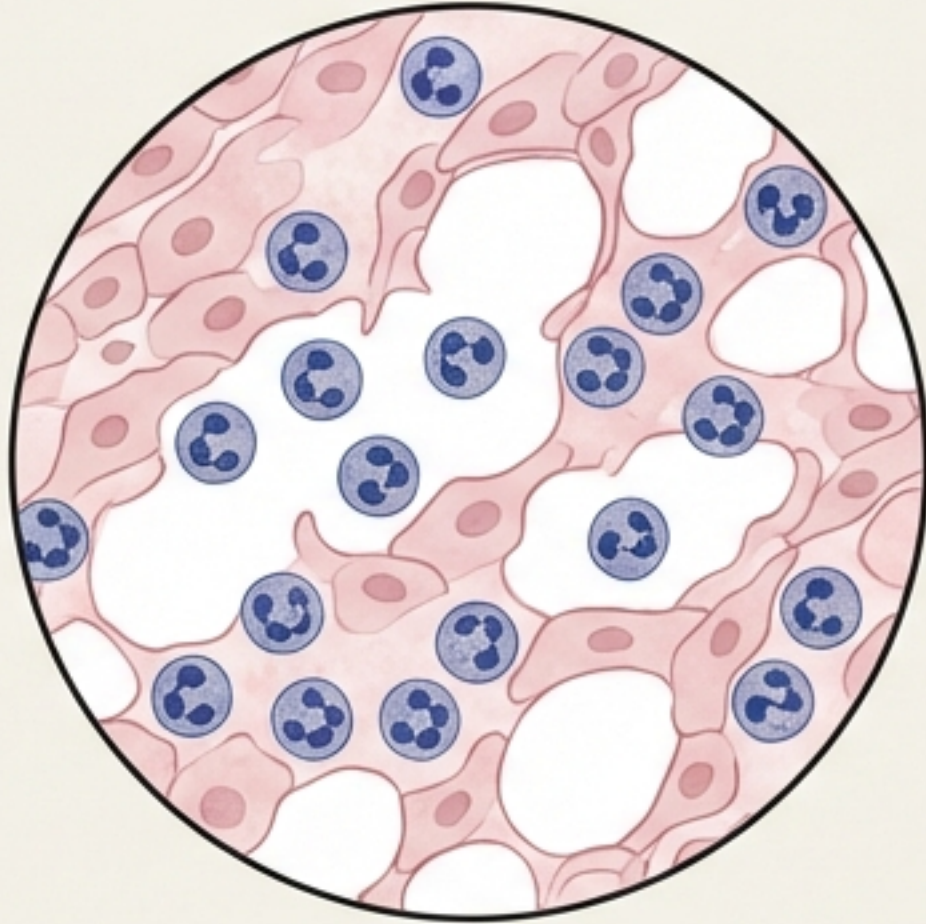


# Acute Inflammation: The Body's Immediate Defense, in Heldane Display

## Mechanisms, Mediators, and the Cellular Response Cascade, in Inter

# The Battlefield: Acute vs. Chronic

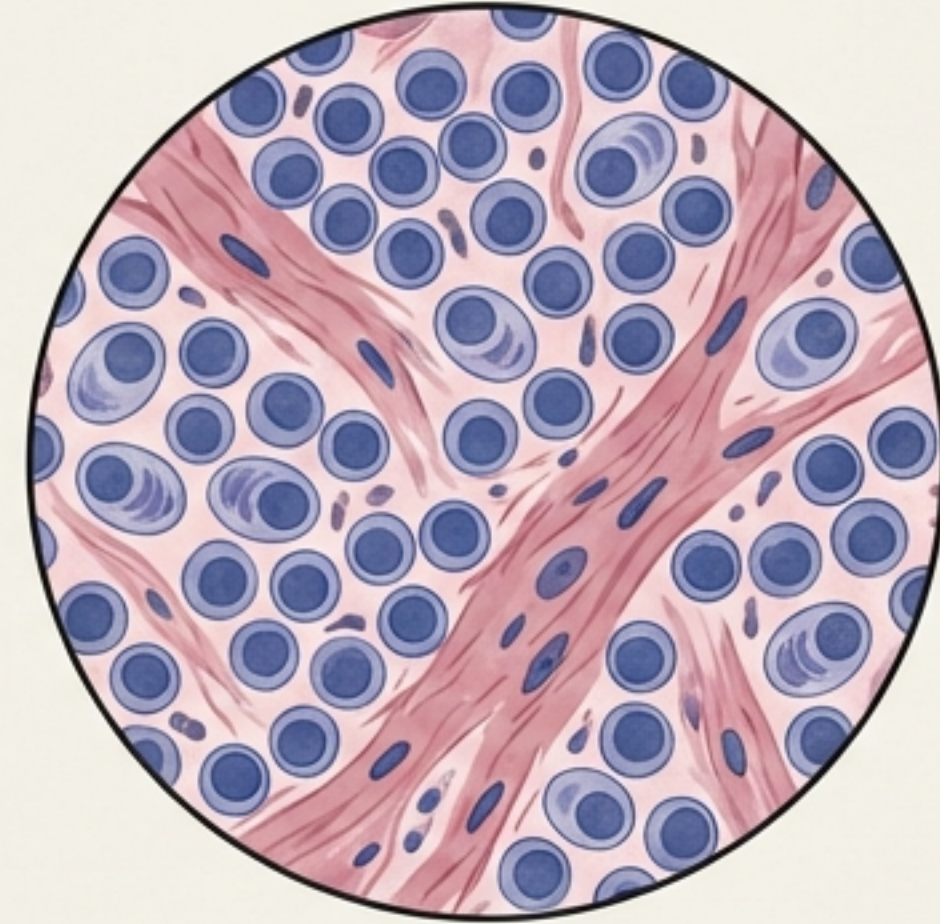
## ACUTE INFLAMMATION



### ACUTE

Innate Immunity  
Immediate Response  
Limited Specificity  
Key Markers: Edema + Neutrophils

