

# MIRACLE Academy

قال تعالى (يَزِفَعُ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ)

تفريغ المناة  
زميلتكم يقين خليل

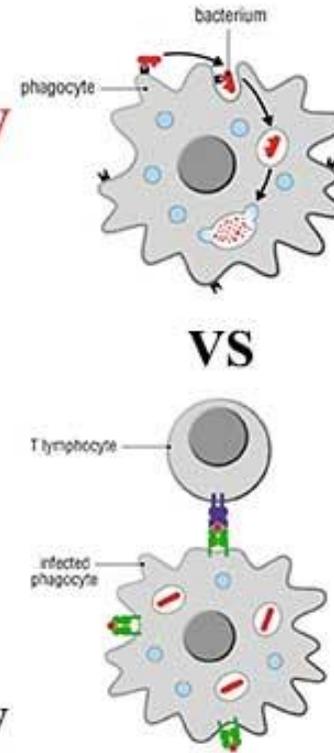
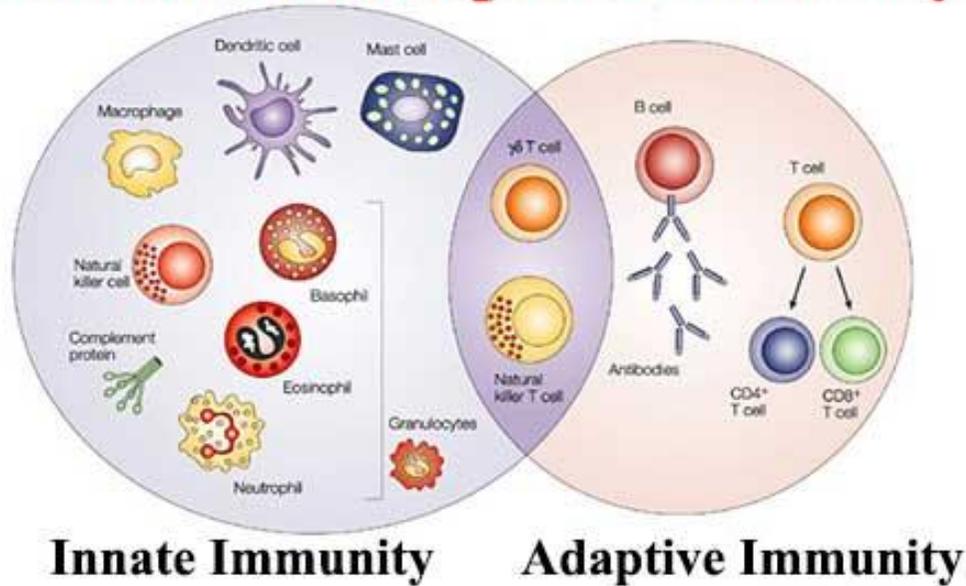
- اللهم لا سهل الا ما جعلته  
سهل وانك تجعل العزن  
اذا شئت سهل ...  
- بسم الله



لجان الدفعات

# Innate Immunity

## Difference between Innate and Adaptive Immunity



# Objectives

- Discuss the concept of innate immunity - features, importance.
- Explain how the innate immune system recognizes foreign antigens in general.
- Outline the components of the innate immune system.
- Discuss how these components combat various foreign antigens.

# Introduction

و طبيعتها تعمل حماية من العدوى

- Protection against infections that relies on the mechanisms that exist before infection and are capable of rapid response to pathogens

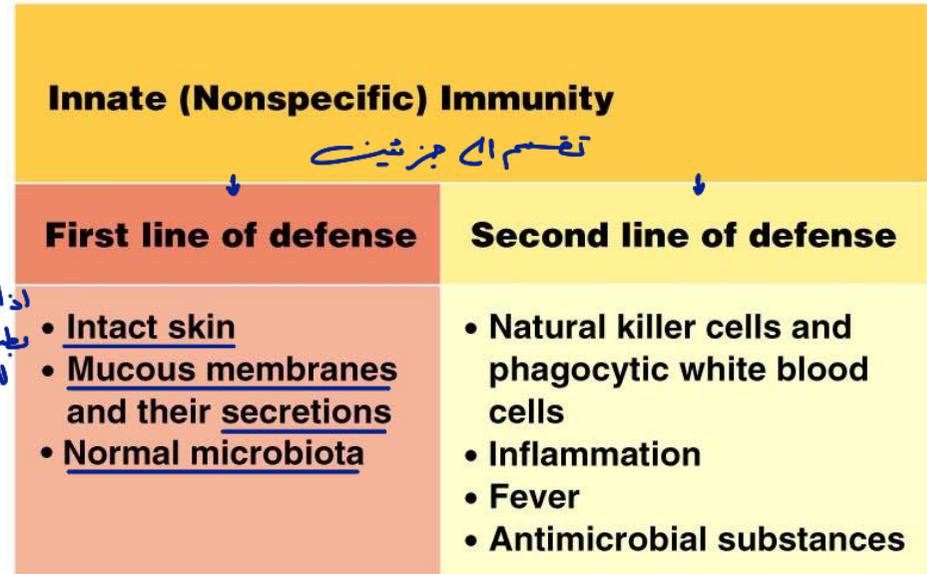
تتعمد على طرق املاء موجودة في الجسم وما يكون فيها  
specificity او Memory

