

جامعة الانبار
كلية العلوم
قسم التقنيات الأحيائية

اسم المادة: المناعة
عنوان المحاضرة: Phagocytosis
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Phagocytosis

phagocytes

Definition: Cells which can **recognize & ingest & kill microbes & foreign bodies**

Types:

1. Neutrophil

2. Macrophage

	Neutrophil	Macrophage
% in blood	Most numerous WBCs ↑ in acute infection	Few
Size	Small	Large & mononuclear
Life	Few hours	Days

Stages of Phagocytosis

1- Delivery of phagocytic cell to site of infection:

- Diapedesis: histamine → stimulates phagocytes to migrate through wall of blood vessel to enter tissue
- Chemotaxis : chemotactic factors as chemokines & complement (C3a & C4a & C5a) attract phagocytes towards microbes in tissue

2- Recognition of microbes:

- Phagocytes can recognize and bind microbes through receptor on its outer surface e.g. mannose receptor & Toll-Like receptor

3- adherence to target (opsonization)

- ❖ Microbe coated with IgG or complement (C3b)
- ❖ IgG or C3b bind with their receptors on phagocytic cells
- ❖ So they bring microbe near phagocytic cell → easy, helped phagocytosis.
- ❖ Opsonins: antibodies (IgG) or C3b which are capable of enhancing phagocytosis.

4- Ingestion of target

- Cell membrane of phagocytes invaginate to enclose microbe → microbe become in cytoplasm surrounded by cell membrane (vacuole) phagosome

5- Phagolysosome formation

- Phagosome fuses with lysosome forming phagolysosome to kill microbe

6- Intracellular killing

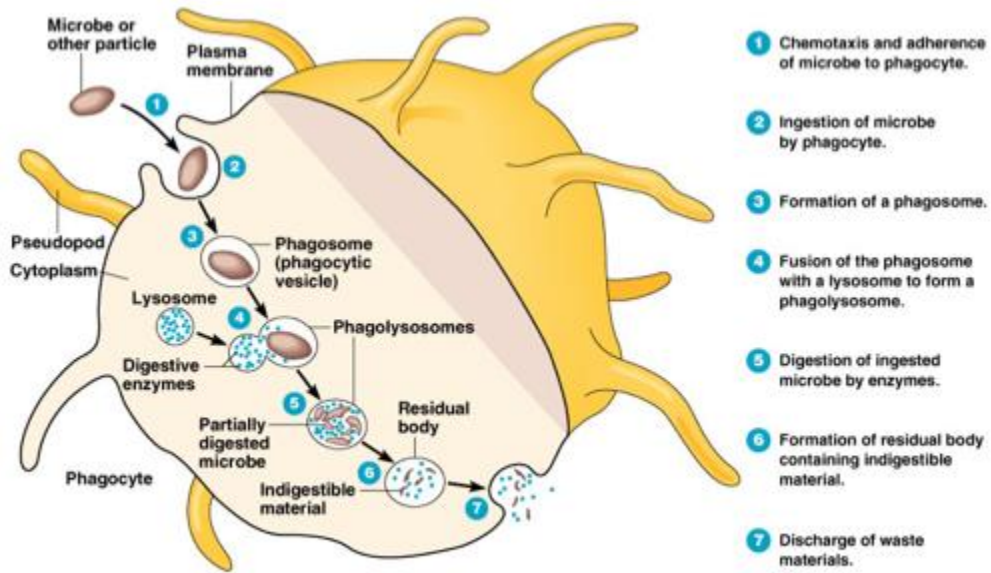
a) O₂ dependent system (Respiratory bursts):

- O₂ free radicals as H₂O₂ , O₂ & OH .

b) O₂ independent agents by using enzymes such as lysozyme, nuclease, phospholipase and lactoferrin

7- Digestion by macrophage

- ✓ Microbes now are digested into small antigen peptides which presented on MHC major histocompatibility complex (MHC) to T helper cell.



(a) Phases of phagocytosis

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COMPLEMENT

Historically, the term complement (C) was used to refer to a heat-labile serum component that was able to lysis bacteria (activity is destroyed (inactivated) by heating serum at 56 degrees C for 30 minutes). However, complement is now known to contribute to host defenses in other ways as well.

COMPLEMENT FUNCTIONS

The following are the basic functions of complement

1. **Opsonization** – enhancing phagocytosis of antigens
2. **Chemotaxis** – attracting macrophages and neutrophils
3. **Cell Lysis** – rupturing membranes of foreign cells
4. **Agglutination** – clustering and binding of pathogens together (sticking)

Complement comprises over 20 different serum proteins that are produced by a variety of cells including

- Hepatocytes,
- Macrophages
- Gut epithelial cells.