## CHRONIC INFLAMMATION



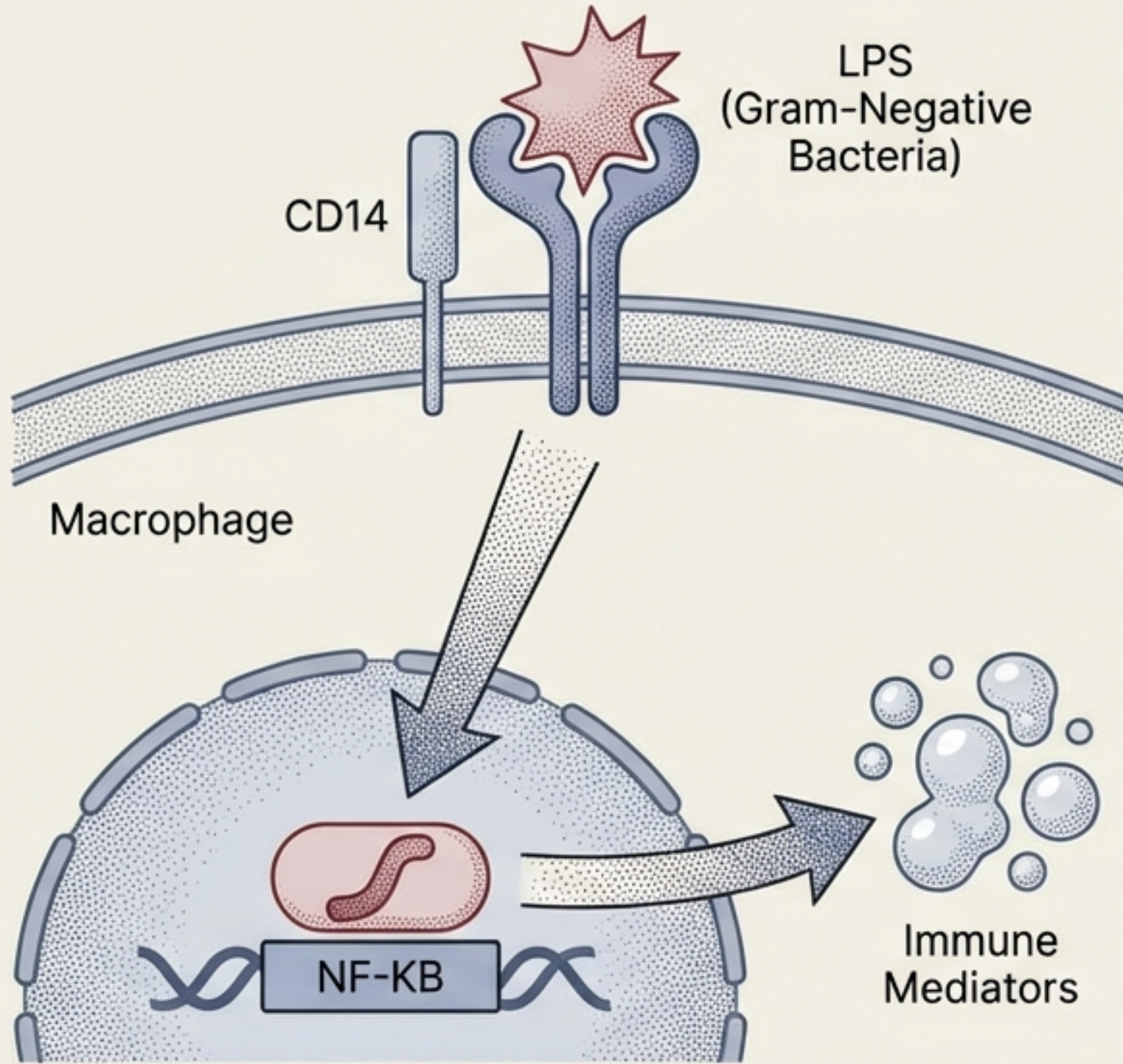
### CHRONIC

Adaptive Immunity  
Delayed Response  
High Specificity  
Key Markers: Lymphocytes + Plasma Cells

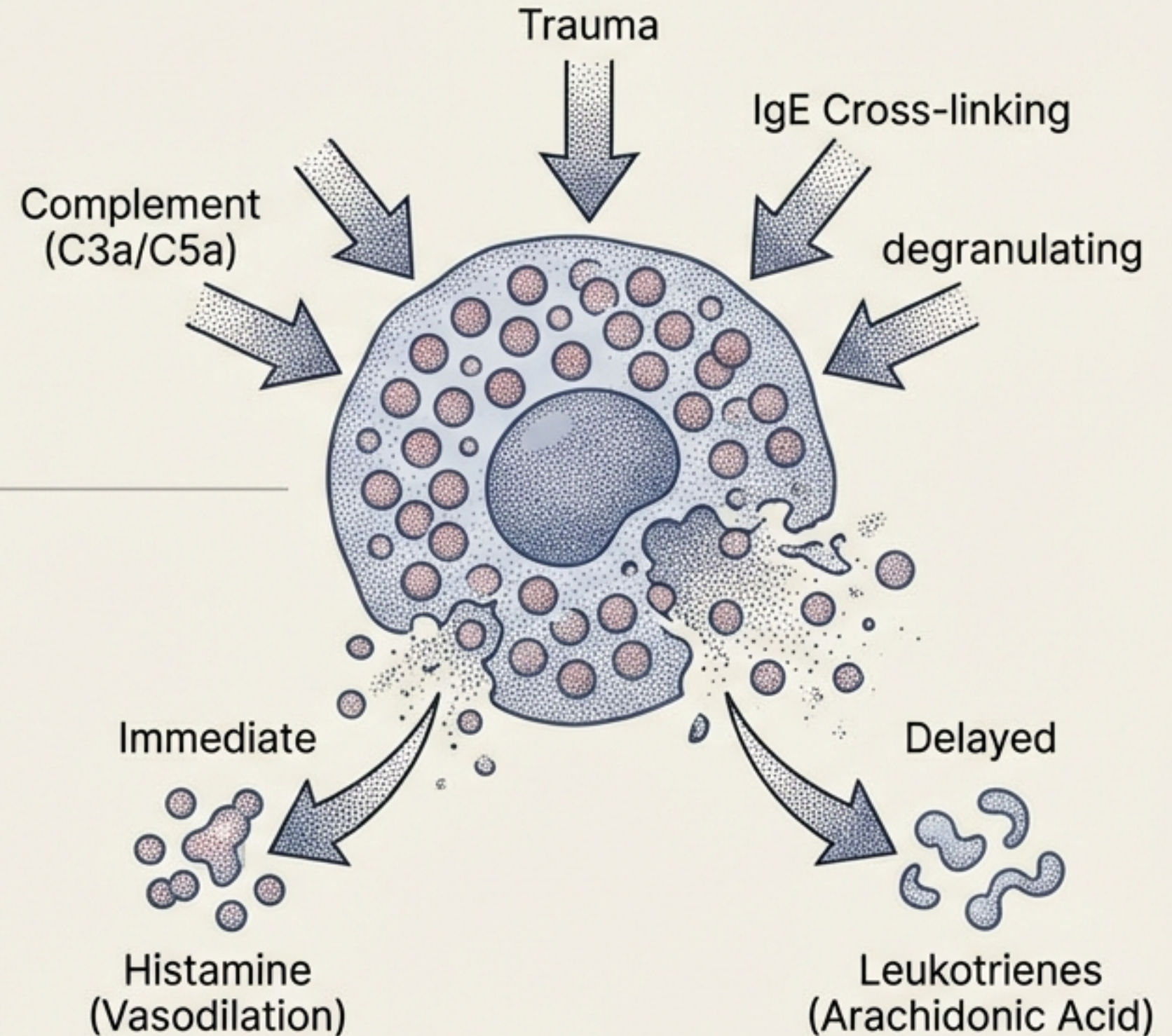
Inflammation is the delivery mechanism for cells and proteins to exit blood vessels and enter the interstitial space to eliminate pathogens or clear necrosis.

