Reticuloendothelial System (RES) & Spleen

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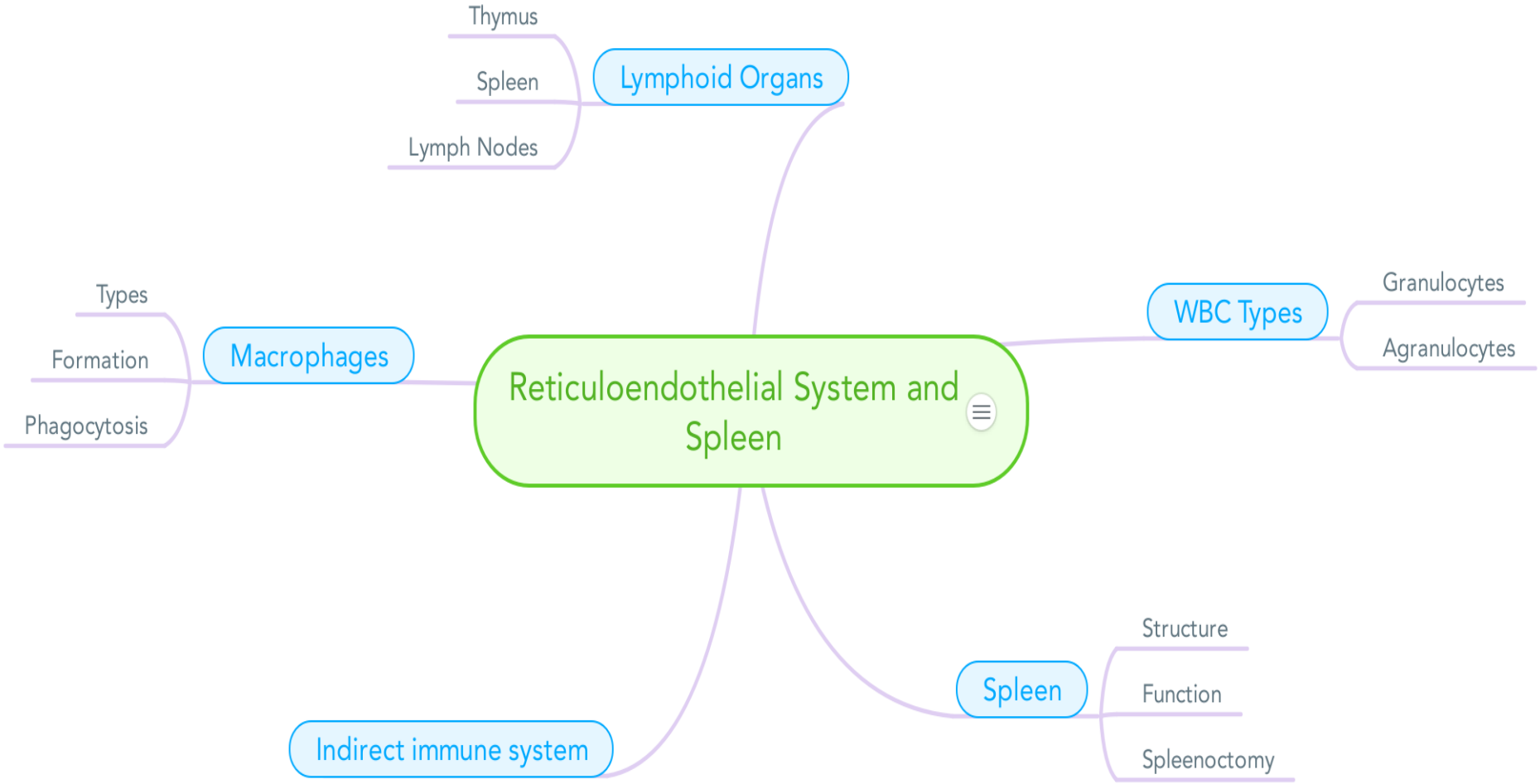
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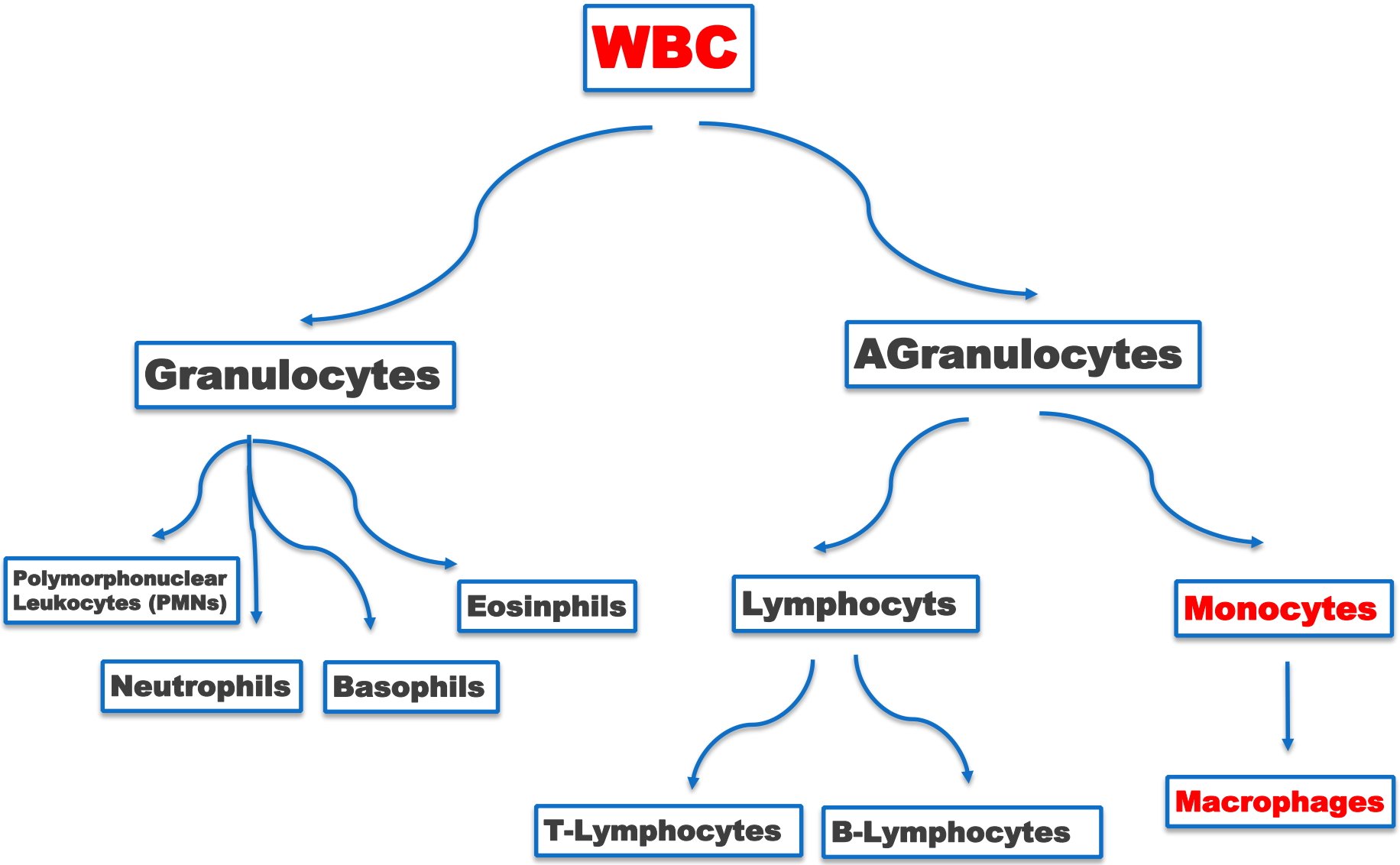
WBC Types


