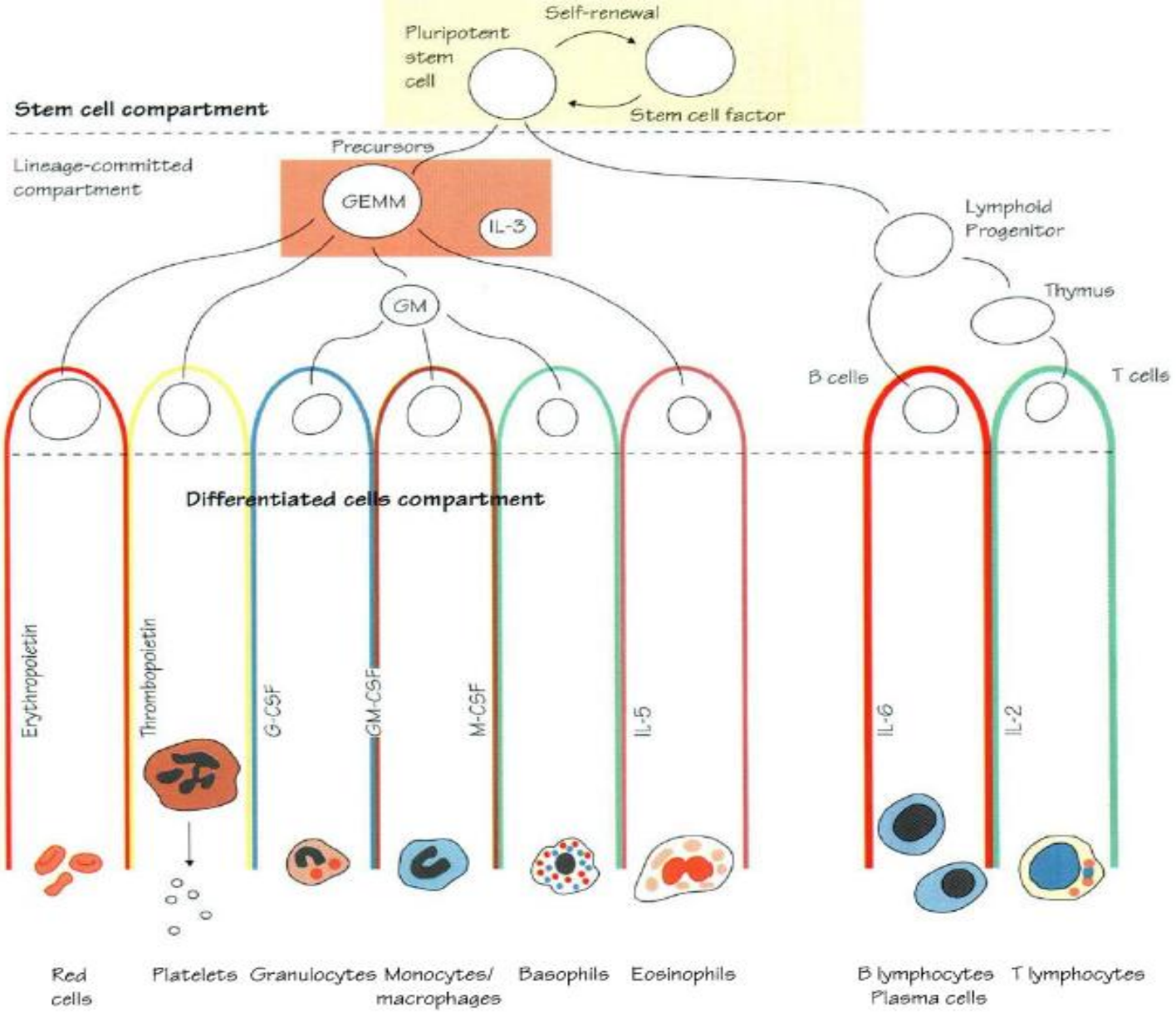
    ~ erythropoiesis

    ~ granulopiesis

    ~ monopiesis

    ~ thrombopiesis

  * *Jalur lymphoid* → limfosit dan sel plasma



Key

GEMM = Granulocyte/erythroid/monocyte/megakaryocyte precursor
GM = Granulocyte/monocyte precursor
GM-CSF = Granulocyte - macrophage colony - stimulating factor
G - CSF = Granulocyte colony - stimulating factor
IL-2 = Interleukin 2
IL-3 = Interleukin 3
IL-5 = Interleukin 5
IL-6 = Interleukin 6

Terima kasih…….SEMANGAT!

(dilarang menghitung jumlah slide)