- Innate immunity is the first line of defense against infection

## Characteristics:

- set up at birth
- non-specific
- hereditary
- no immune memory
- Little individual difference

اذا ما رخي جرح او تلغ مثل المروق  
طبقت الجلد يكون الجسم ملزم  
للعدوى مثل مرضية الدم



# Innate Host Defense Mechanisms

كيف يشتغل الجسم من طريقه  
innate system

كله عباره عن جزء من  
innate

- Physical factors
- Biochemical factors
- Microbiological factors
- Fever
- Innate Immune cells
- Cytokines
- Complement system
- Inflammation

# 1. Physical Factors

بجناح 28 يوم حتى يتجدد وتجدد الخلايا يمنع نمو البكتريا يليه 2 نروج مع الجلدا يتغشتر →

1. **Skin**: microbes sloughed off along with skin cells,

Microbes must penetrate several layers

- Stratified and cornified epithelium provides a mechanical barrier
- Indigenous microbial flora competes with pathogens
- Acid pH inhibits growth of disease producing bacteria
- Bactericidal long chain fatty acids in sebaceous gland secretions

تبااض Normal Flora الميكروبات

عبارة عن اخراجات

Fatty Acids من بكتريا

2. **Mucous membranes**: produce mucus to trap microbes, most lined with cilia

مادة لزجة تعلق فيها الميكروبات  
و مجرعة cilia بيخرج خارج الجسم

## 2. Biochemical Factors

→ This environment is not suitable for most of the pathogens

1. **Low pH** in vaginal and urinary tracts, and stomach

في منام انواع Alpha α & Beta β

2. **Defensins**: short antimicrobial peptides, insert into bacterial membranes and form pores.

اول مرة اكتشفها على جلد الضفدع ووجدوا انواعها Antibacterial effect

3. **Lysozyme**: degrades peptidoglycan

يرتبط بالفضاء بين الجزيئات وبيقل فيه فتكون بزيد permeability و بيقل lysis

- **Tears** contain a high concentration of lysozyme (**effective against gram positive microorganisms**)

موجودة بشكل كبير في الدموع

4. **Interferon**: are cytokines that trigger:

↓  
اكتر اشياء

- **Macrophage activation** Macrophage بتحفز تنشيط

• بروج صند

- Production of substances to **interfere with RNA viral reproduction**

Viral infections

# Antimicrobial Peptides/Defensins



- Originally **isolated from frog skin** based on their **ability to kill bacteria**

جسمه صغير

- **Small polypeptides** (<10kDa) **secreted at mucosal surfaces**

- Four hundred peptides described to date

موجود بالحشرات والنباتات  
والإنسان

- Defensins (four families in eukaryotes)

بالإنسان

- **$\alpha$ -defensins** (neutrophils and intestinal Paneth cells)

- **$\beta$ -defensins** (epithelial cells)

- **Insect defensins**

- **Plant defensins**

- Defensins appear to act by binding to outer membrane of bacteria, resulting in increased membrane permeability

- May also **play a role in inflammation** and **wound repair**

### 3. Microbiological Barriers

- **Normal Flora**: is **not part of immune system**, but are **part of first line of defense**  
من خلال انهما يتنافسان pathogens بالتالي  
لتساعد الجسم يتخلص منط.
- Protection they provide is considerable
  - **Competitive exclusion** of invading microbes
  - **Produce compounds that are toxic to other bacteria**  
- يتنافسان pathogens الأخرى على مصادر، الغذاء بالتالي يمنع نموها وتكاثرها  
- تبغز مواد تقتل من غيرها pathogens  
- لما بنا ضد Antibiotic نجر من هاي Normal flora للتخل بالتالي يمنع للبكتريا الضا، انهما نمو  
- مثل في حالات UTI (Urinary tract infections) لما بصير في عدوى مثل العدوى بال زكام. ع  
بنستعملهم ادوية Sulpha drugs  
الما لواعطيناهم Ciprofloxacin فينبر منفرهم، Secondary infection بالظريات.