WBC
Granulocytes
AGranulocytes
Polymorphonuclear Leukocytes (PMNs)
Eosinphils
Neutrophils
Basophils
Lymphocyts
Monocytes
T-Lymphocytes
B-Lymphocytes
Macrophages

The reticuloendothelial system (RES)

Reticuloendothelial system is an older term for the mononuclear phagocyte system. Most endothelial cells are not macrophages here.

It is a network of connective tissue fibers inhabited by phagocytic cells such as macrophages ready to attack and ingest microbes, RES is an essential component of immune system

General Functions of RES

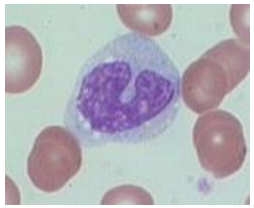
1.**Phagocytosis: Bacterial,dead cells or foreign particles (direct).**

2.**Immune function: processing antigen and antibodies production (indirect).**

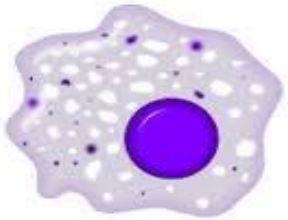
3.**Breakdown of aging RBC.4.Storage and circulation of iron.**

Components of RES

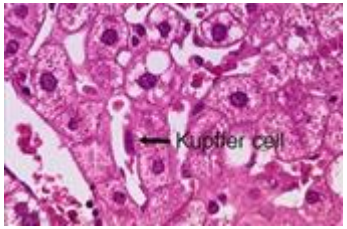
Monocytes



1.Macrophage Located in all tissues such as skin (histiocytes), liver (kupffer), spleen, bone marrow, lymph nodes, lung.



1.Endothelial cells: bone marrow, spleen, lymph node.



Macrophages

Often remain fixed to their organs. They filter and destroy objects which are foreign to the body, such as bacteria, viruses. Some macrophages are mobile, and they can group together to become one big phagocytic cell in order to ingest larger foreign particles.

