



IMMUNOLOGY FIRST COURSE

EFFECT OF COMPLEMENT AGAINST BACTERIA

Sawa University

جامعة ساوة الاهلية

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قسم تقنيات المختبرات الطبية

Third Stage

المرحلة : الثالثة

محاضرة رقم 8

الجانب العملي

Lecture No. 8

Practical

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Introduction

- The complement system is a set of over 30 plasma proteins.
- Produced mainly by the liver.
- Circulates in an inactive form.
- Activated in a cascade to fight infections.

Complement Activation Pathways

- 1. Classical Pathway** – Triggered by antibody (IgG or IgM) bound to bacterial surface.
- 2. Alternative Pathway** – Triggered by direct binding of complement (C3b) to bacterial surface.
- 3. Lectin Pathway** – Triggered by mannose-binding lectin (MBL) binding to bacterial carbohydrates.

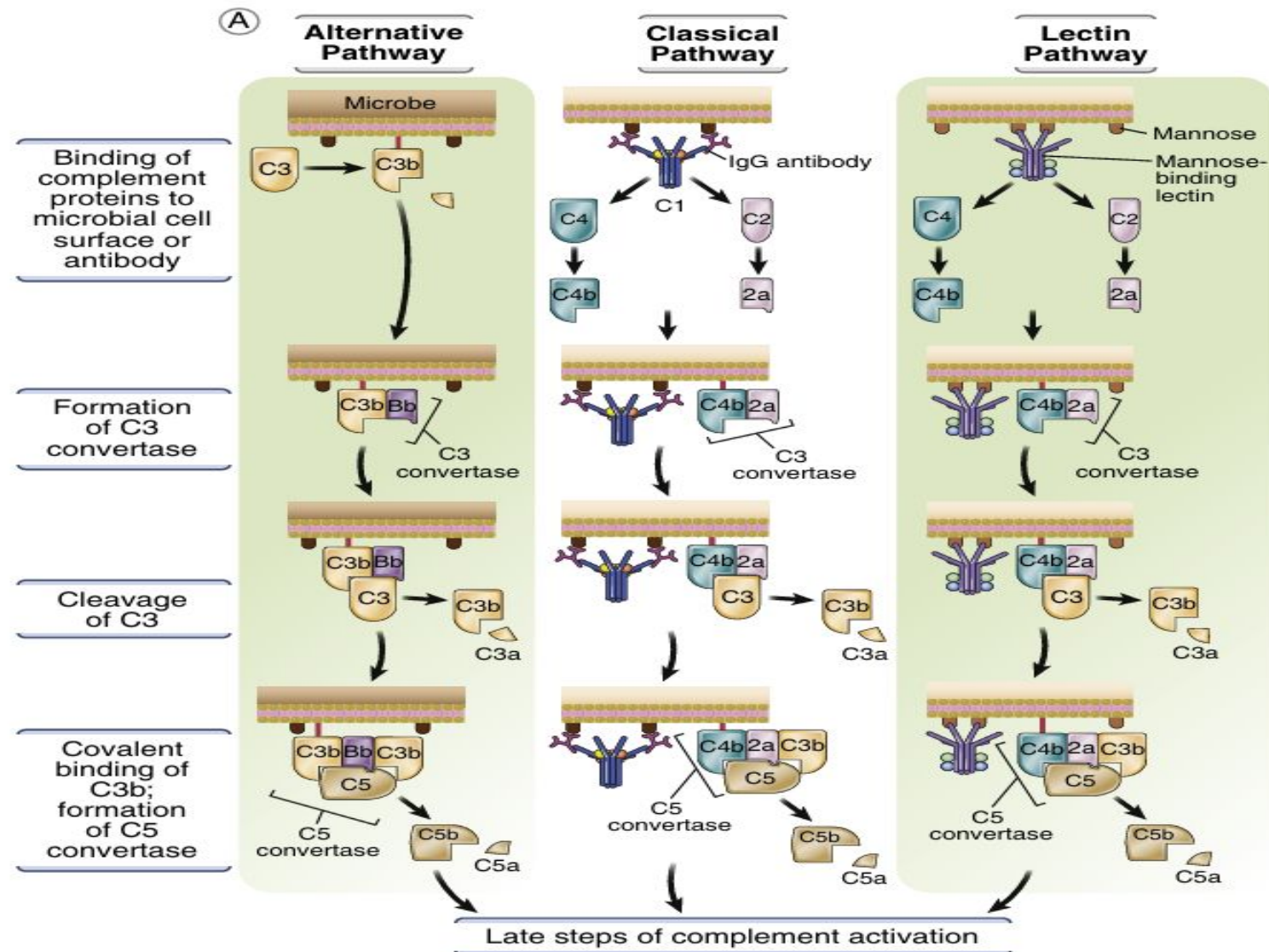
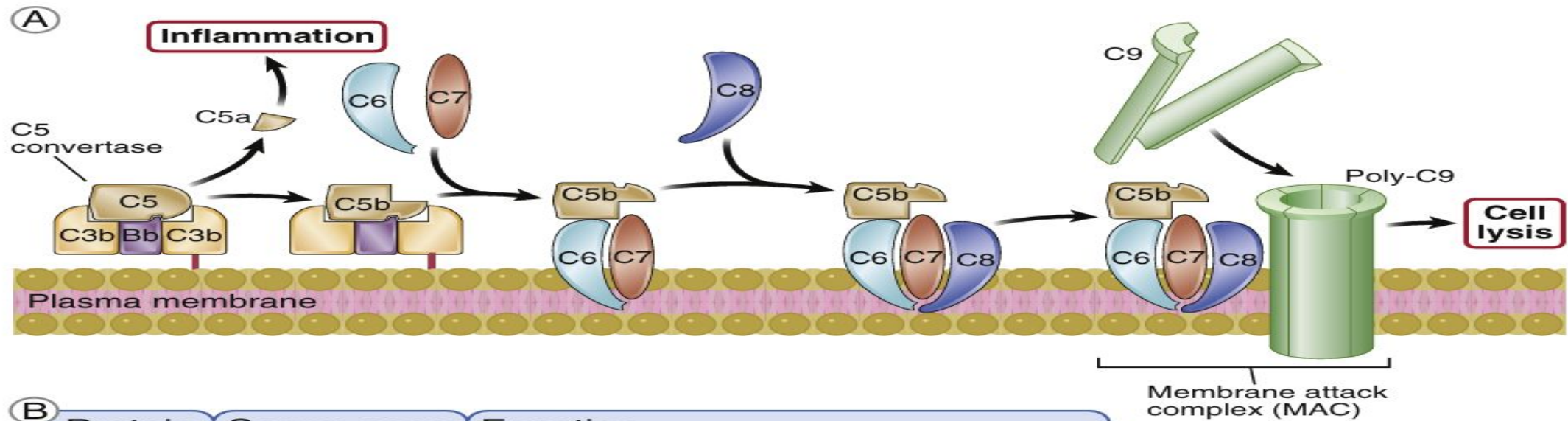