- الحرارة العالية بالجسم يكون الهدف منها هو قتل البكتيريا التي تكون حساسة للحرارة .

## 4. Fever

- لكي عند الاضطراب كيميائي ما ترتفع حرارتها كثير لحد ما يصير تلحق بالخلايا الدماغية

### • Mechanism of fever:

1. Higher body temperature occurs as a result of certain cytokines called pyrogens وهي نوع من انواع cytokines تبغطي اشارة لـ hypothalamus لحد ترتفع حرارة الجسم .
2. Cytokines carried in bloodstream to hypothalamus
3. Hypothalamus responds by raising temperature بالتالي تبصر اعلى مع optimum growth Temperature

### • Fever inhibits growth of many pathogens by at least two mechanisms:

1. Elevates temperature above optimum growth temperature
2. Activates and speeds up a number of other body defenses

# 5. Innate Immune Cells

Cell type

Principal function(s)

Monocytes/Macrophages

Phagocytosis, inflammation,  
T-cell activation, tissue repair

Neutrophils

Phagocytosis, inflammation

NK cells

↳ Natural killer

Killing of infected or tumor cells

Dendritic cells

Phagocytosis, activation of naive T-cells  
↳ يکي ما تعريفت على اي antigen (مقابل).

Mast cells

Inflammation

Eosinophils

Defense against parasites

# Phagocytes

• Performed by **Neutrophils** and **Macrophages**

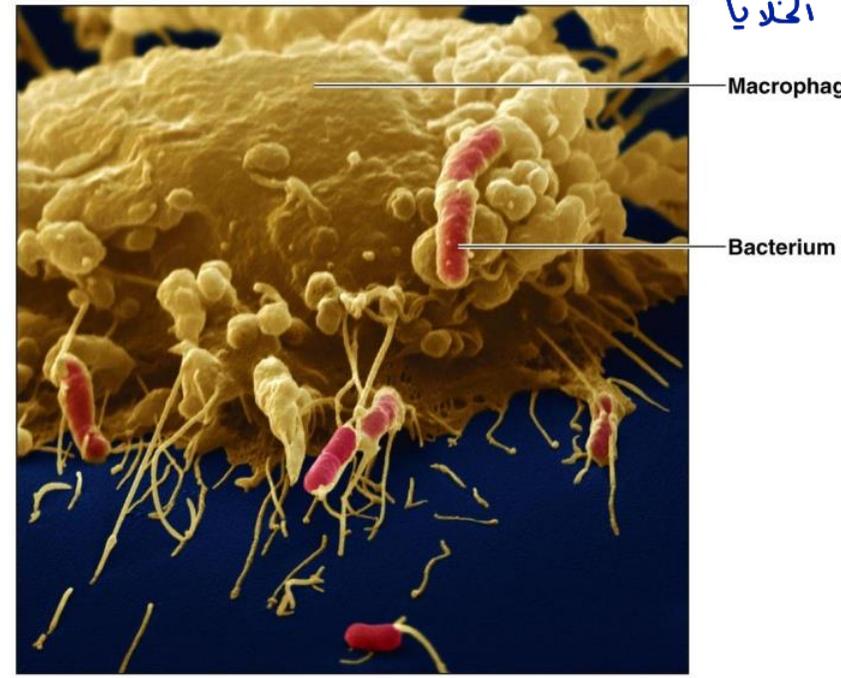
1. **Phagocytosis** is the **capture** and **digestion** of **foreign particles**
2. **Chemokines** are **cytokines** that attract **macrophages** and **neutrophils** to infected tissues
3. **Opsonins** attach to microbes to increase the ability of **phagocytes** to **adhere** (opsonization)

هذه دور Cytokines يجذبوا الخلايا للنطقة  
يلج منها البكتيريا  
بمساعدة الالتصاق  
الخلايا

Macrophages تكون عندها شعيرات مثل الخطافات  
وظيفةها تحمل Capturing للبكتيريا.