# Recognition: The Sentinels

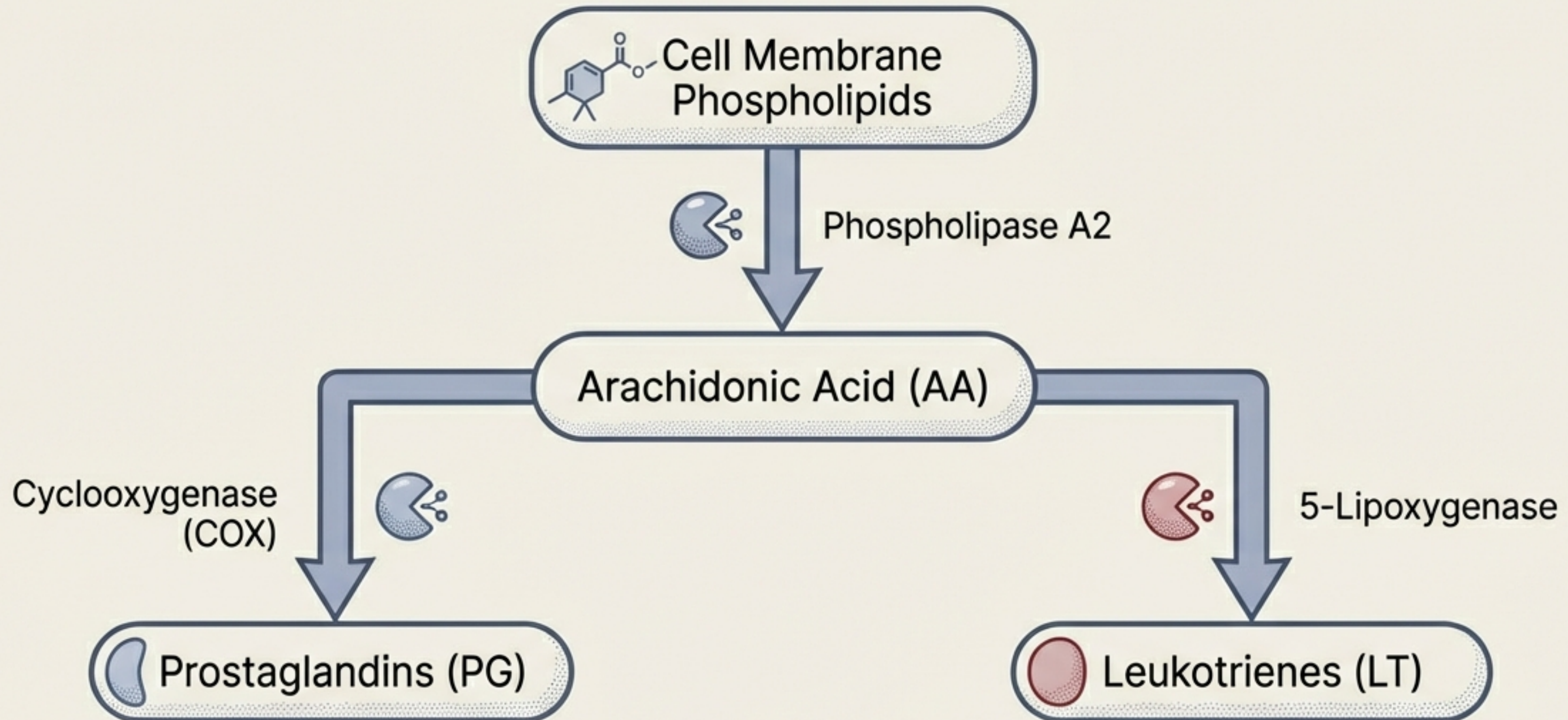
## The Toll-Like Receptor (TLR)



## The Mast Cell



# The Chemical Cocktail: Arachidonic Acid Pathway

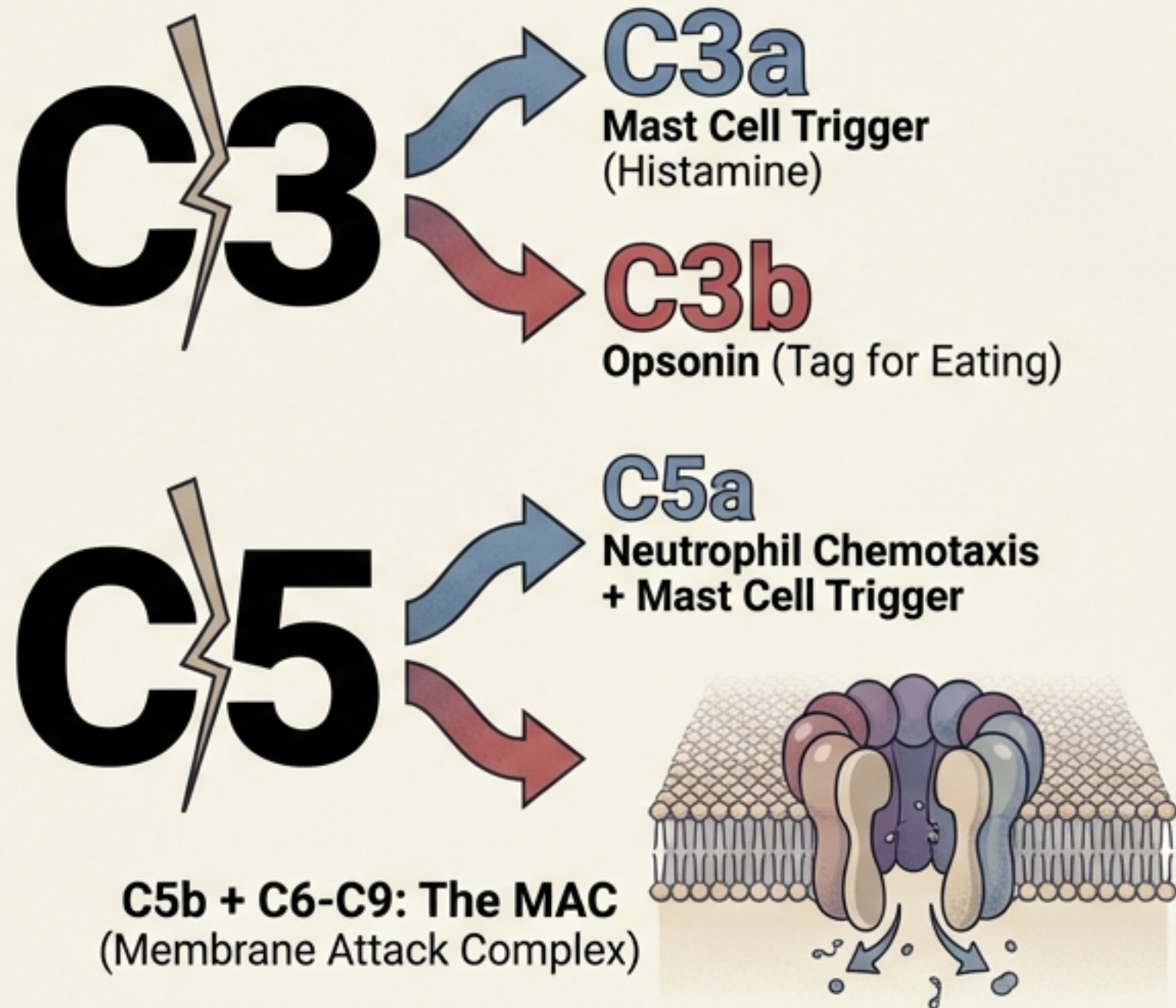


- PGI<sub>2</sub>, PGD<sub>2</sub>, PGE<sub>2</sub> → Vasodilation & Permeability 🩹
- PGE<sub>2</sub> → Pain & Fever 🦻