Types of Macrophages

Kupffer cells in the liver. Microglia in the brain. Reticular cells in the lymph nodes, bone marrow and spleen.Tissue histiocytes (fixed macrophages)in subcutaneous tissues.Alveolar cells in the lungs. Osteoclast in bone

Formation of Macrophages

1-Begin by Stem cell in Bone Marrow: monoblast maturing to promonocyte and mature monocytes released into blood.

2-Stay for 10-20 hours in circulation.

3-Then leave blood to tissues transforming into larger cells macrophage.

4-Macrophage life span is longer up to few months in tissues.

Transformation of monocytes to macrophage

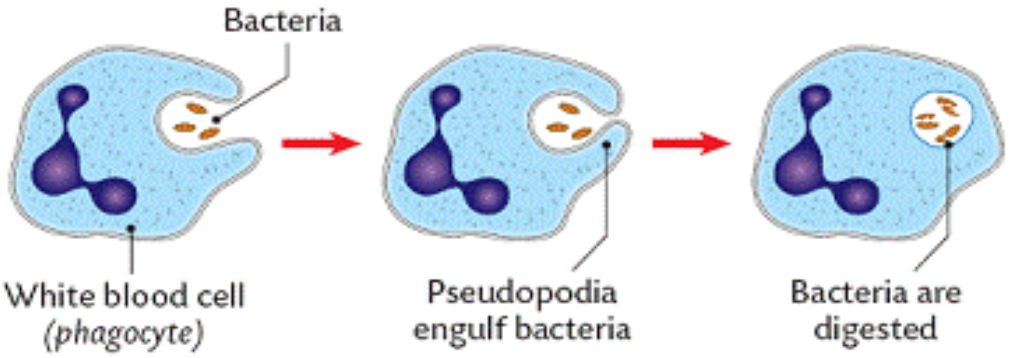
-Characterized by an increase in:

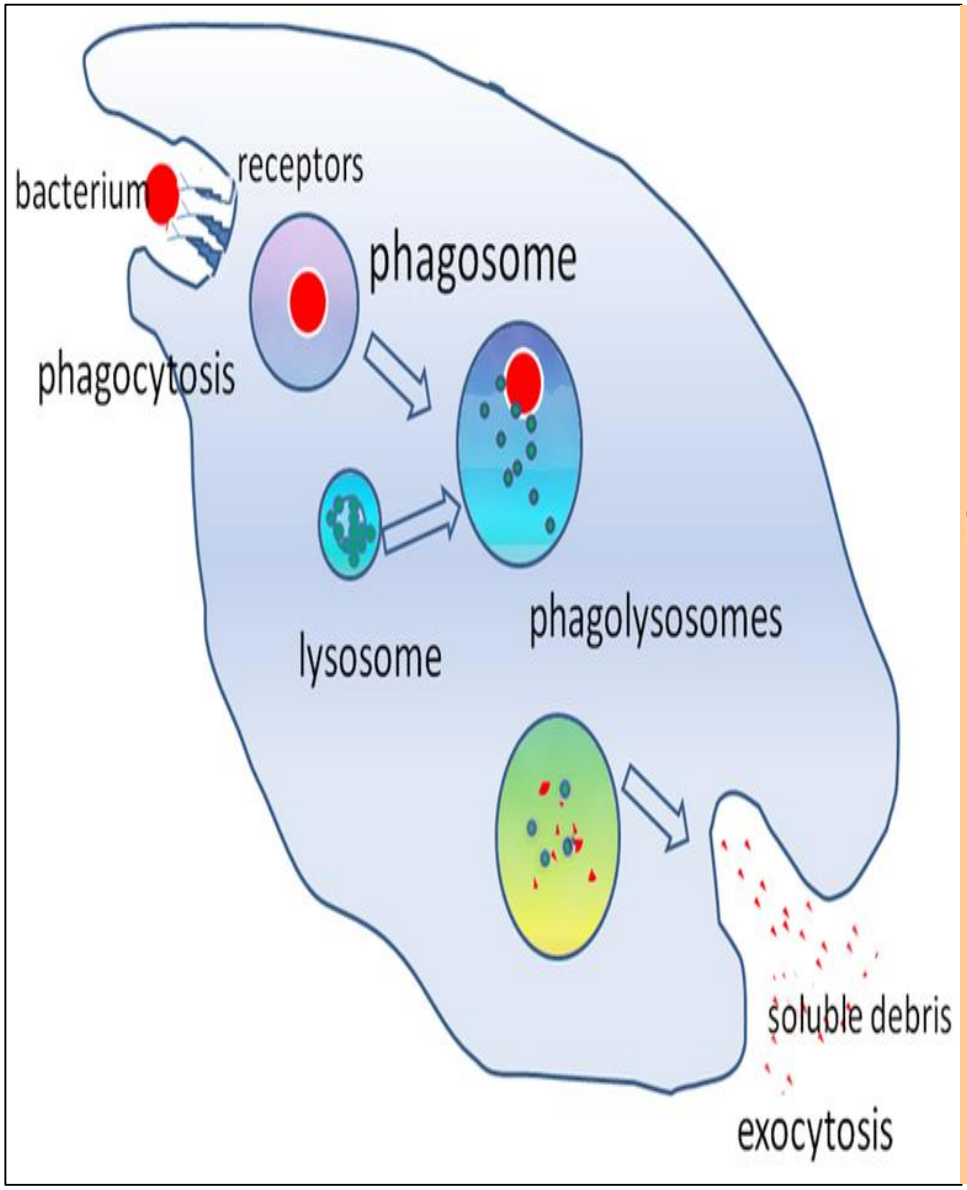
1-**Cell size. 2-Number and complexity of intracellular organelles Golgi, mitochondria and lysosomes.**