ومن طريق endocytosis يتدخل الى داخل الخلية

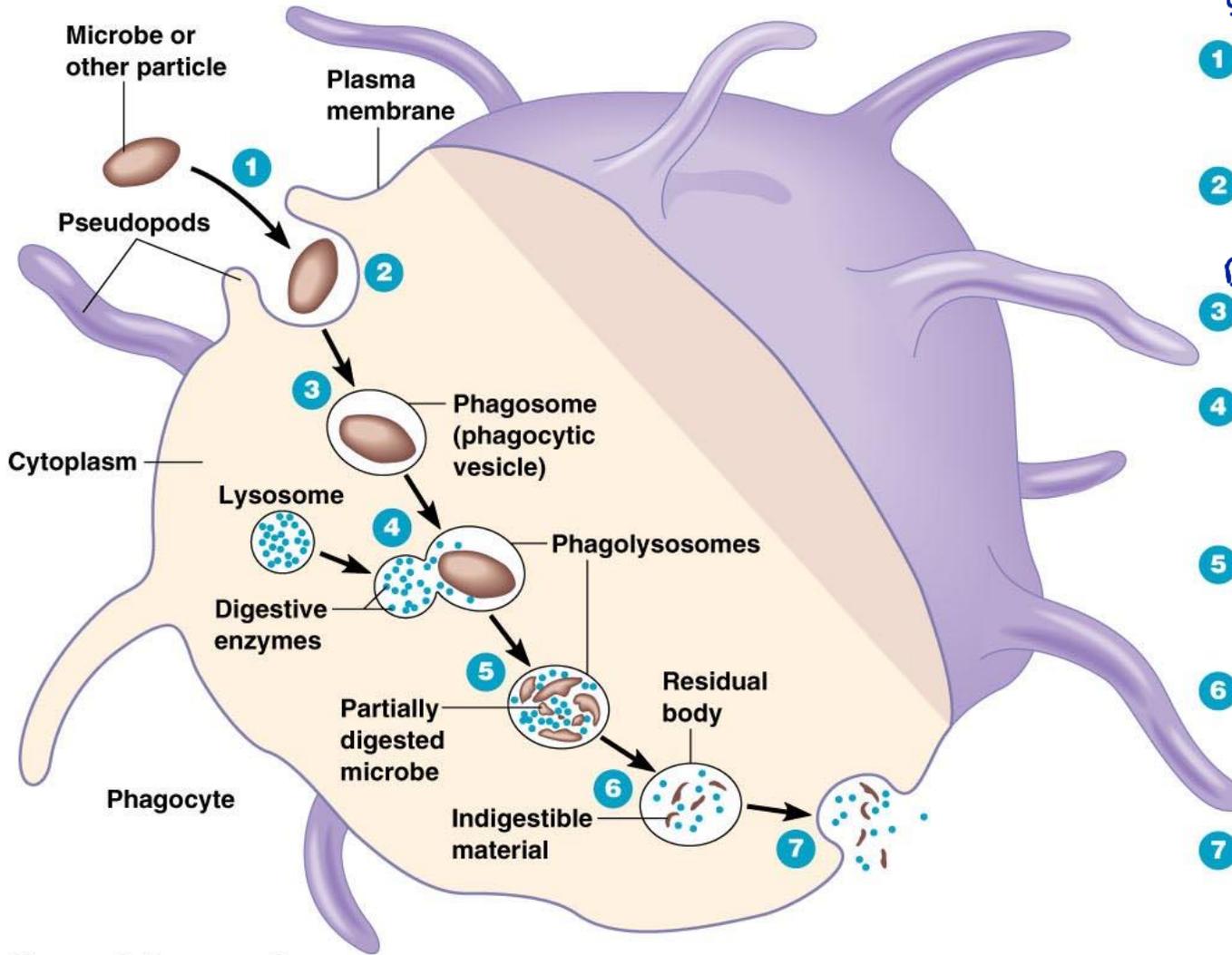
تكون داخل الخلية في vacule فيه lysosimes تتحلل degradation  
للبيكتيريا عن طريق اتحاد vacules يلي فيها البكتيريا مع  
vacule يلج فيها lysosimes بعدها بصير exocytosis



# Steps of Phagocytosis

- Recognition
- Ingestion- pseudopods engulf microbe through endocytosis  
*الخطافات الموجهة على الخلية*
- Vacuole Formation- vacuole contains microbe
- Digestion- vacuole merges with enzymes to destroy microbes
- Exocytosis- microbial debris is released

