

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ





RETICULO-ENDOTHELIAL SYSTEM

MONOCYTE-MACROPHAGE CELL SYSTEM

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Learning Outcomes



**Describe the components
of Reticulo-endothelial
system.**



**Describe the role of
monocyte macrophage
system in immunity.**



**Explain the mechanism of
destroying foreign body by
the Monocyte-
Macrophage System.**

Reticulo - Endothelial System

Monocytes

+

Mobile + Fixed
Tissue
Macrophages

+

Specialized
Endothelial cells in
bone marrow,
spleen and lymph
nodes

Monocytes

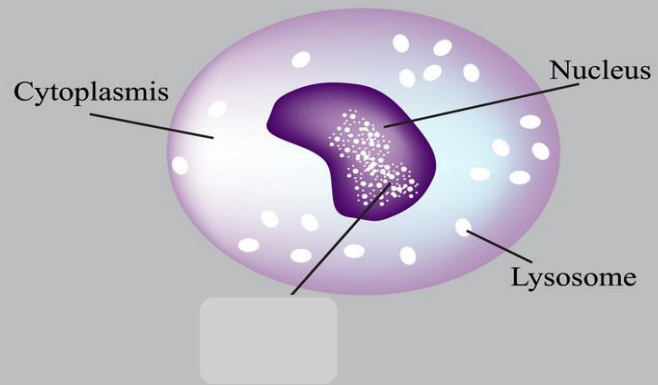
- **Largest leucocytes**
- Immature cells when leave the bone marrow with little ability to fight infectious agent
- Circulate for **1-2 days** before settling down in tissues
- Become large and mature →

‘Tissue Macrophages’ (macro-large; phago-eater)

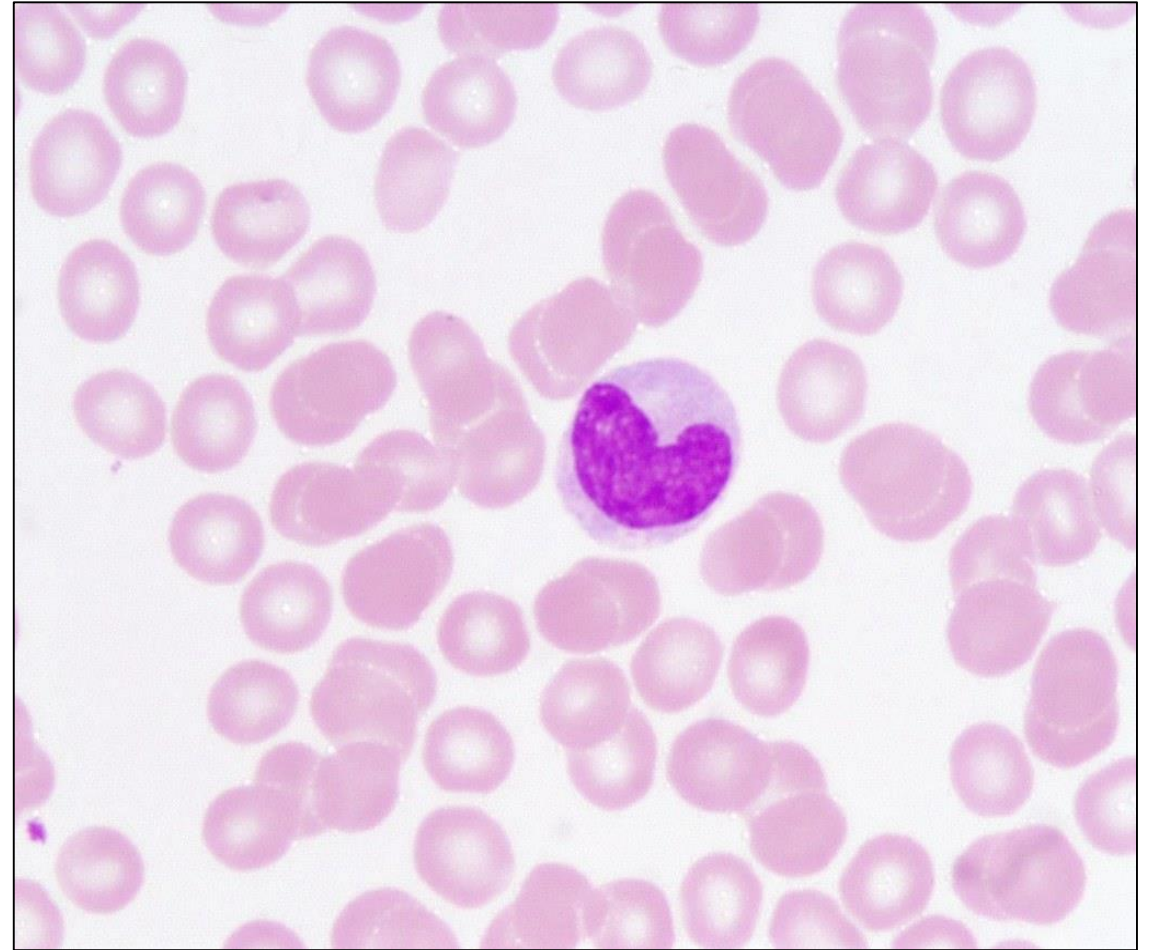
Lifespan of a macrophage is **months to years** unless dies sooner during phagocytosis (3months by BM transplantation data)

Monocyte

Monocyte



Carry antitumor, antiviral, antibacterial and antiparasitic immunity and are involved in regulation of hematopoiesis