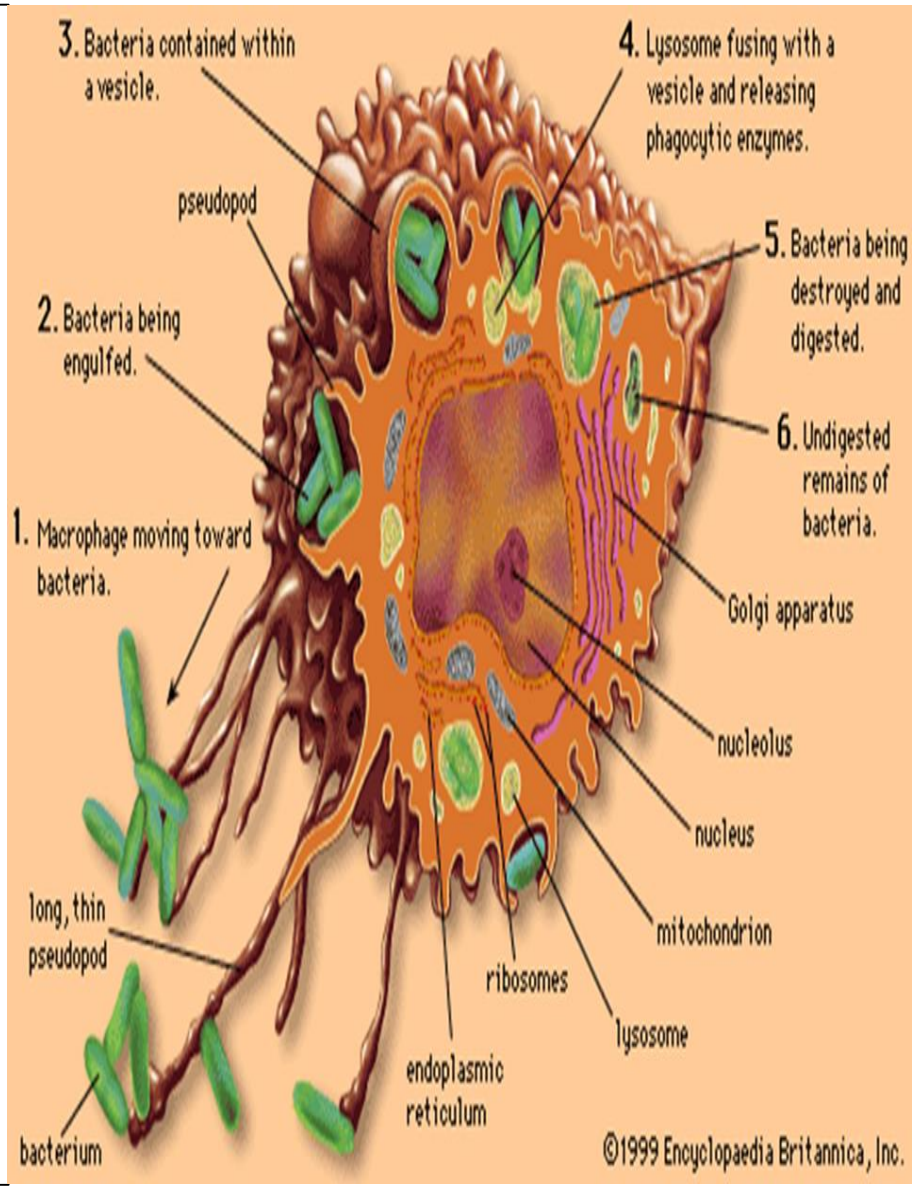
3- **Intracellular digestive enzymes.**

Phagocytosis

Phagocytosis is part of the natural or innate immune process.
Macrophages are a powerful phagocytic cells: Ingest up to 100 bacteria. Ingest larger particles such as old RBC.Get rid of waste products.