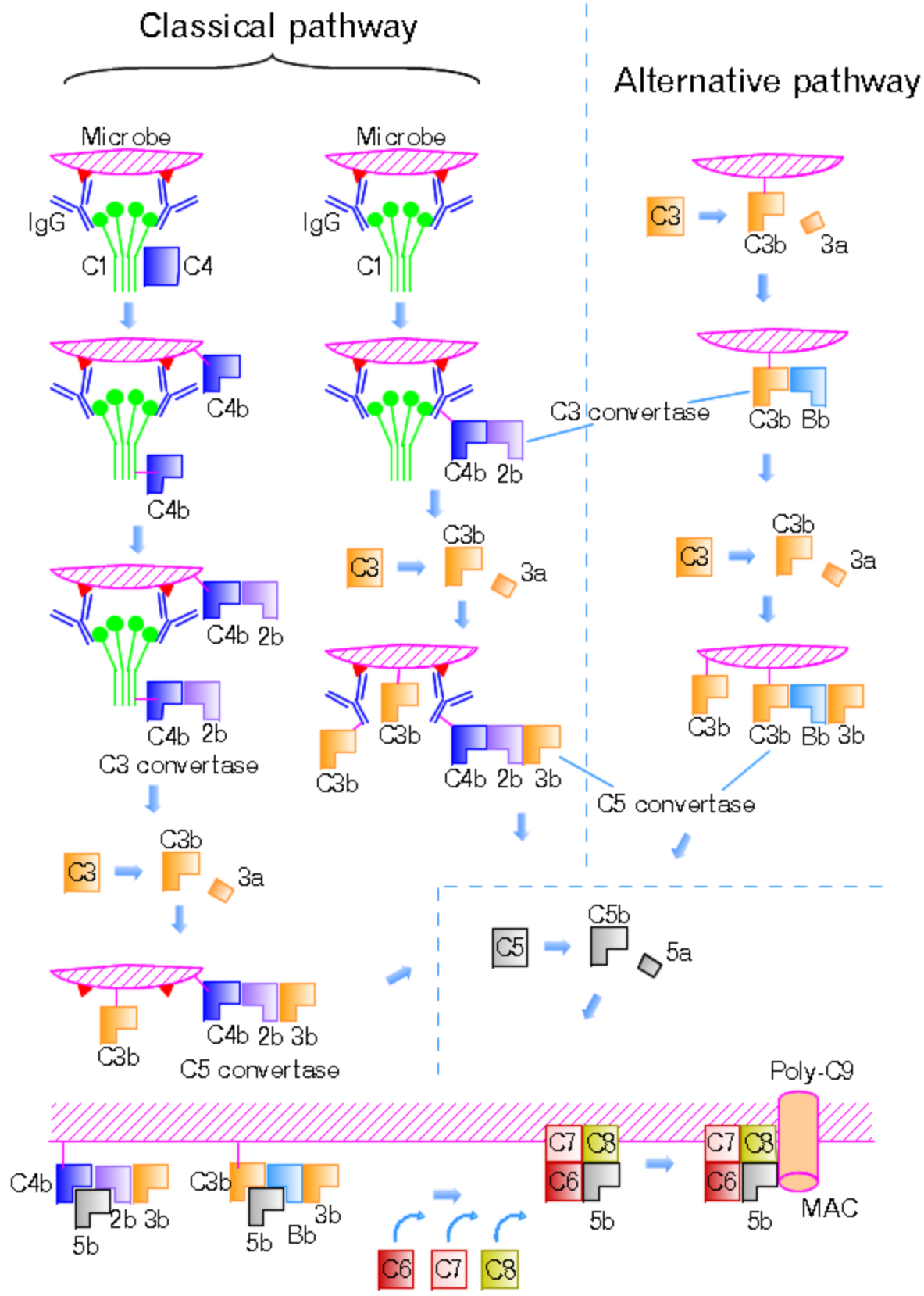
Complement activation can be divided into four pathways

- 1) classical pathway
- 2) alternative pathway

3) lectin pathway

4) membrane attack (or lytic) pathway.

Both classical and alternative pathways lead to the activation of C5 convertase and result in the production of C5b which is essential for the activation of the membrane attack pathway.



References:-

- 1- Richard Coioco and Geoffery Sunshine (2014). Immunology. Seventh edition. Wiley Blackwell.