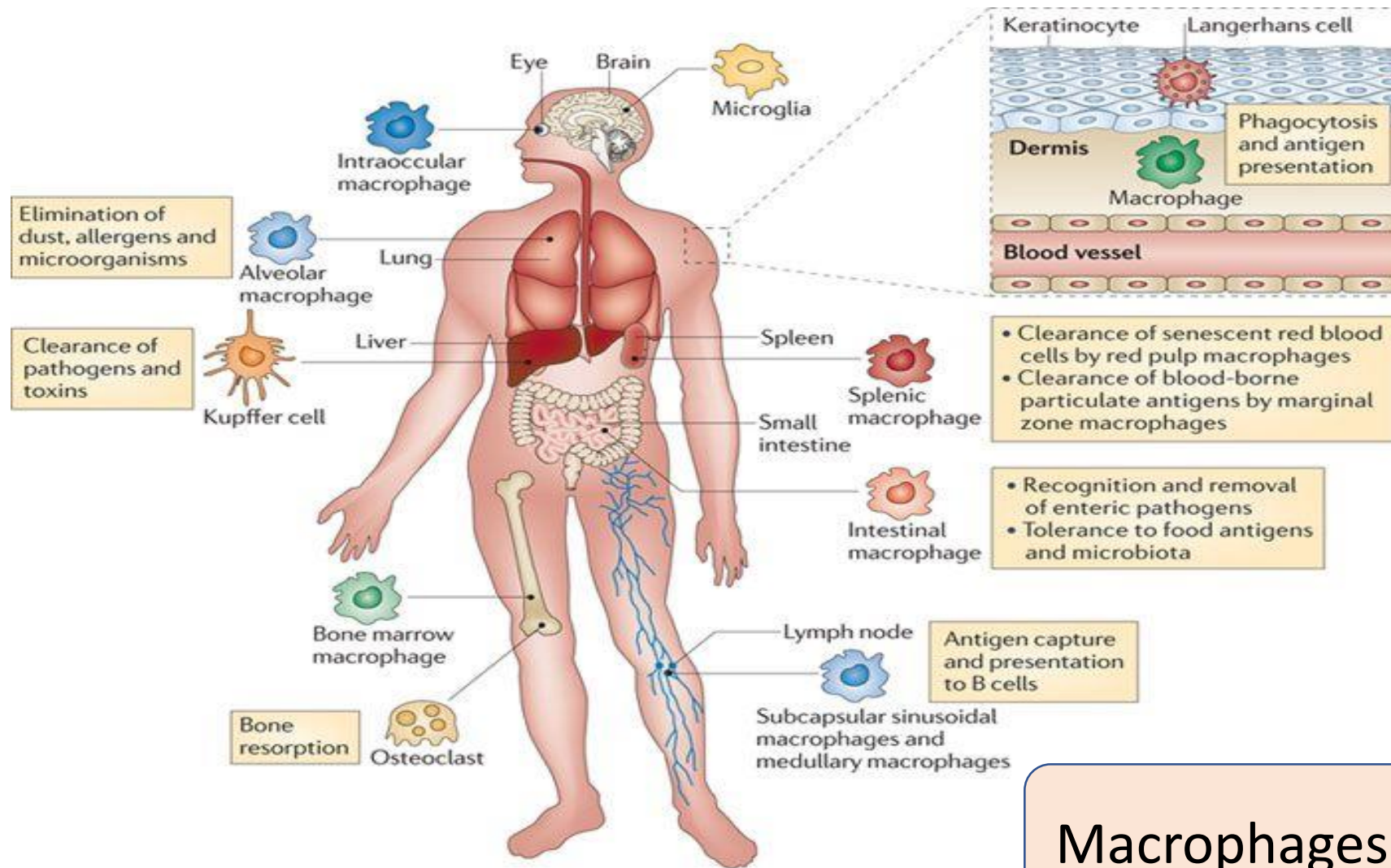
Wandering Macrophages

- **Wandering Macrophages-** monocytes that have recently entered tissues
- Monocytes change during **Maturation**
 1. Increase in **cell size**
 2. Increase in **number and complexity of organelles**
Golgi apparatus, mitochondria, lysosomes

Functions of Monocytes

1. In tissues form tissue macrophages –act as **scavengers**
2. Phagocytose several **bacteria (up to 100)**
3. Engulf large particulate matter, **dead tissue cells and senile cells**
4. Help with B & T lymphocyte in both **Humoral & Cellular** immunity

Tissues	Names Of Macrophages
Skin And Subcutaneous Tissues	Histiocytes
Lymph Nodes/ spleen	Sinus Histiocytes
Lungs	Alveolar Macrophages
Liver	Kupffer Cells
Kidneys	Mesangial Cells
Bone Marrow	Erythroblastic Island/ Hematopoietic stem cell/Osteal
Brain	Microglia