# الصورة بتوضح الحكي يلي حكيانه فوق



بتعبر ن الخويا

1 Chemotaxis and adherence of microbe to phagocyte

2 Ingestion of microbe by phagocyte

Bacterin يلي فيها vacule  
3 Formation of a phagosome

4 Fusion of the phagosome with a lysosome to form a phagolysosome

5 Digestion of ingested microbe by enzymes

6 Formation of residual body containing indigestible material

7 Discharge of waste materials

Phases of phagocytosis

# Innate Immune Recognition

كيف جسمنا يميز انوي بي دخوله pathogen؟

كل pathogens على اختلافها عندنا شيء مشترك

وهي conserved molecules تكون موجودة بال pathogens بين ما يتكون موجودة عند Host (يعني لجسمنا)

- All multi-cellular organisms are able to recognize and eliminate pathogens
- Despite their extreme heterogeneity, pathogens share highly conserved molecules, called "pathogen-associated molecular patterns" (PAMPs)
- Host cells do not share PAMPs with pathogens
- PAMPs are recognized by innate immune recognition receptors called pattern-recognition molecules/receptors (PRMs/PRRs)

التنوع الكبير



(Antigen presenting cells, cytokines) Mediation of inflammatory response

يحمل بالها

# Typical PAMPs

- **Typical PAMPs:** انواع  
  - Lipopolysaccharides
  - Peptidoglycans
  - Certain nucleotide sequences unique to bacteria
  - Other bacterial components
- **Binding of Innate immune receptors and PAMPs:**
  - Mediate inflammatory cytokines
  - Antigen-presenting cells recognize PAMPs

# 6. Cytokines

ما يتخز الأ كبا استجابة لـ Microbes

الخلايا التي تتصرفها

- In response to microbes, macrophage and other cells secretes proteins called cytokines that mediate many cellular reaction in innate immunity

وظيفتها ↑

- Cytokines act as

- Inflammatory mediators تتغز inflammation أو يبدأ أو يصير كيف؟

- Communication between leukocytes and leukocytes and other cells

- 4 kinds:

حيزب الخلايا المناعية

- **Chemokines**: important in chemotaxis of immune cells

- **Interferons**: glycoproteins important in the control of viral infections; also help regulate cells involved in immune response

- **Interleukins**: important in innate immunity, inflammation, and adaptive immunity

- **Tumor necrosis factors**: help kill tumor cells, initiate programmed cell death (apoptosis)

الجين المسؤول هو P53

جديد يتم استخدامه في  
مرضى ICU المصابين بـ  
Covid-19 الدور في تحليل  
معدل الوفاة بينهم

# 6. Complement System

- The complement system is a collection of **circulating and membrane associated proteins** that are **important in defense against microbes**
- Many complement proteins are **photolytic enzymes** and **complement activation involve the sequential activation of these enzymes called the enzymatic cascade**
- Three pathways to activate the complement system *Complement System* *كيف يتم تحفيز*
  - • **Classical**: **activated by antibody binding to microbes or antigen** (adaptive part)
  - • **Alternative**: **directly activated by microbes** (innate immunity) *ممكنه يصير له تفعيل من نفس الميكروب*
  - • **Lectin pathway** (**binding to mannose-containing carbohydrates**) (innate immunity- no need for antibodies) *في الميكروب بدون Antibodies*

# 6. Complement System

خلايانا بكون فيها هاد البروتين على سطح الخلية.

- Host cells have complement regulatory proteins on their surface that protect them from spontaneous activation of C3 molecules while microbes can activate the complement pathway but it have no regulatory proteins

هي ما يتكون شخالة دائماً فقط لما يجي Microbe هو ياي بيحلقها Activation

- When pathogen activates the complement system this initiates innate immunity response by three main mechanisms:

- Inflammation
- Phagocytosis and lysis
- Opsonization

Pathogen بيحلق تفعيل لاد Complement وهاد الإثبي

بيشغل جرها، المناعة innate وبيحدث 3 انواع من Mechanisms

كتف تقضي على هاد Pathogen :-

↓  
Macrophages يتعزز  
و بتز يد Phagocytosis

stimulation of Adaptive      innate  
لما يتكون كافيّة لحق الجسم يتقاوم الأمراض ولا يزال

## Role of innate immunity in stimulation of adaptive immune response

- Adaptive immune system activation (T or B-cells) need two signals for activation
  - First signal: antigen recognition
  - Second signal: derived by innate immunity