bacterium
receptors
phagosome
phagocytosis
lysosome
phagolysosomes
soluble debris
exocytosis


3. Bacteria contained within a vesicle.
4. Lysosome fusing with a vesicle and releasing phagocytic enzymes.
pseudopod
5. Bacteria being destroyed and digested.
2. Bacteria being engulfed.
6. Undigested remains of bacteria.
1. Macrophage moving toward bacteria.
Golgi apparatus
nucleolus
nucleus
mitochondrion
long, thin pseudopod
ribosomes
lysosome
endoplasmic reticulum
bacterium
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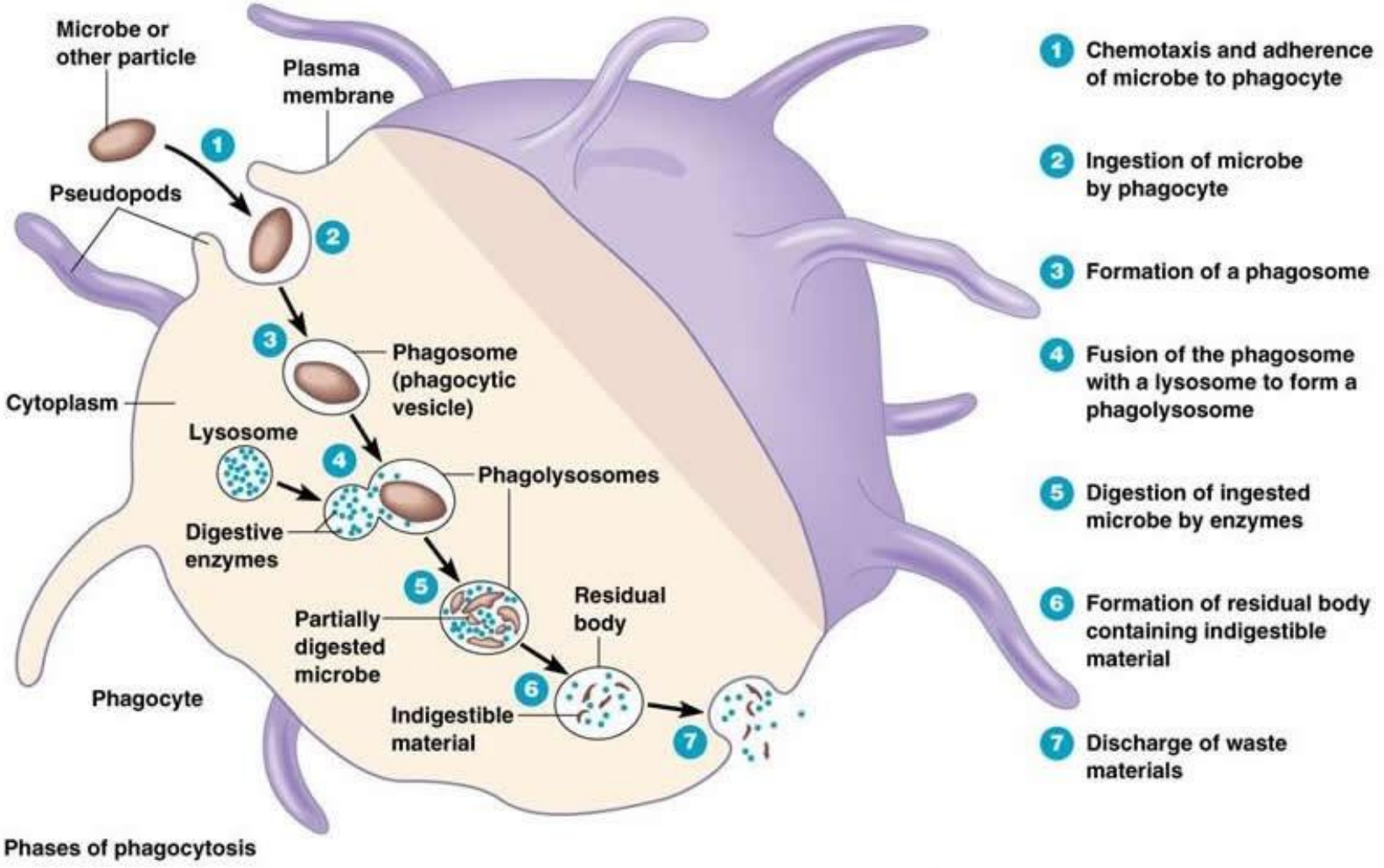
Microbial killing