Macrophages In the body

Tissue Macrophages In Spleen And Subcutaneous Tissues

Skin is normally **impregnable** to infectious agents

Skin **when broken** → infectious agents can enter

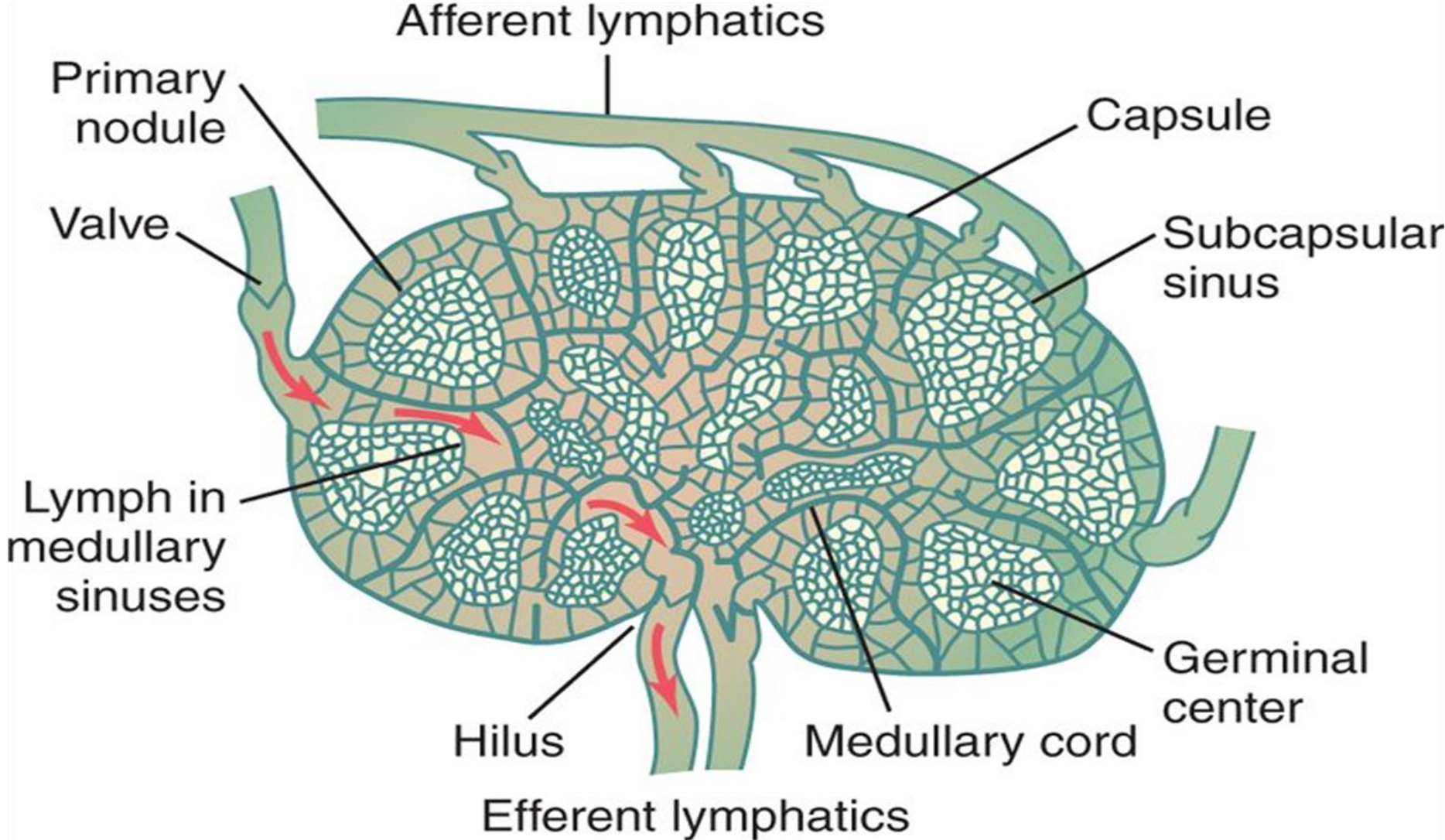
Infection in subcutaneous tissues → local inflammation and macrophages in the area multiply →

Destruction of infectious agent

Macrophages In Lymph Nodes

- If infectious agent/ particles are **not destroyed** locally in tissues →
- Enter the Lymphatic circulation → lymph Nodes and are destroyed by **tissue macrophages** lining the sinuses

Lymph Node



Alveolar Macrophages

- Can engulf, phagocytose and digest the invading organisms
- Form a **GIANT CELL** capsule if the particle is non digestible
- Such capsules are formed around **Tuberculosis bacilli, Silica** and **Carbon** particles

