



محاضرة رقم 3

Lecture No. 3

المناعة 1

Complement system

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Third Stage

جامعة ساوة الاهلية

كلية التقنيات الصحية والطبية

قسم تقنيات المختبرات الطبية

المرحلة الثالثة

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The complement system

The complement system, also known as complement cascade, is a part of the immune system that **enhances** (complements) the ability of **antibodies** and **phagocytic cells** to **clear microbes and damaged cells from an organism**, promote inflammation, and attack the pathogen's cell membrane.

It is a part of the **innate immune system**, the complement system can, however, be recruited and brought into action by antibodies generated by the **adaptive immune system**.

The complement system consists of **approximately 30 serum molecules consisting nearly 10% of the total serum proteins and forming one of the major defense systems of the body.** Most of the complement glycoproteins **are synthesized predominantly by the liver.**

Three main effects of complement activation

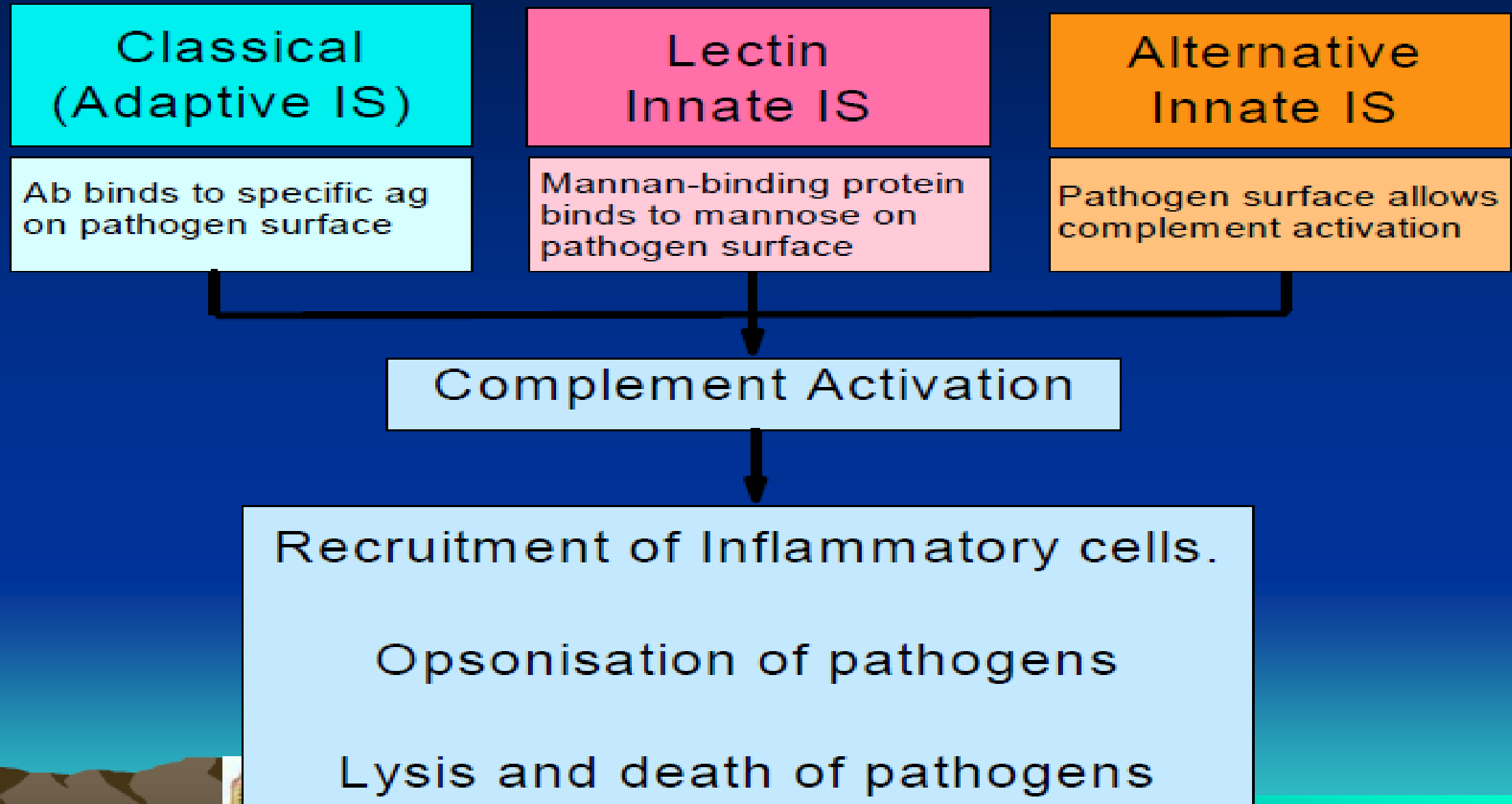
- 1. Lysis of cells** such as bacteria, allografts and tumor cells.
- 2. Generation of mediators** that participate in inflammation and attract neutrophils.
- 3. Opsonization** ie. Enhancement of phagocytosis.