Fig. 8.9 Early steps of complement activation. A, The steps in the activation of the alternative, classical, and lectin pathways. Although the sequence of events is similar, the three pathways differ in their requirement for antibody and the proteins used. Note that C5 is cleaved by the C5 convertase but is not a component of the enzyme.

1. Bacterial Cell Lysis (Killing)

- a) The Membrane Attack Complex (MAC: C5b–C9) forms pores in bacterial membranes.
- b) Causes leakage of ions and water leading to cell lysis.
- c) Most effective against Gram-negative bacteria such as *Neisseria* species.



B

Protein	Serum conc. (µg/mL)	Function
C5	80	C5b initiates assembly of the membrane attack complex (MAC) C5a stimulates inflammation
C6	45	Component of the MAC: binds to C5b and accepts C7
C7	90	Component of the MAC: binds C5b, 6 and inserts into lipid membranes
C8	60	Component of the MAC: binds C5b, 6, 7 and initiates binding and polymerization of C9
C9	60	Component of the MAC: binds C5b, 6, 7, 8 and polymerizes to form membrane pores

Fig. 8.10 Late steps of complement activation. **A**, The late steps of complement activation start after the formation of the C5 convertase and are identical in the alternative and classical pathways. Products generated in the late steps induce inflammation (C5a) and cell lysis (membrane attack complex). **B**, Properties of the proteins in the late steps of complement activation.

2. Opsonization (Enhanced Phagocytosis)

- a. C3b binds to bacterial surfaces and acts as an opsonin.
- b. Phagocytes recognize C3b through their receptors.
- c. Facilitates bacterial ingestion and killing.

3. Inflammation and Chemotaxis

- a. C3a and C5a act as anaphylatoxins.
- b. They increase vascular permeability and recruit immune cells.
- c. Stimulate mast cell degranulation and histamine release.

4. Immune Complex Clearance

- a. Complement helps remove antigen–antibody complexes.
- b. C3b binds these complexes to allow clearance by the liver and spleen.

Summary of Complement Effects

1. **C3b** – Opsonization (enhances phagocytosis)
2. **C5a** – Chemotaxis and inflammation
3. **C3a** – Inflammation (mast cell activation)
4. **C5b–C9 (MAC)** – Direct bacterial lysis
5. **C4b** – Opsonization (less potent than C3b)

Any questions?

*Thank
You*