Kupffer Cells

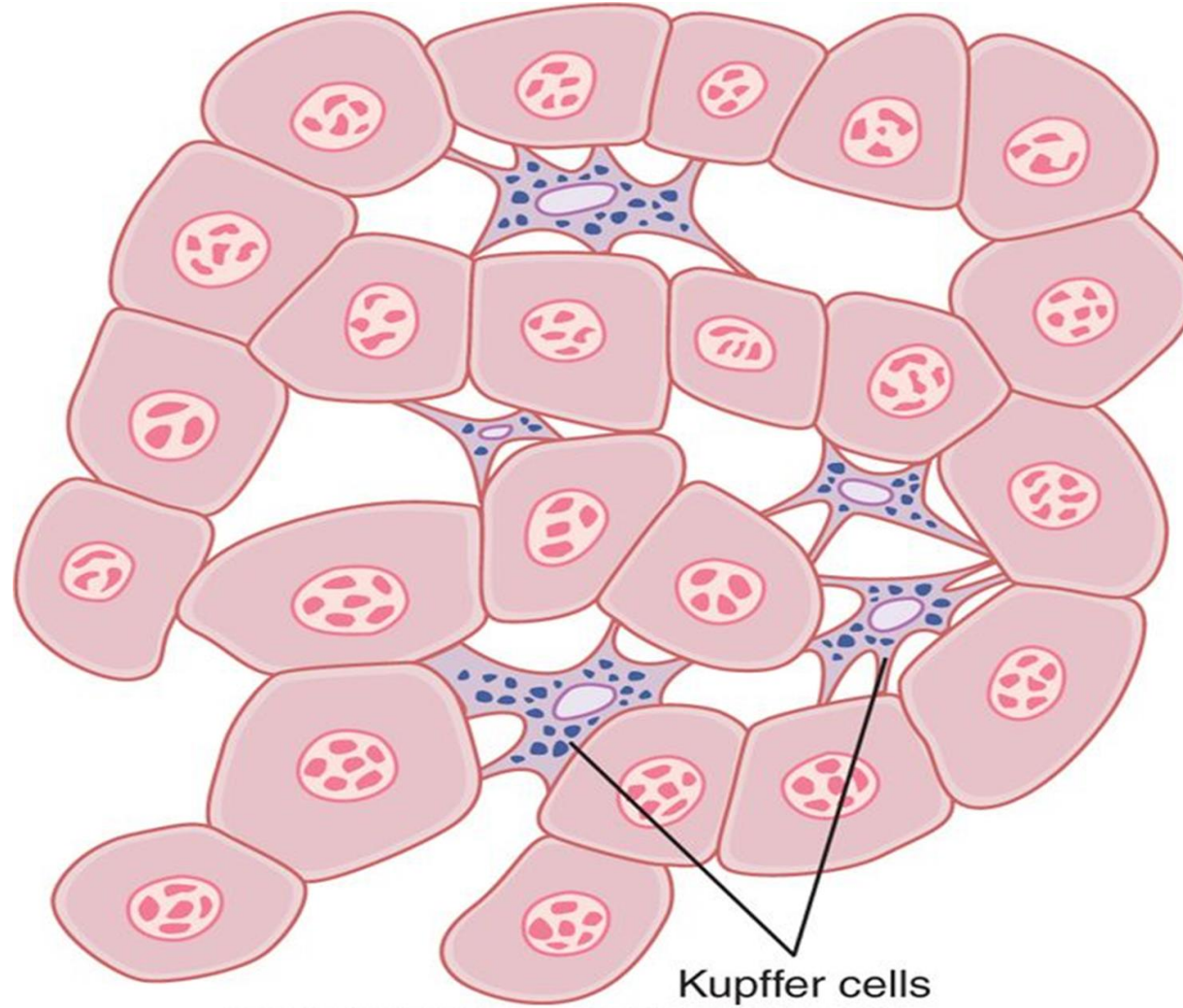
Bacteria

- Gastrointestinal Tract

→ Portal Blood

- Liver sinusoids lined by Kupffer cells
- Phagocytosis and filtration

Kupffer Cells in Liver

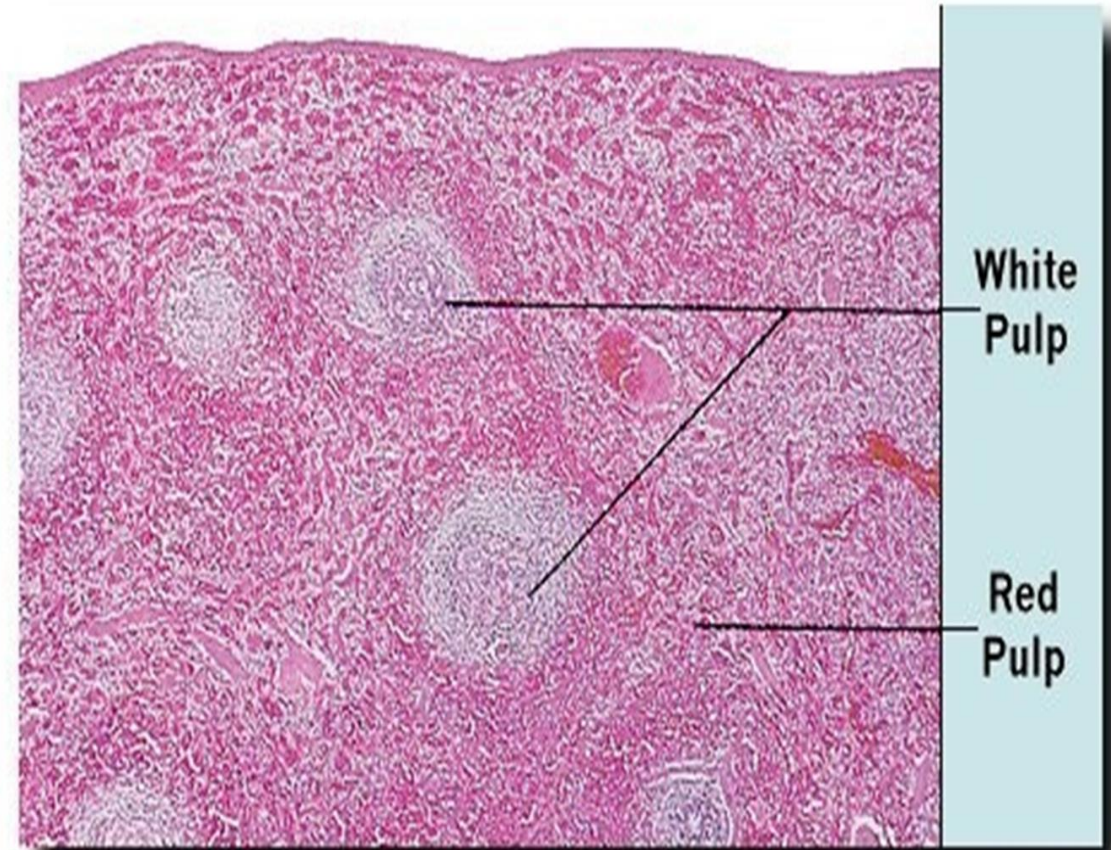
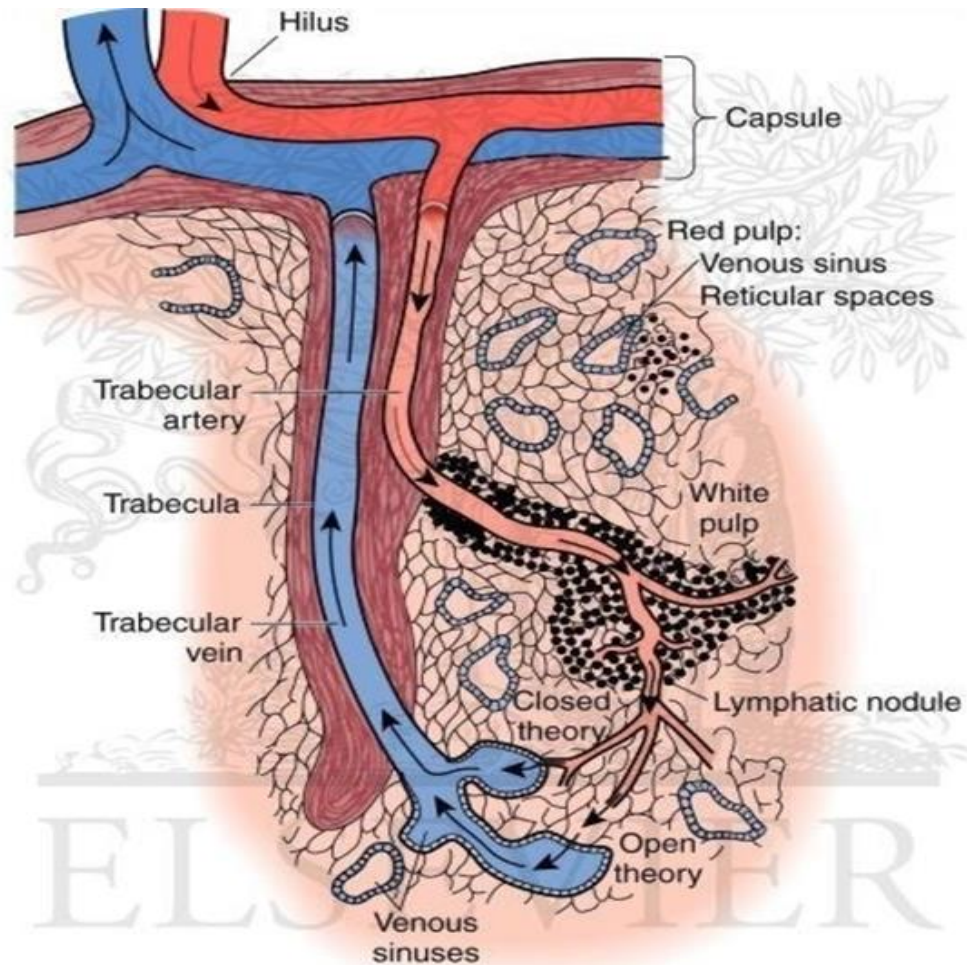