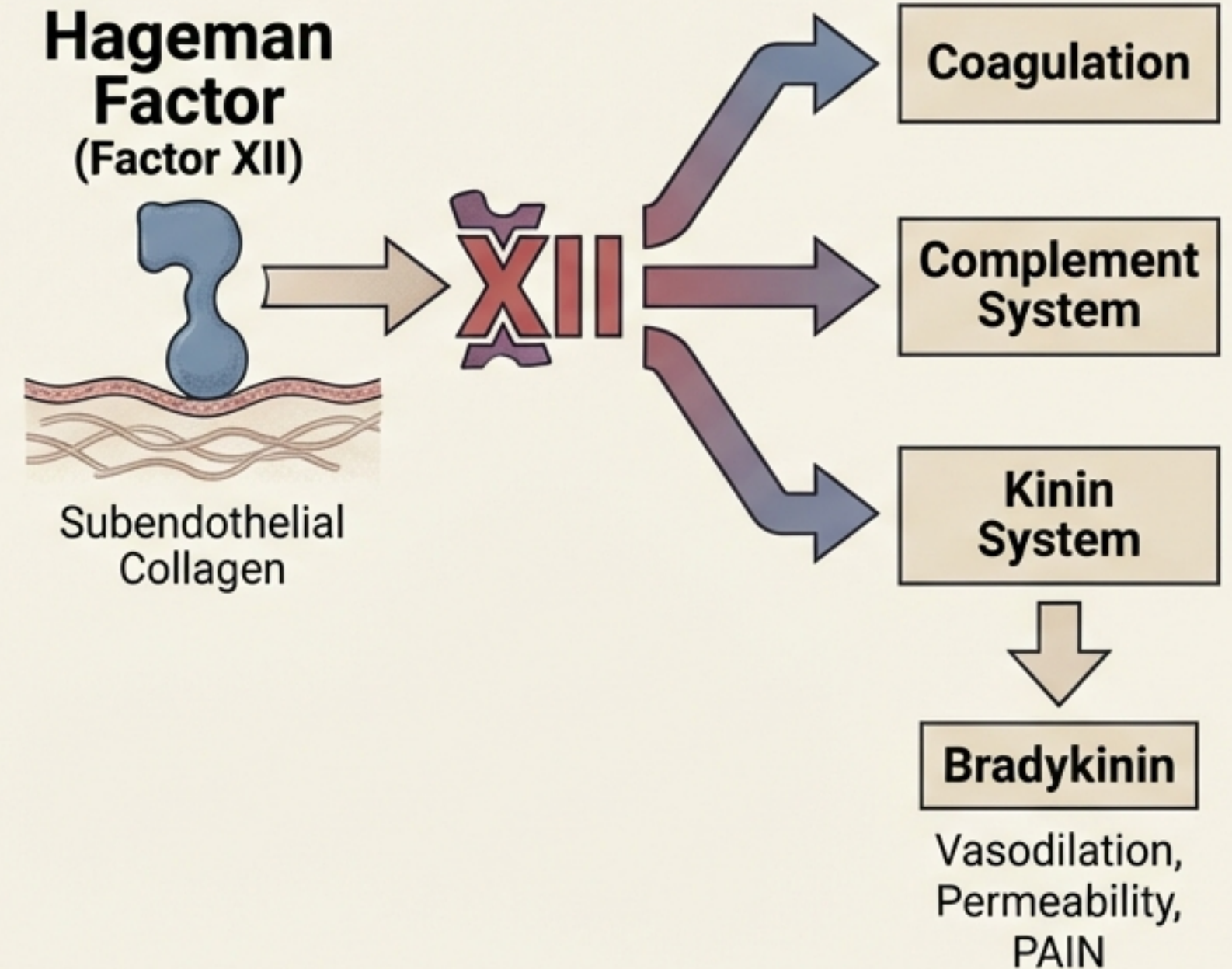
- LTB<sub>4</sub> → The Recruiter (Neutrophil Chemotaxis) 🫁
- LTC<sub>4</sub>, LTD<sub>4</sub>, LTE<sub>4</sub> → Bronchospasm & Permeability

# Systemic Reinforcements: Complement & Factor XII

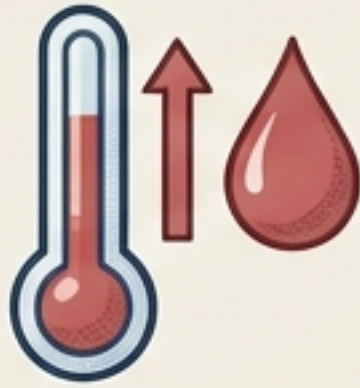
## The Complement Cascade



## Hageman Factor (Factor XII)



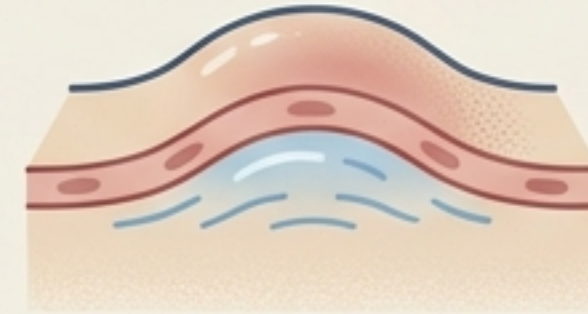
# The Cardinal Signs: Physiology Meets Symptom