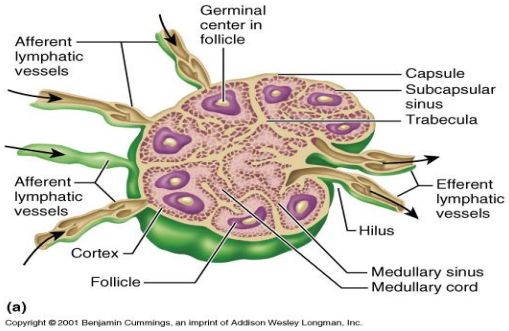
Phases of phagocytosis

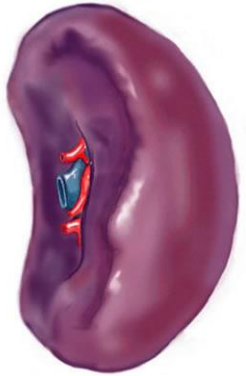
Indirect Immune function Of RES

- **Ingest foreign body, process it and present it to lymphocytes**

Lymphoid Organs

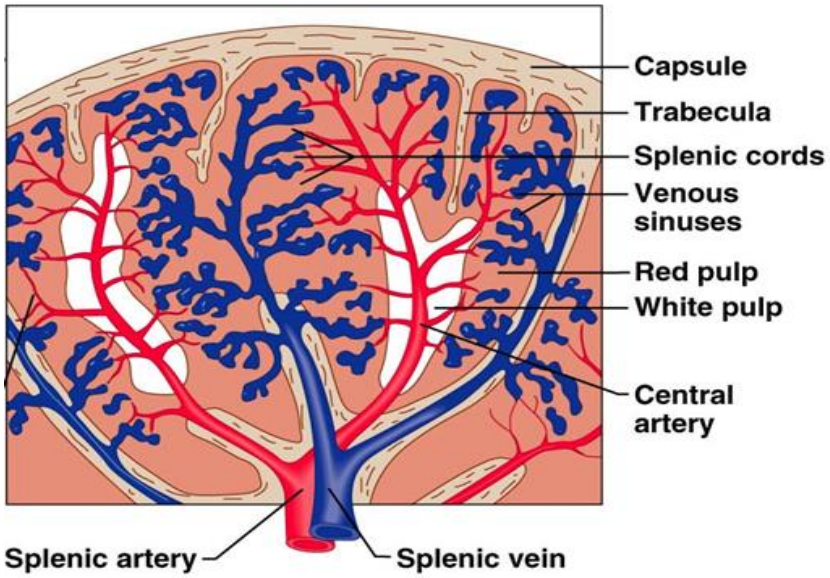
1. **Thymus: has a high rate of growth and activity until puberty, then it begins to shrink and degenerate; its the site of T-cell maturation.**
2. **Lymph nodes: are small, encapsulated organs stationed along lymphatic channels and large blood vessels of the thoracic and abdominal cavities.**
3. **Spleen: is structurally similar to lymph node, it filters circulating blood to remove exhausted RBCs and pathogens.**





Spleen

- Is a soft purple-gray in color located in the left upper quadrant of the abdomen.
- It is a highly vascular lymphoid organ that plays an important roles in: red blood cells integrity and has an immune function.
- It holds a reserve of blood in case of hemorrhagic shock.
- It is one of the centers of activity of the RES and its absence leads to a predisposition toward certain infections, Despite its importance, there are no tests specific to splenic function.



Structural Function of Spleen

White pulp: Thick sleeves of lymphoid tissue, that provides the immune function of the spleen.

Red pulp :surrounds white pulp, composed of:
1- Venous sinuses filled with whole blood
2-Splenic cords of reticular connective tissue rich in macrophages.

Immune Functions of Spleen

1. Because the organ is directly connected to blood circulation, it responds faster than other lymph nodes to blood-borne antigens.
2. Destruction and processing of antigens.
3. Reservoir of lymphocytes in white pulp.
4. Site for Phagocytosis of bacteria and worn-out blood cells (Slow blood flow in the red pulp cords allows foreign particles to be phagocytosed)
5. Site of B cell maturation into plasma cells, which synthesize antibodies in its white pulp and initiates humoral response.
6. Removes antibody-coated bacteria along with antibody-coated blood cells.
7. It contains (in its blood reserve) half of the body monocytes within the red pulp, upon moving to injured tissue (such as the heart), turn into dendritic cells and macrophages that promoting tissue healing.

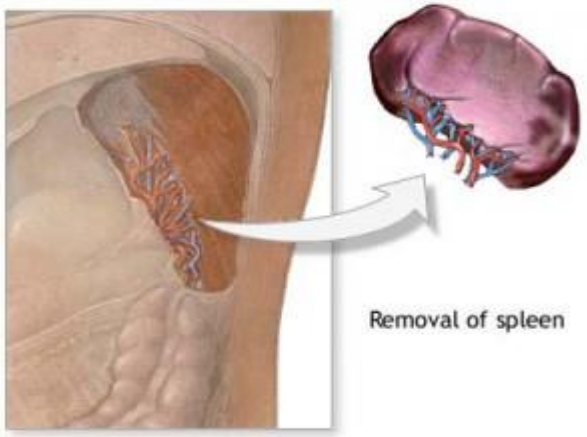
Functions of Spleen →

1. Haematopoiesis (Hemopoiesis): fetal life.
2. Spleen is a main site for destruction of RBCs specially old and abnormal e.g. spherocytosis.
3. Blood is filtered through the spleen.
4. Reservoir of thrombocytes and immature erythrocytes.
5. Recycles of iron.
6. immune function