Spleen and Bone Marrow

If the invading organism enters the circulation

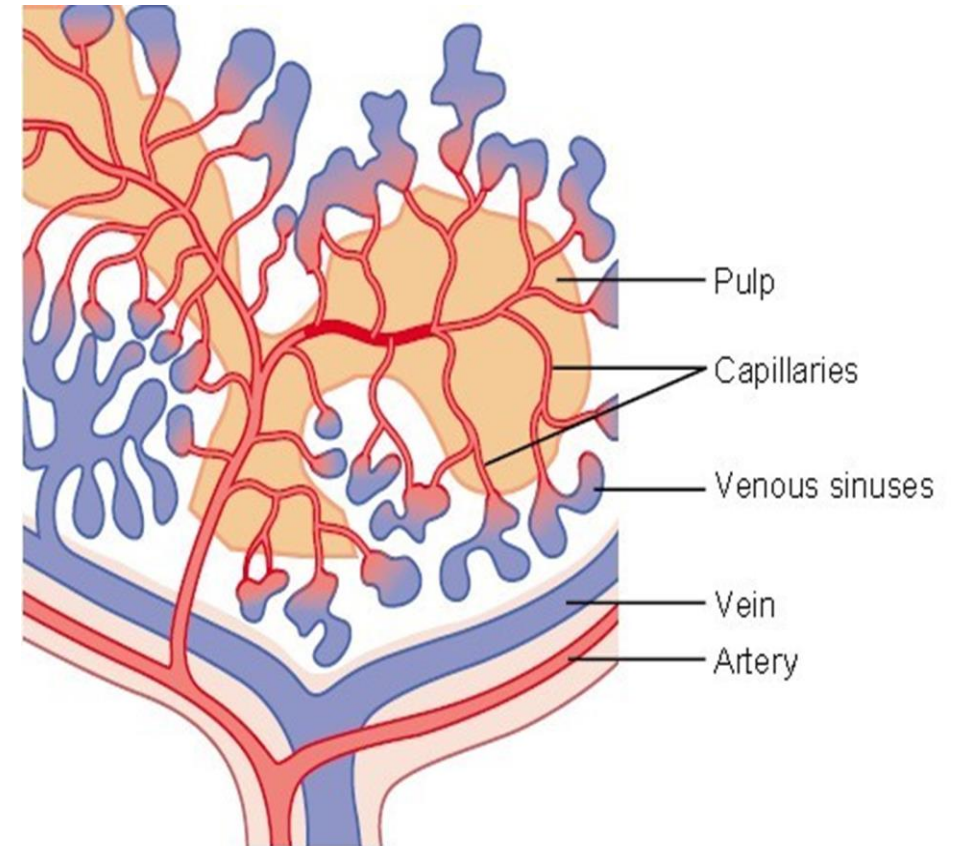
- trabeculae of red pulp and venous sinuses lined by macrophages
- Phagocytosis of unwanted organism/matter(old RBCs)