Primary Function of the Complement System

The third complement component (C3) is a major factor .

The complement system can be activated by **classical, alternative and lectin pathways.**

Pathways of Complement Activation



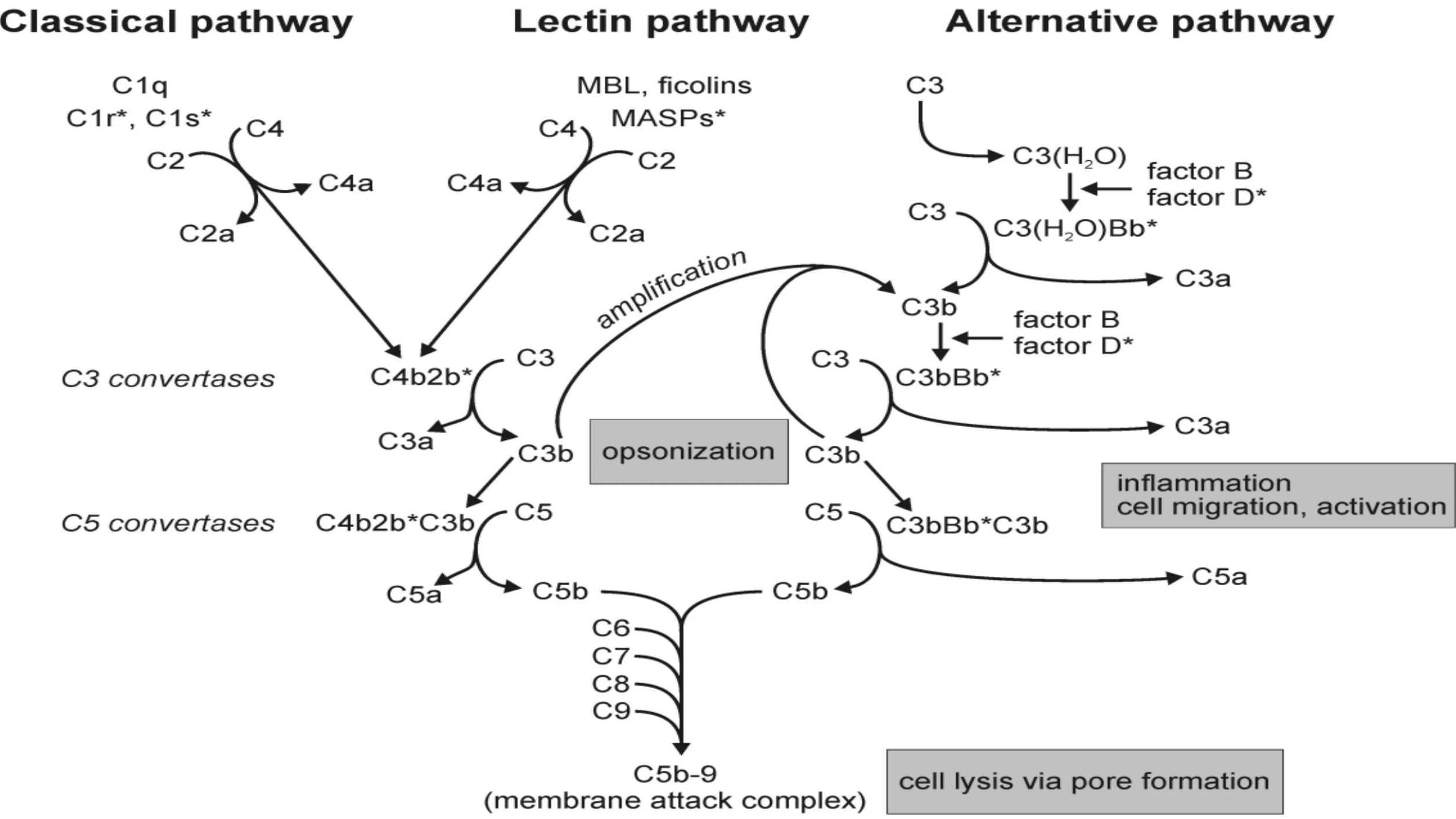
Components of the complement system

There are more than 20 components of which followings are important.