## Redness (Rubor) & Warmth (Calor)

**Mechanism:** Vasodilation (Arteriolar relaxation)

**Molecules:** Histamine, Prostaglandins, Bradykinin



## Swelling (Tumor)

**Mechanism:** Endothelial contraction allowing fluid leakage (Exudate)

**Molecules:** Histamine, Tissue Damage



## Pain (Dolor)

**Mechanism:** Sensitization of sensory nerve endings

**Molecules:** Bradykinin, PGE2

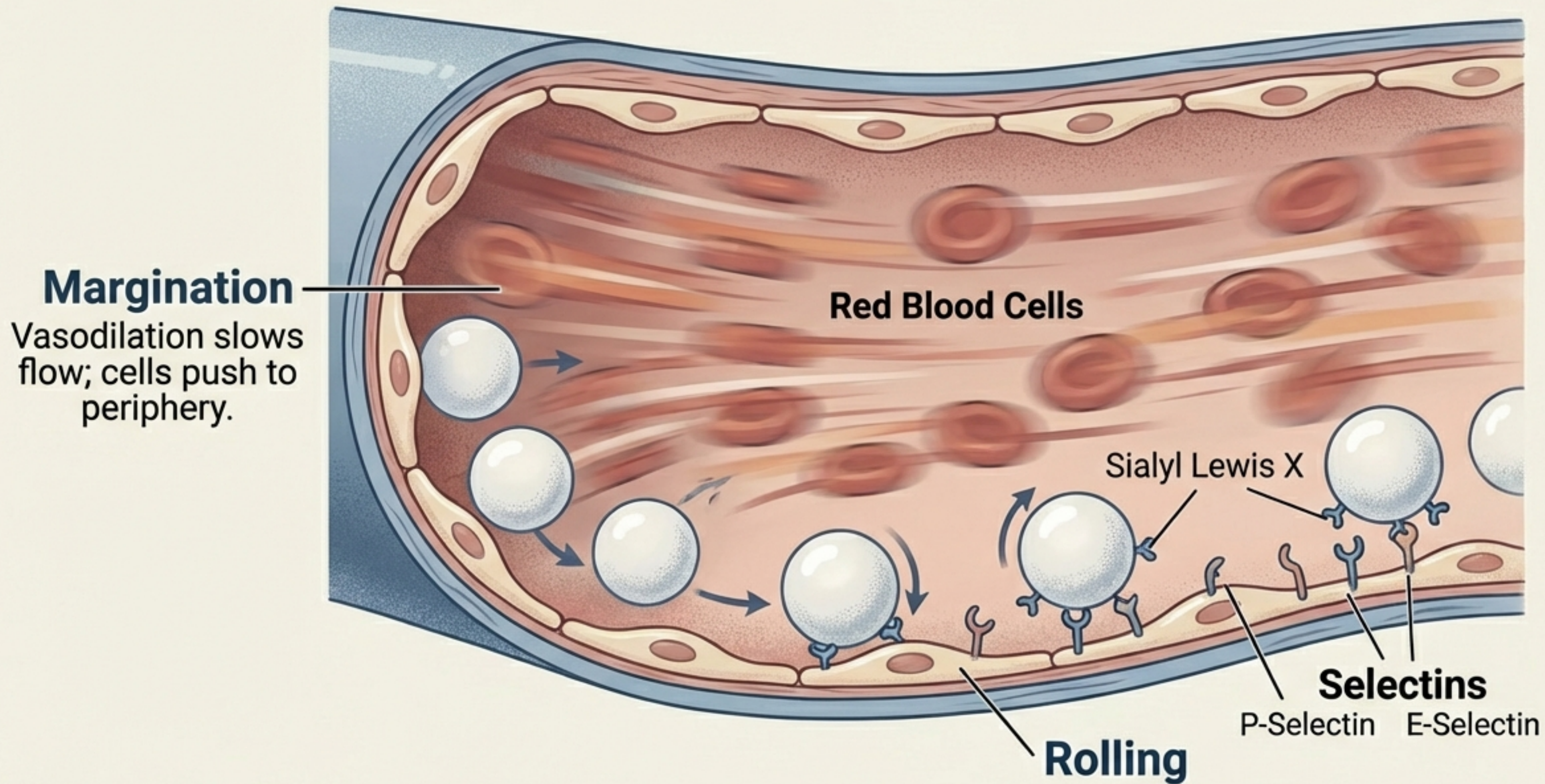


## Fever

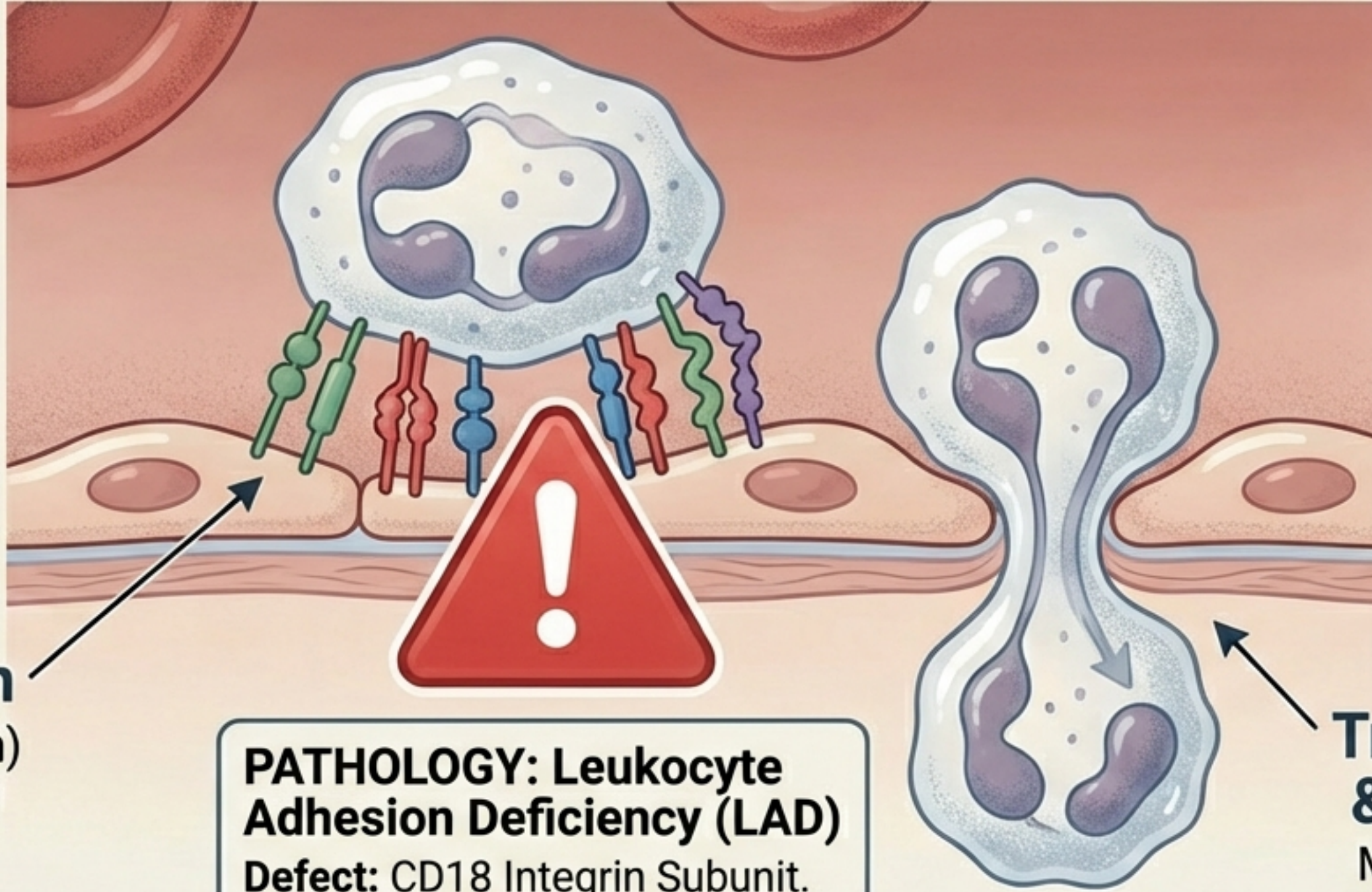
**Mechanism:** Pyrogens → Hypothalamus set-point increase

**Molecules:** IL-1, TNF → Cyclooxygenase → PGE2

# Mobilization: From Flow to Wall



# The Breach: Adhesion & Transmigration



## Firm Adhesion

CAMs (Endothelium) lock with Integrins (Leukocyte).