Splenic Structure

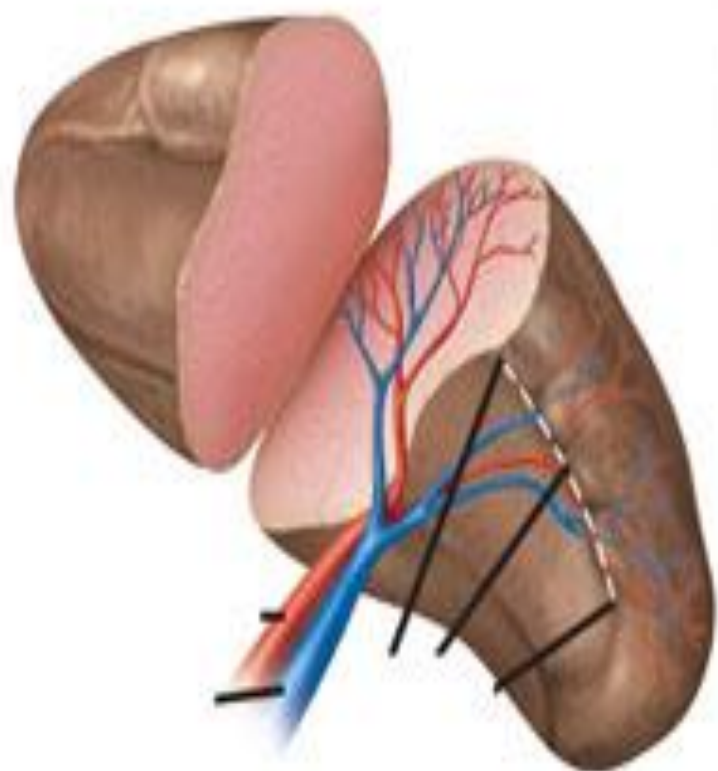


Functions of Spleen

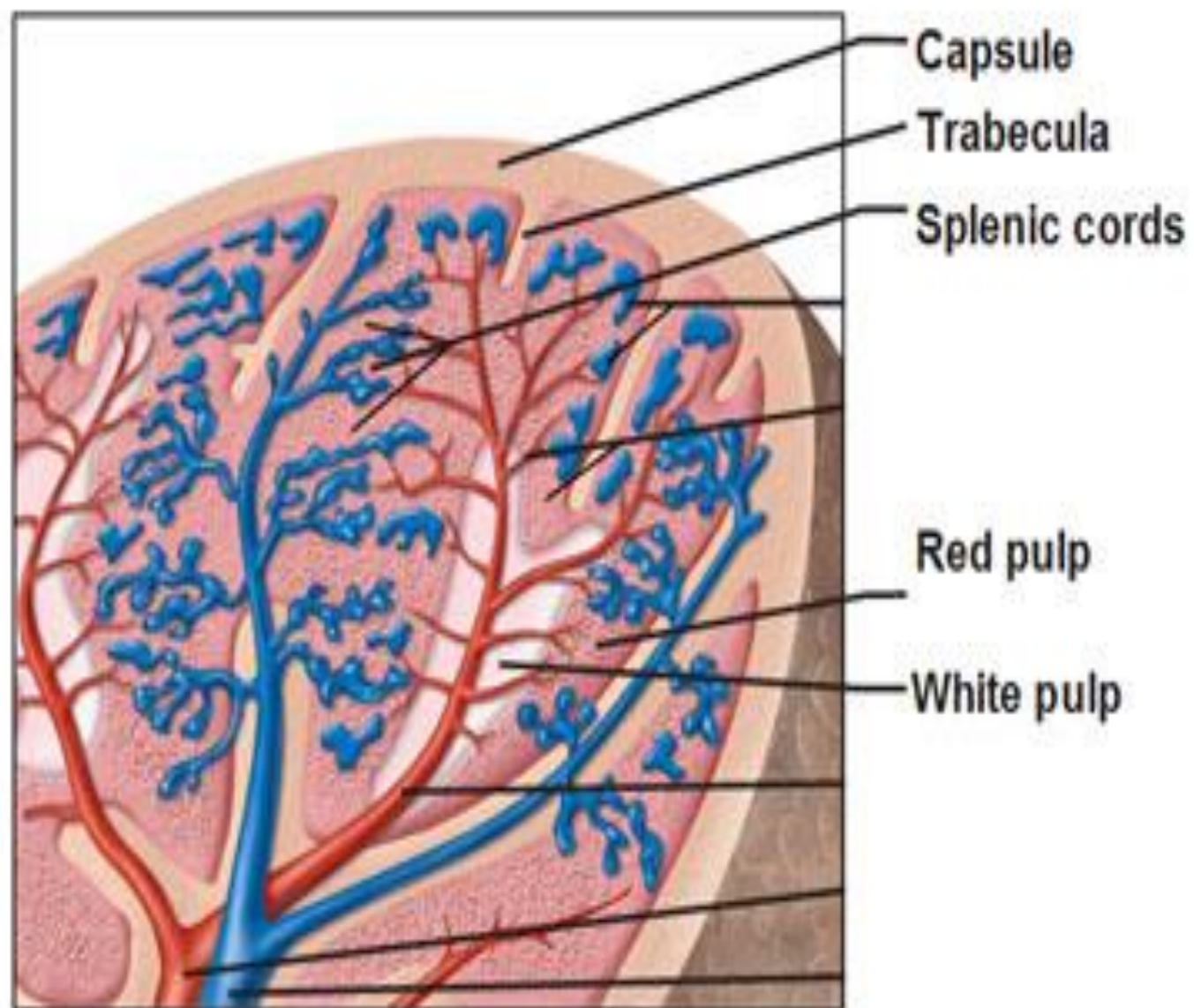
- Formation of RBCs (fetal)
- Removal of unwanted elements from blood
- Reservoir function
- Role in defense mechanism
- Storage and metabolism of iron