1- C1, C2, C3, C4, C5, C6, C7, C8, C9

2- Factor B, Factor D, Factor H, Factor I.

3- Properdin, C1 inhibitor, C4 binding protein, S protein.



Activation pathway	Classic	Alternative	Lectin
Activator	Ag-Ab Complex	spontaneous hydrolysis of C3	MBL-Mannose Complex
C3-convertase	C4b2a	C3bBb	C4b2a
C5-convertase	C4b2a3b	C3bC3bBb	C4b2a3b
MAC development	C5b+C6+C7+C8+C9		

Cytokines

Cytokines are a broad and loose category of small proteins (~5–20 kDa) that are important in cell signaling. Cytokines are peptides, and cannot cross the lipid bilayer of cells to enter the cytoplasm.

Cytokines include

1-A chemokine is a specific type of cytokine that can make immune cells move toward a target.

2-Interleukins are a group of cytokines that act as chemical signals between white blood cells (WBCs).

3-Interferons are chemicals that help the **body resist viral infections and cancers.**

B Cytokine	Principal cell source(s)	Principal cellular targets and biologic effects
Tumor necrosis factor (TNF)	Macrophages, T cells	Endothelial cells: activation (inflammation, coagulation) Neutrophils: activation Hypothalamus: fever Liver: synthesis of acute phase proteins Muscle, fat: catabolism (cachexia) Many cell types: apoptosis
Interleukin (IL-1)	Macrophages, endothelial cells, some epithelial cells	Endothelial cells: activation (inflammation, coagulation) Hypothalamus: fever Liver: synthesis of acute phase proteins
Chemokines	Macrophages, endothelial cells, T lymphocytes, fibroblasts, platelets	Leukocytes: chemotaxis, activation
Interleukin-12 (IL-12)	Macrophages, dendritic cells	NK cells and T cells: IFN- γ synthesis, increased cytolytic activity T cells: T _H 1 differentiation
Interferon- γ (IFN- γ)	NK cells, T lymphocytes	Activation of macrophages Stimulation of some antibody responses
Type I IFNs (IFN- α , IFN- β)	IFN- α : Macrophages IFN- β : Fibroblasts	All cells: antiviral state, increased class I MHC expression NK cells: activation
Interleukin-10 (IL-10)	Macrophages, T cells (mainly T _H 2)	Macrophages: inhibition of IL-12 production, reduced expression of costimulators and class II MHC molecules
Interleukin-6 (IL-6)	Macrophages, endothelial cells, T cells	Liver: synthesis of acute phase proteins B cells: proliferation of antibody-producing cells
Interleukin-15 (IL-15)	Macrophages, others	NK cells: proliferation T cells: proliferation
Interleukin-18 (IL-18)	Macrophages	NK cells and T cells: IFN- γ synthesis

Note :- At high concentrations, TNF promotes thrombus formation on the endothelium and reduces blood pressure by a combination of reduced myocardial contractility and vascular dilation and leakiness. Severe, disseminated bacterial infections sometimes lead to a potentially lethal

Function :-

They act through receptors, and are especially important in **the immune system**; **cytokines modulate the balance between humoral and cell-based immune responses, and they regulate the maturation, growth, and responsiveness of particular cell populations. Some cytokines enhance or inhibit the action of other cytokines in complex ways**

Antigen-Presenting Cells

Antigen-presenting cells (APCs) located in the epithelium that capture antigens, transport them to peripheral lymphoid tissues, then expose it to the surface of its [antigen](#) embedded in the molecular pocket of individually specific *major histocompatibility complex (MHC)* proteins **and display (present them to lymphocytes.**

Antigen-presenting cells (APCs) are primarily phagocytic cells:

- dendritic cells,
- macrophages
- B-lymphocytes (possibly activated T-lymphocytes).

Thank
you!