**Upregulated by:**  
TNF, IL-1, C5a, LTB4.

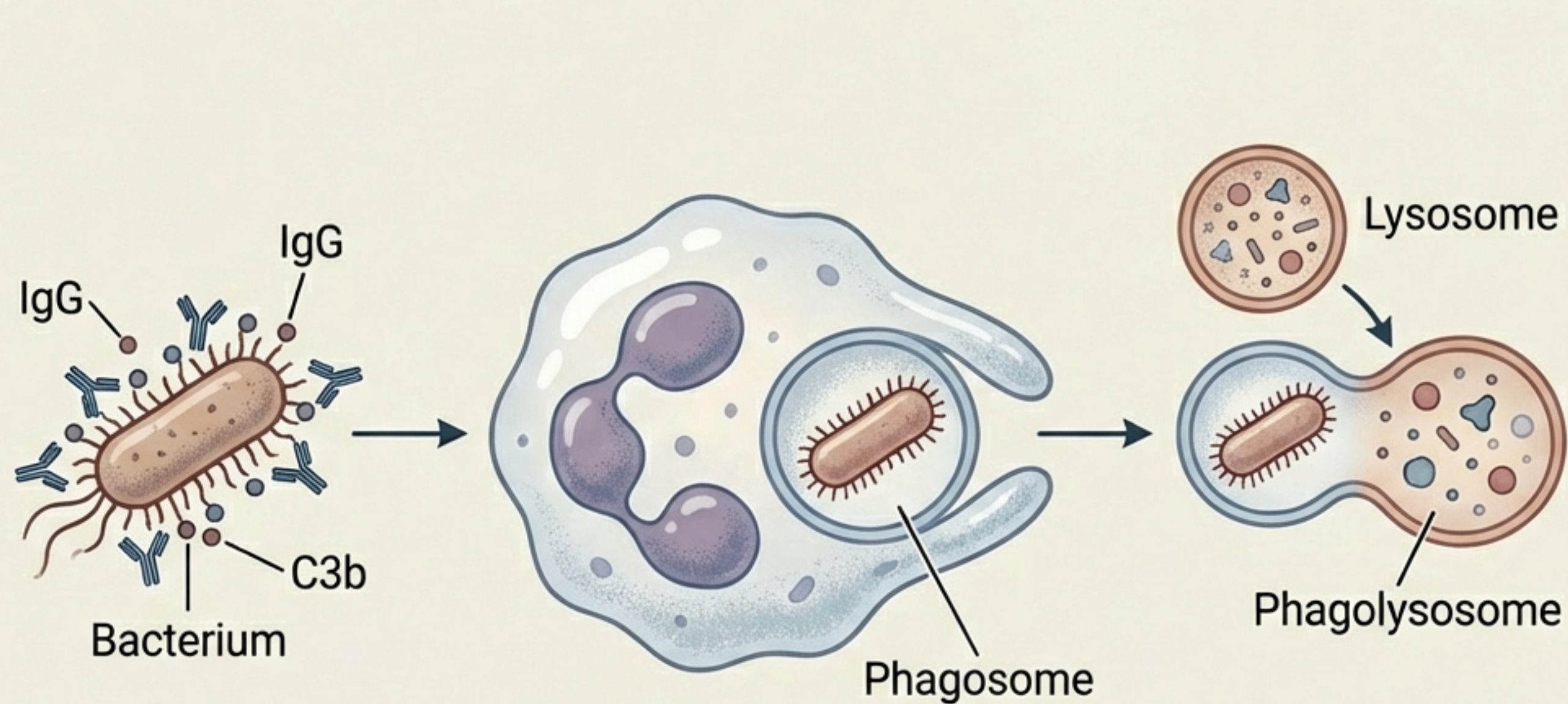
## PATHOLOGY: Leukocyte Adhesion Deficiency (LAD)

**Defect:** CD18 Integrin Subunit.  
**Signs:** Delayed cord separation, High serum neutrophils, No pus.

## Transmigration & Chemotaxis

Moving toward the chemical gradient:  
IL-8, Bacterial Products.

# Engagement: Phagocytosis



## Recognition

Opsonization (IgG, C3b) tags the target.

## Engulfment

Neutrophil extends pseudopods around the target, forming a Phagosome.

## Fusion

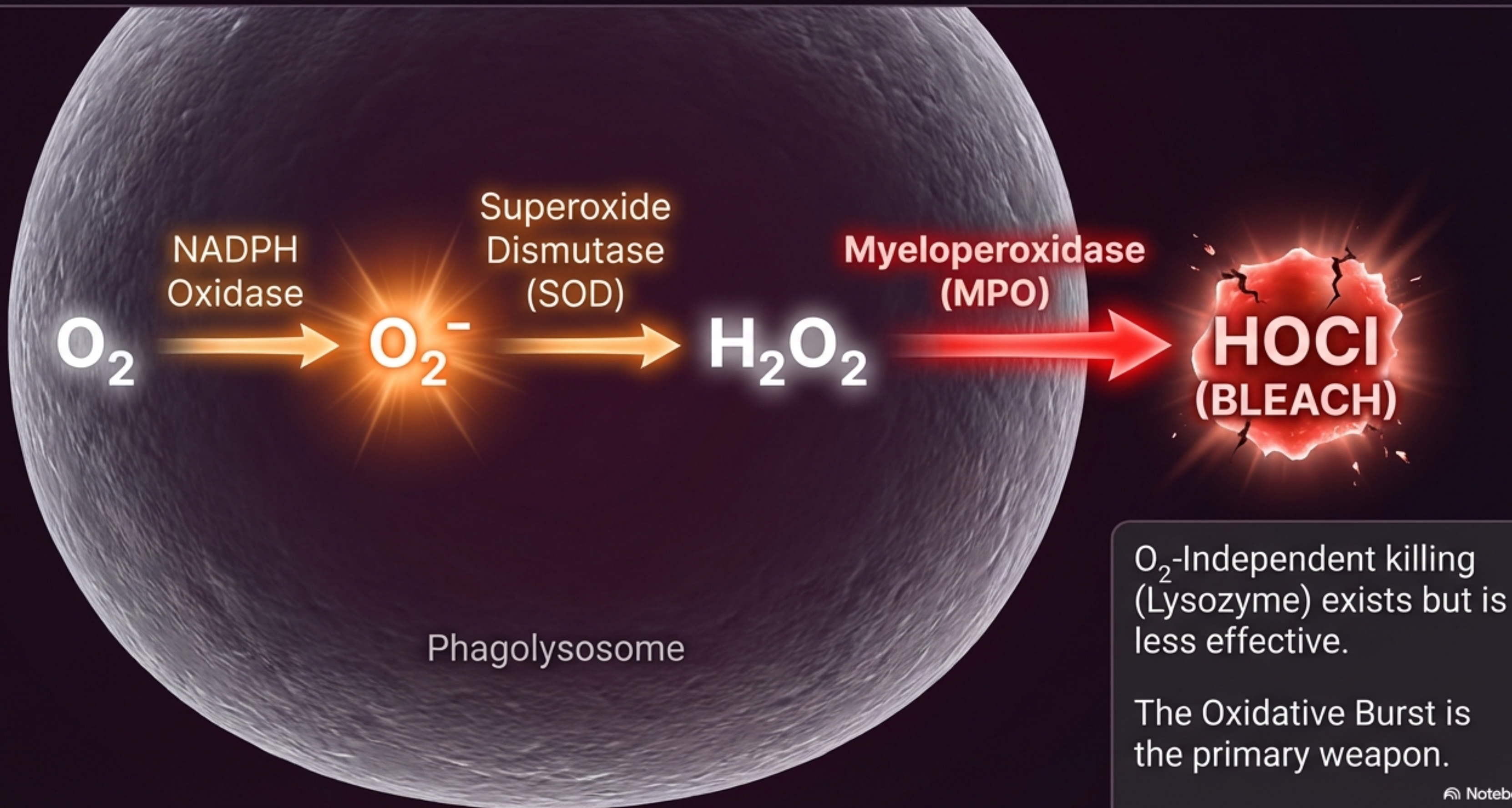
Phagosome merges with Lysosome, releasing enzymes for digestion.



## PATHOLOGY: Chediak-Higashi Syndrome

**Defect:** Microtubule trafficking failure (No phagolysosome).  
**Signs:** Giant granules, Albinism, Pyogenic infections.