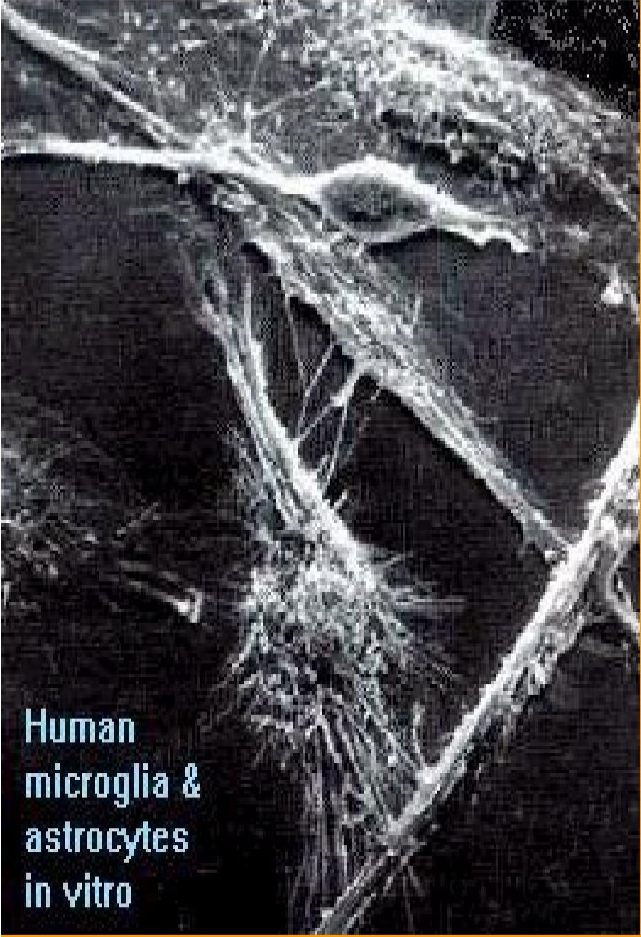
Spleen



(a) Diagram of the spleen, anterior view

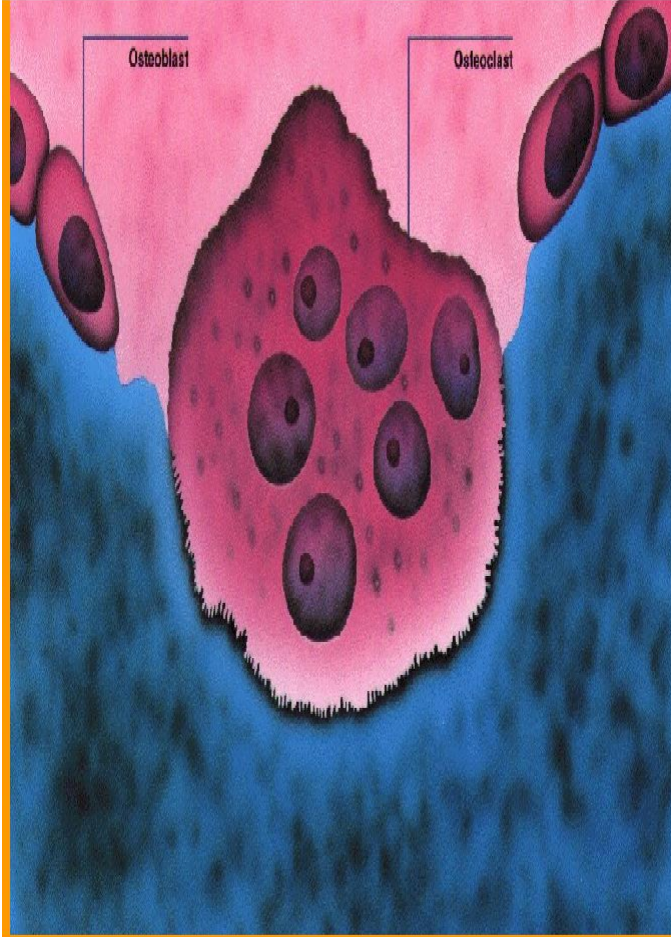


(b) Diagram of spleen histology



Human
microglia &
astrocytes
in vitro

**CNS
MICROGLIA**

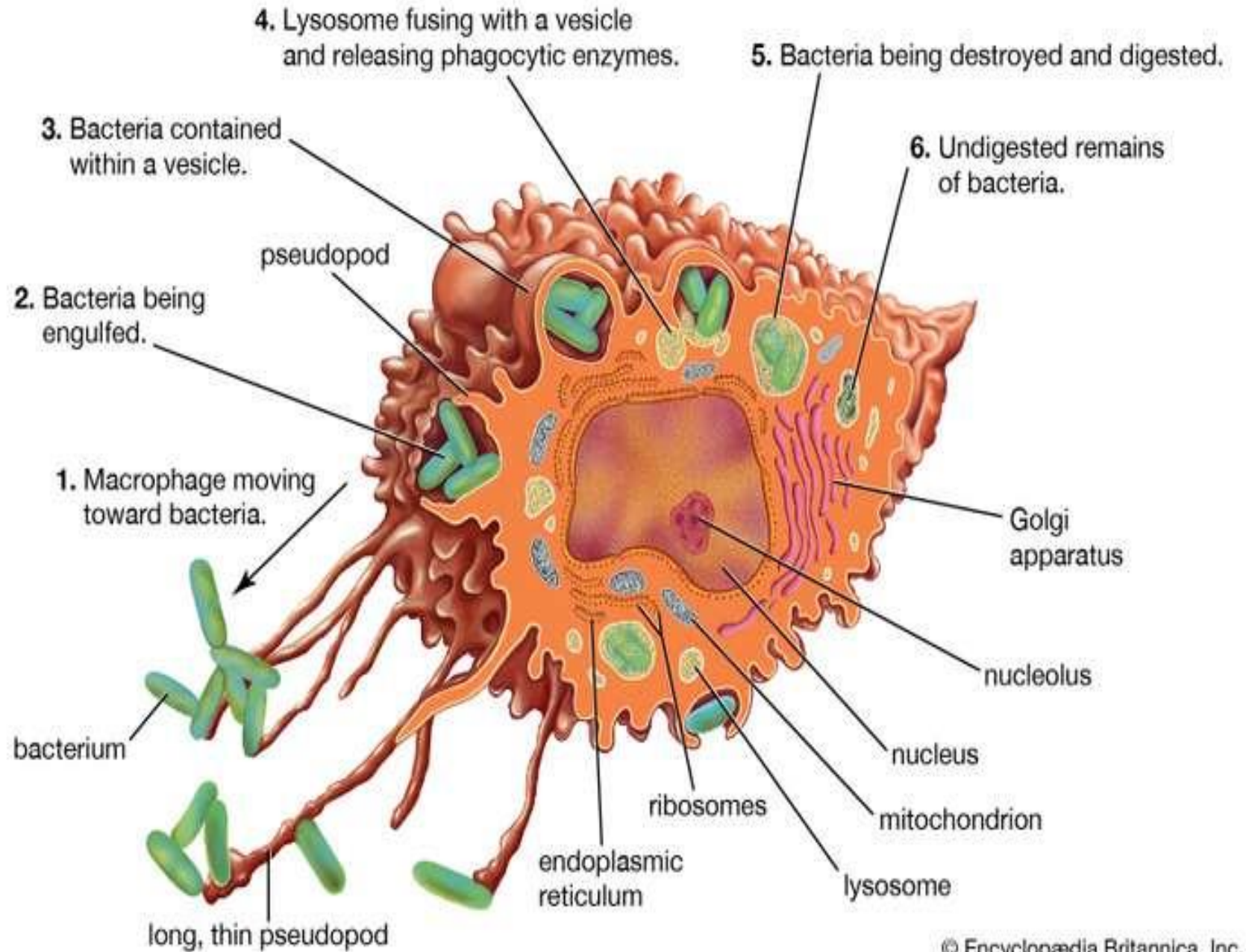


**BONE
OSTEOCLAST**



**SKIN
LANGERTHAN
CELLS**

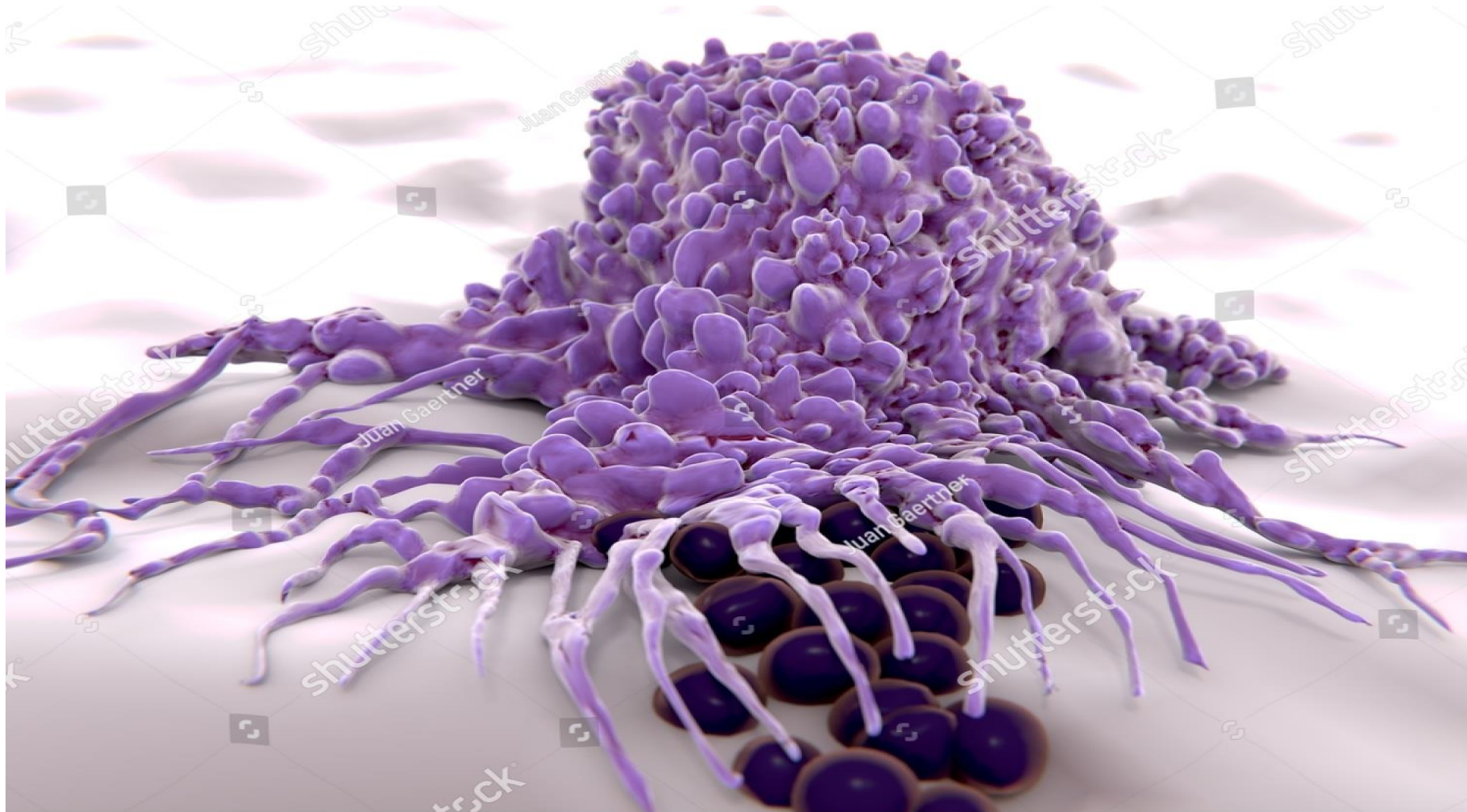
Macrophage Destroying A Bacterium



Mechanism of Destroying Foreign body

- **Engulf inorganic particulate matter** (carbon & dust particles)
- Formation of '**Multinucleated Giant Cell**'
- Organic matter such as thorn, fish bone, catgut are destroyed by **enzyme action & lysis**
- Engulf micro-organism, senile WBC, RBC, tissue debris & some parasites
- **Help 'T' & 'B' lymphocyte** in the acquired immunity by presenting antigens

A Macrophage Engulfing Cocci



Functions of Mononuclear Phagocytic System

- Phagocytosis and destruction of **foreign agents**
- Destruction of **worn-out red blood cells** →
- **Recycling of Iron** Specialized macrophages in the bone marrow, liver, and spleen →
- break down old RBCs and **metabolize the hemoglobin** →
- freeing the iron compound heme → **New Red Blood Cells**

Disorders Associated with Mononuclear Phagocyte System

- **Anemia** caused by the excessive destruction of red blood cells
 - **Malignant Tumors** that can be either localized or widespread malignant histiocytosis and monocytic leukemia
- **Niemann-Pick disease** and **Gaucher disease** are hereditary disorders characterized by abnormal products of lipid metabolism

Summary

References

- Guyton and Hall Physiology 13th edition
- Sherwood Physiology
- Ganong's Physiology
- www.britannica.com/science/mononuclear-phagocyte-system



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THANK YOU