Spleenectomy

- **Indications:**

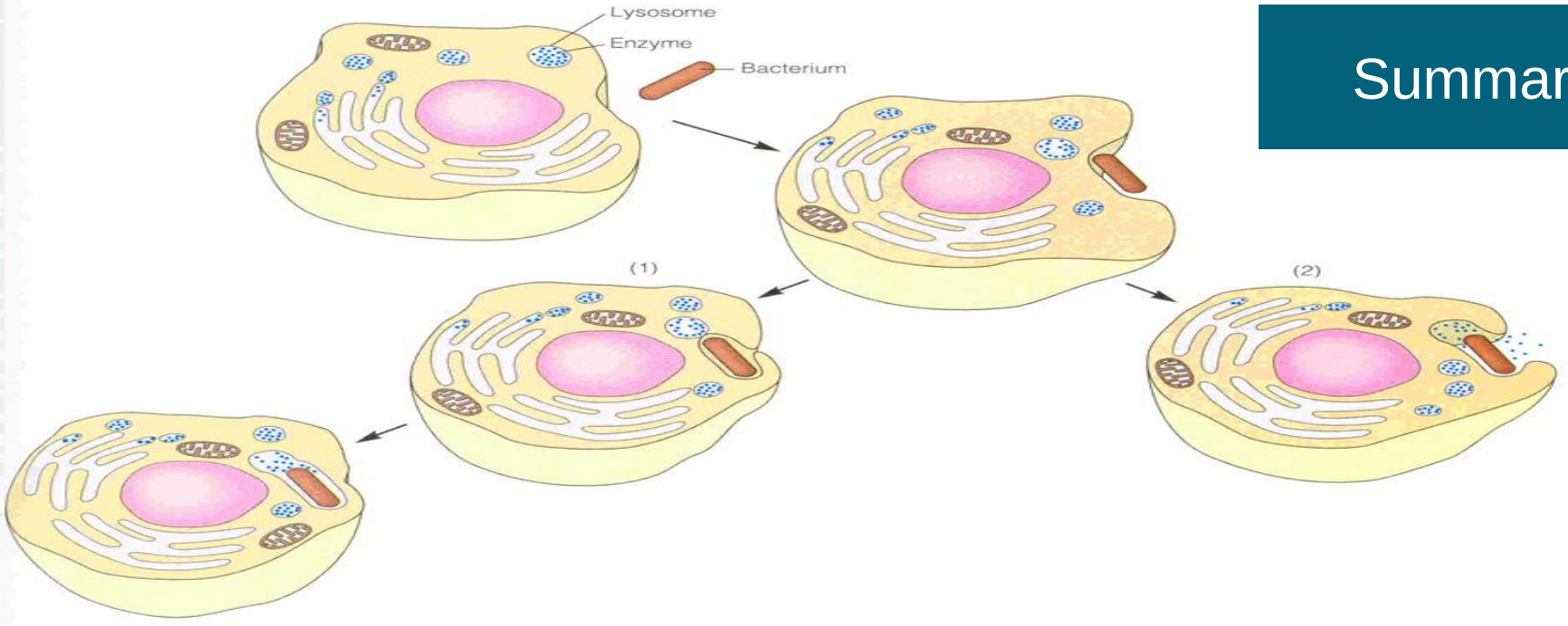
1. **Hypersplenism: enlargement of the spleen (splenomegaly) with defects in the blood cells count.**
2. **Primary spleen cancers.**
3. **Haemolytic anaemias: Sickle cell anaemia, Thalassemia,hereditary spherocytosis (HS) and elliptocytosis,**
4. **Idiopathic thrombocytopenic purpura (ITP).**
5. **Trauma.**
6. **Hodgkin's disease.**
7. **Autoimmune hemolytic disorders.**