# Destruction: The Oxidative Burst

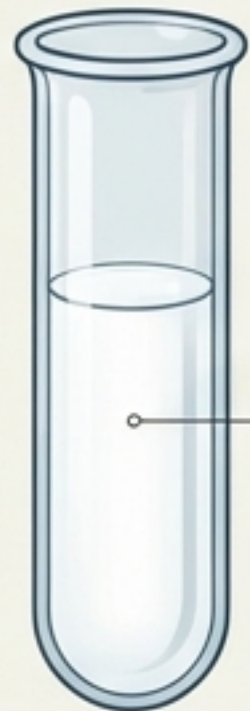


# When Defenses Fail: CGD vs. MPO Deficiency

## Chronic Granulomatous Disease (CGD)

**Defect:** NADPH Oxidase (No Oxidative Burst).

**Risk:** Catalase-Positive Organisms (*S. aureus*, *Pseudomonas*, *Aspergillus*).



**NBT Test: Abnormal  
(Colorless).**

## MPO Deficiency

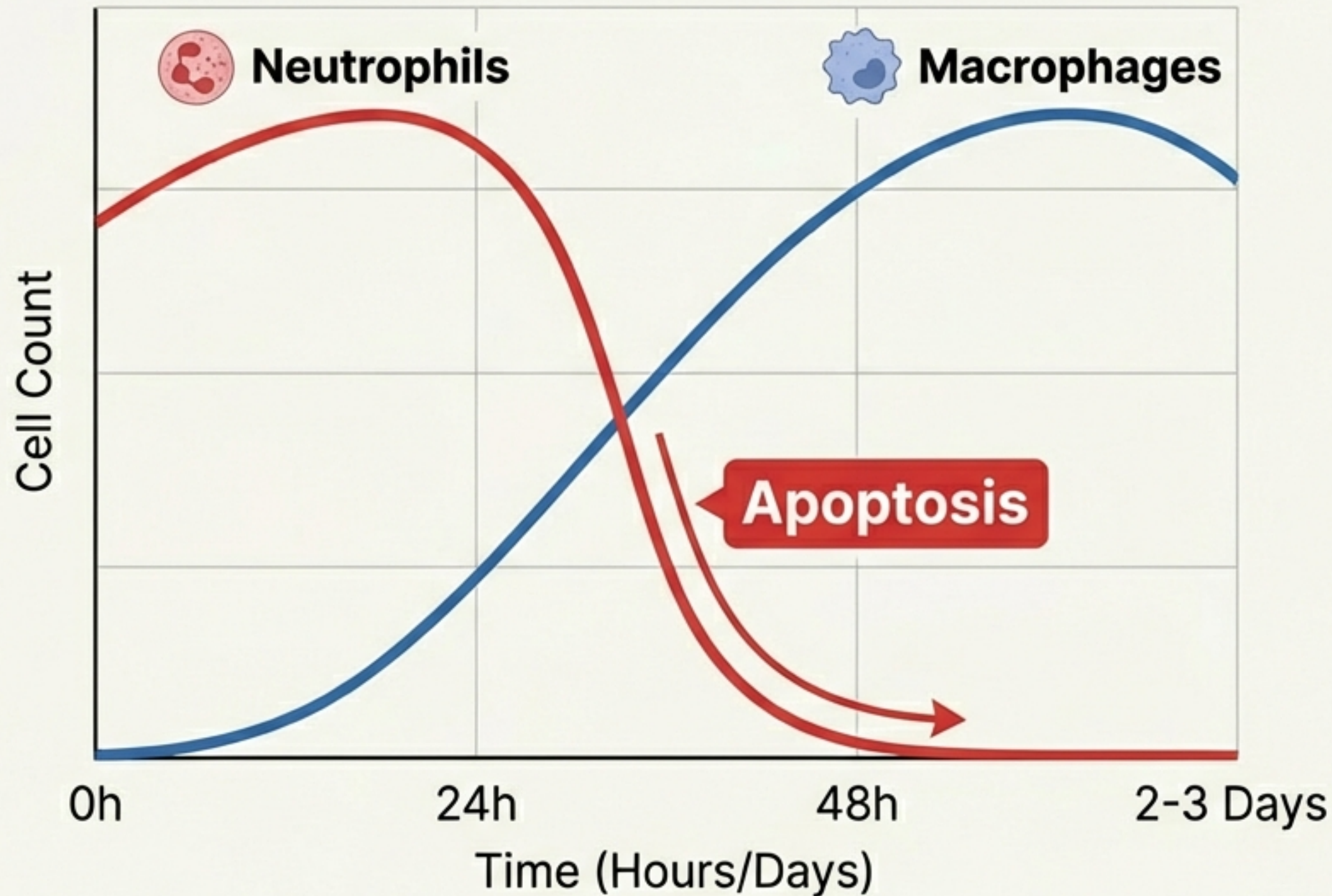
**Defect:** Myeloperoxidase (No Bleach production).

**Risk:** *Candida* infections (often asymptomatic).






**NBT Test: Normal  
(Blue) - Respiratory  
burst is intact.**

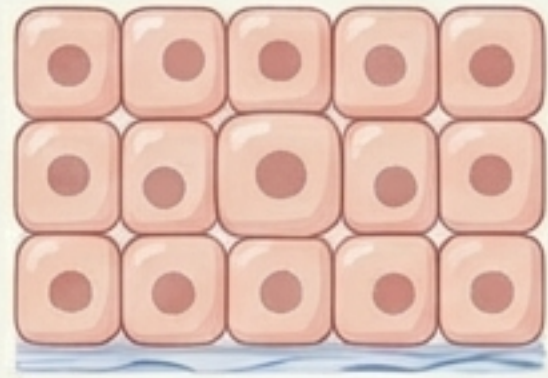
# The Aftermath: Shift to Macrophages



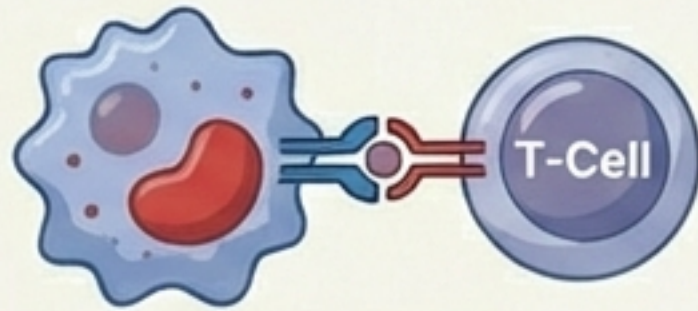
## The Field Commander Arrives.

-  **Source:** Blood Monocytes.
-  **Killing Style:** Oxygen-Independent (Lysozyme).
-  **Role:** Manage the outcome.

# The Four Outcomes.



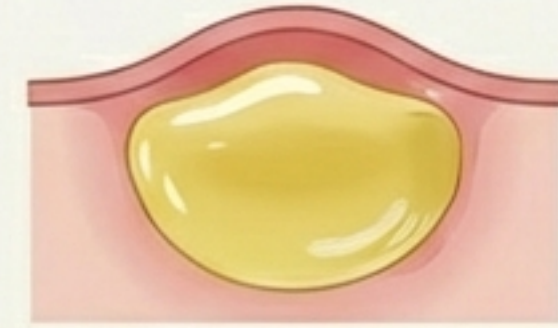
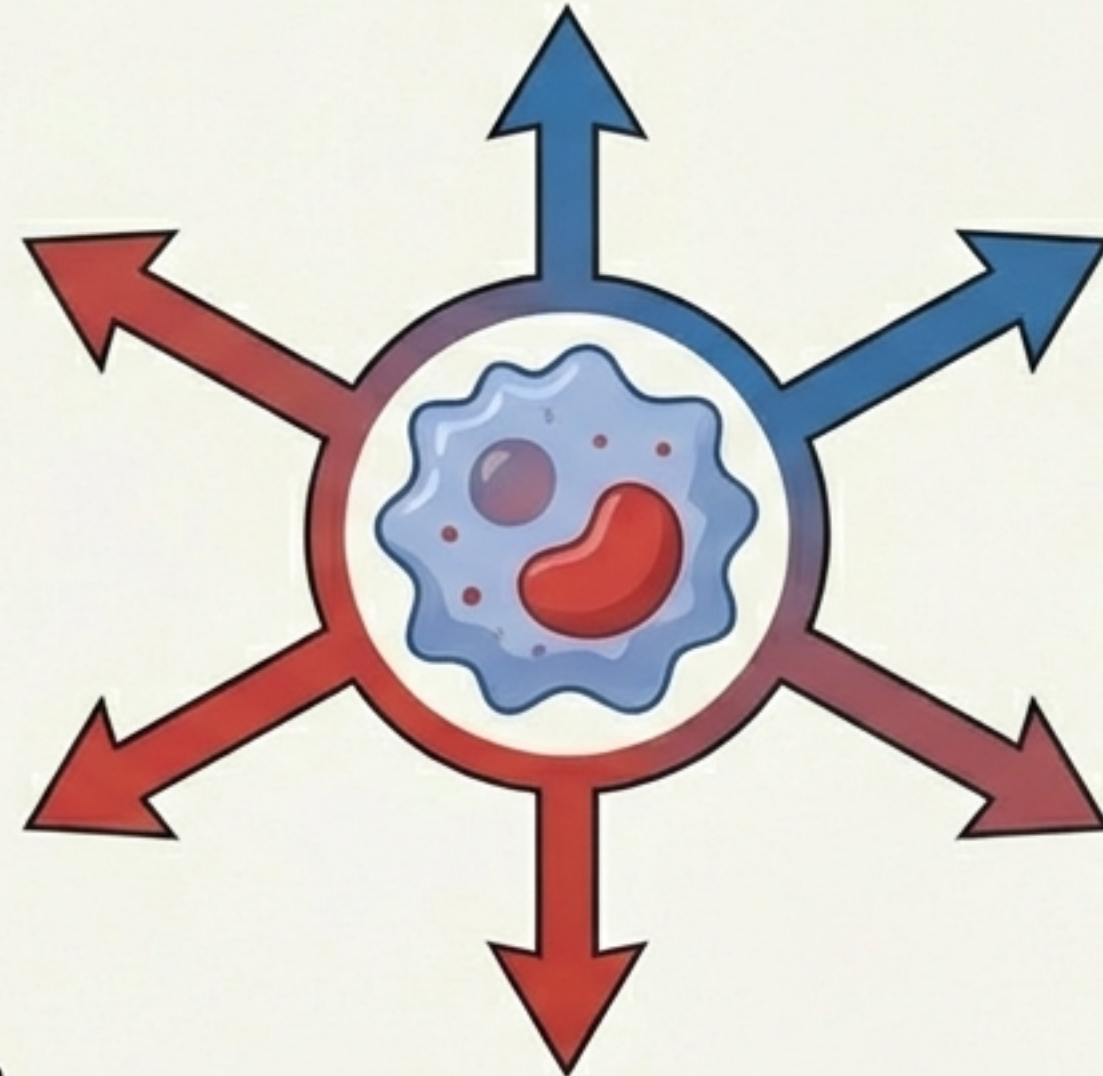
IL-10, TGF-Beta → Healing



## Chronic Inflammation

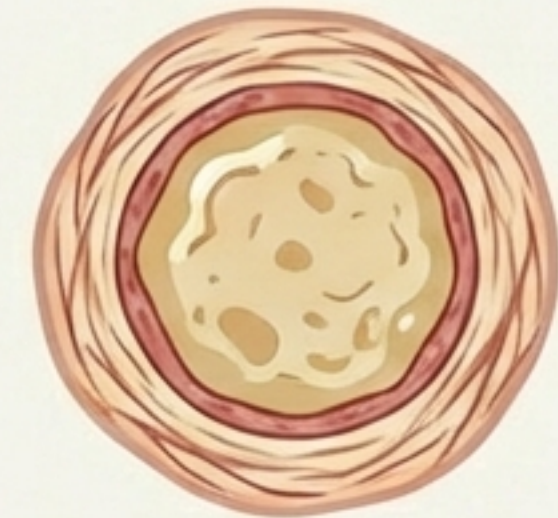
Antigen Presentation → CD4<sup>+</sup> T-Cells

## Resolution



## Continued Acute Inflammation

IL-8 → More Neutrophils (Pus)



IL-8 → More Neutrophils (Pus)

## Abscess

Fibrogenic Growth Factors → Fibrosis

# Mediator Cheatsheet

## Vasodilation & Permeability

- Histamine
- Prostaglandins (I2, D2, E2)
- Bradykinin

## The Recruiters (Chemotaxis)

- LTB4
- C5a
- IL-8
- Bacterial Products

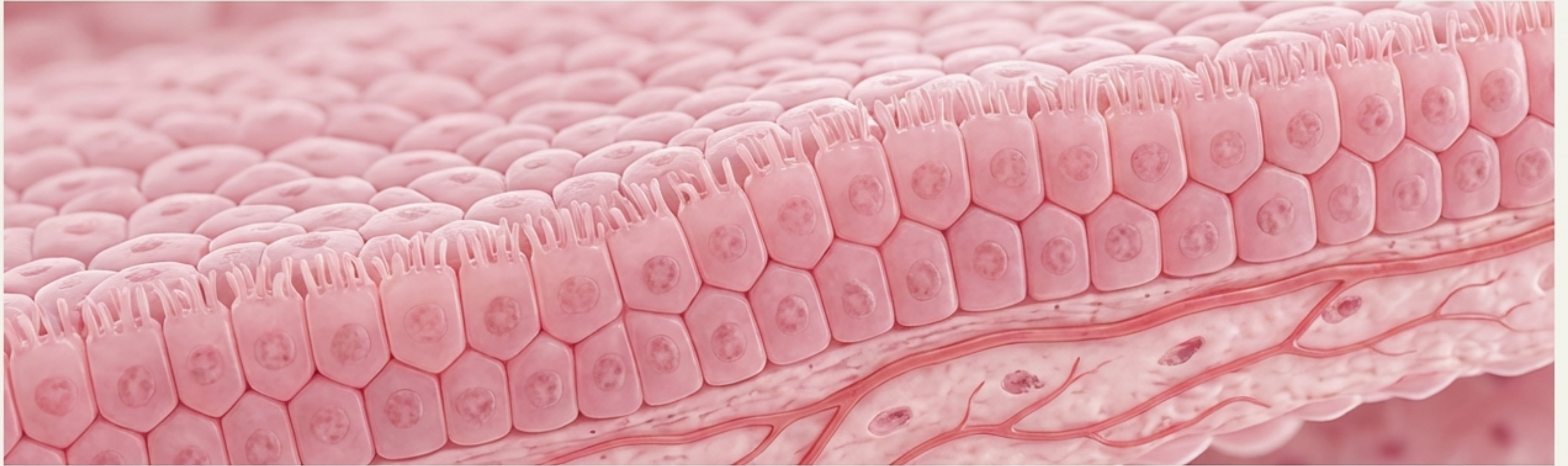
## Pain & Fever

- Pain: PGE2 + Bradykinin
- Fever: PGE2 (Hypothalamus set-point)

## The Opsonins (Eat Me)

- IgG
- C3b

# From Chaos to Cure



The inflammatory response is a precise, double-edged sword. It is essential for survival, yet capable of damage. The transition from Neutrophil destruction to Macrophage management is the critical pivot point for health.