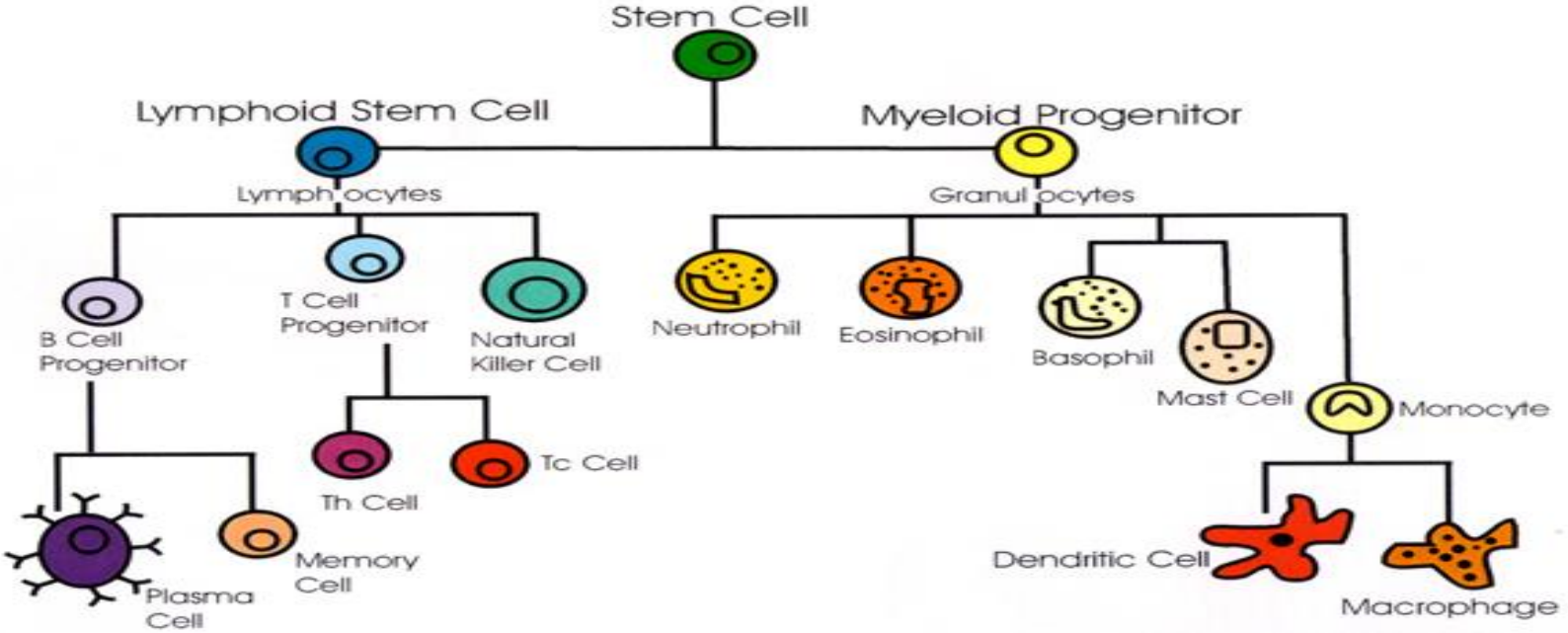
Risks & complications of Spleenectomy

- **Overwhelming bacterial infection or post splenectomy sepsis.**
- **Patient prone to malaria.**
- **Inflammation of the pancreas and collapse of the lungs.**
- **Excessive post-operative bleeding (surgical).**
- **Post-operative thrombocytosis and thrombosis.**

Summary



Cells of the Immune System



MCQs

Answer key:1:C , 2:D , 3:D , 4:C , 5:D , 6:C

1-Monocyte develops into:
A.T-Lymphocyte.
B.Eosinphil.
C.Macrophages.
D.Neutrophil.

2-which of the following is function of spleen:
A.Immune function.
B.Destruction of old RBCs.
C.Recycles of iron.
D.All of the above.

3-Macrophages in the liver called:
A.Alveolar cell.
B.Histiocyte.
C.Microglia.
D.Kuppfer’s cell.

4-In thymus:
A. B cell maturation.
B. RBC storage.
C. T cell maturation.
D. destruction of pathogenic antigen.

5-which of the following is indication of spleoctomy:
A.Trauma.
B.Hodgkin's disease.
C.Autoimmune hemolytic disorders.
D.All of The Above.

6-Which of the following if Agranulocyte:
A.Neutophil.
B.Eosinphil.
C.B-Lymphocyte.
D.Basophils.

SAQs

Q1:What are the components of endothelial system:

Ans:

1-Monocytes – 2-Macrophages – 3-Endothelial Cells:

(Bone Marrow – Spleen-Lymph Nodes).

Q2:What are the functions of spleen?

Ans:

1Haematopoiesis (Hemopoiesis): fetal life.

2-Spleen is a main site for destruction of RBCs specially old and abnormal e.g. spherocytosis.

3-Blood is filtered through the spleen.

4-Reservoir of thrombocytes and immature erythrocytes.

5-Recycles of iron.

6-immune function

Q3:General function of RES:

Ans:

1.Phagocytosis: Bacterial,dead cells or foreign particles (direct).

2.Immune function: processing antigen and antibodies production (indirect).

3.Breakdown of aging RBC.4.Storage and circulation of iron.

Q4:in Transformation of monocyte to macrophages, whar the the ceelular changes:

Ans:

1-Cell size.

2-Number and complexity of intracellular organelles Golgi, mitochondria and lysosomes.

3- Intracellular digestive enzymes.

Thanks for checking our work

Good Luck

Done by:

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