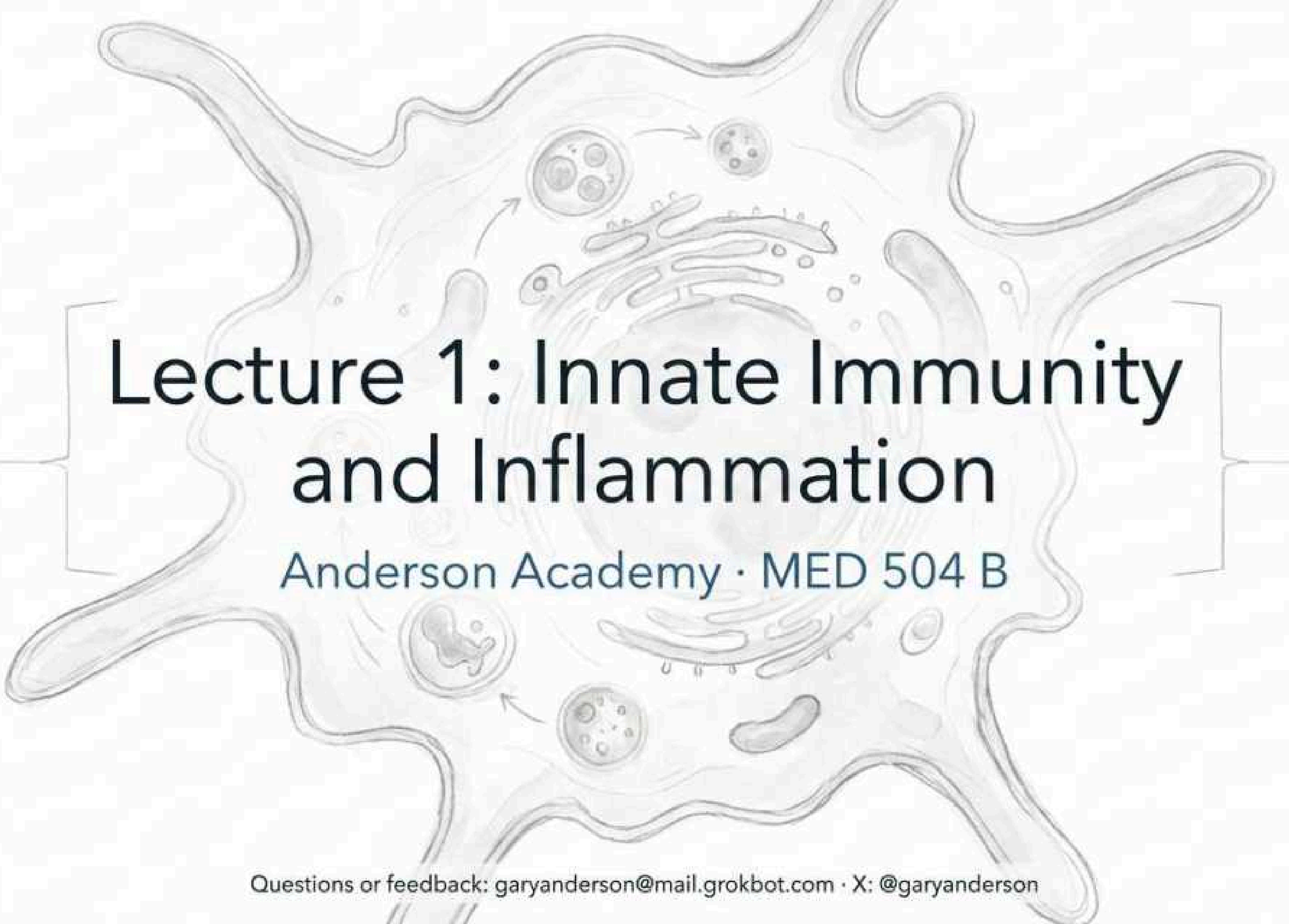


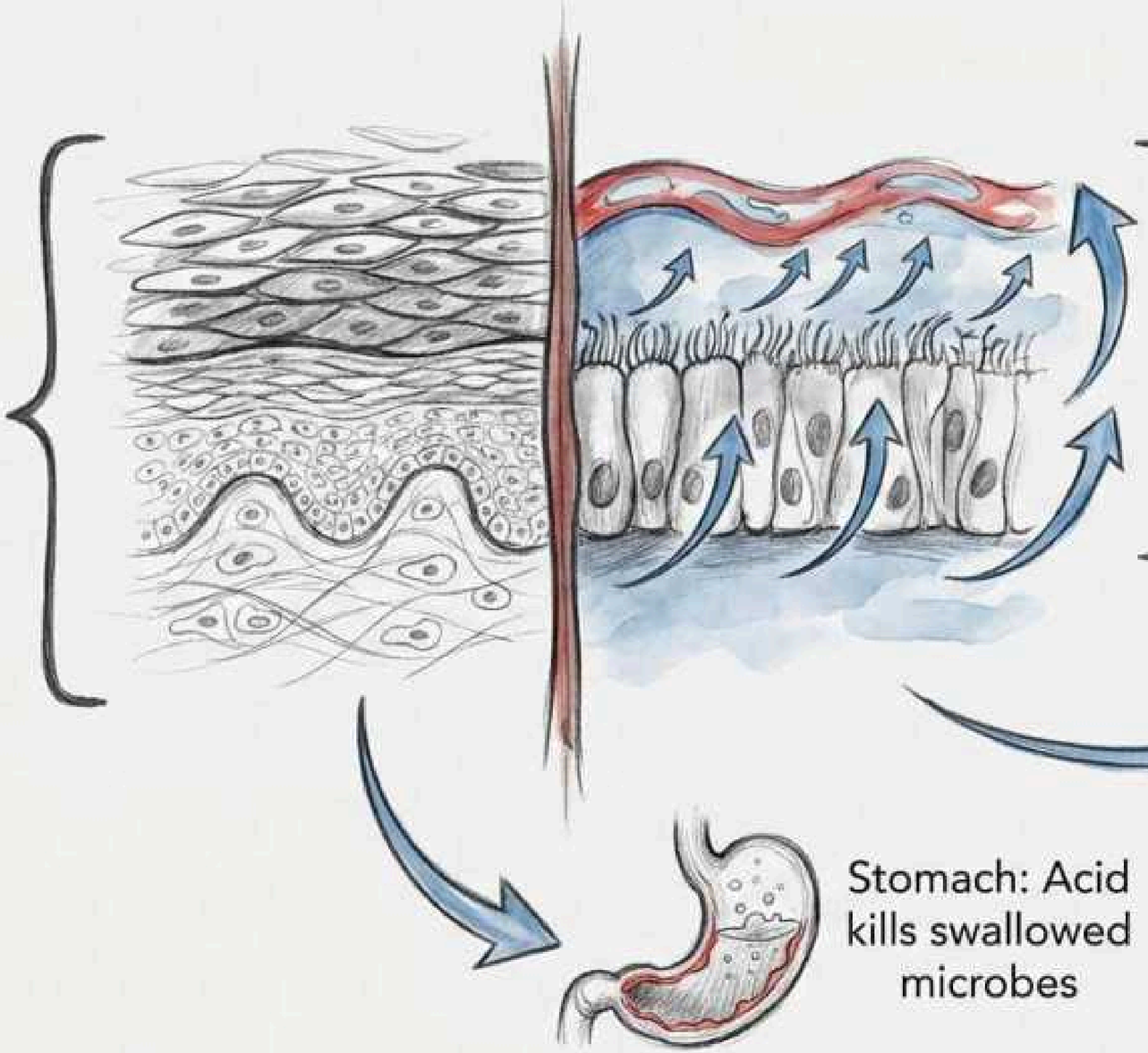
Lecture 1: Innate Immunity and Inflammation

Anderson Academy · MED 504 B

Questions or feedback: garyanderson@mail.grokbot.com · X: @garyanderson

Skin

- Tough, dry, slightly acidic wall



Mucosal Airways

Ciliary Escalator: sweeps trapping mucus upward

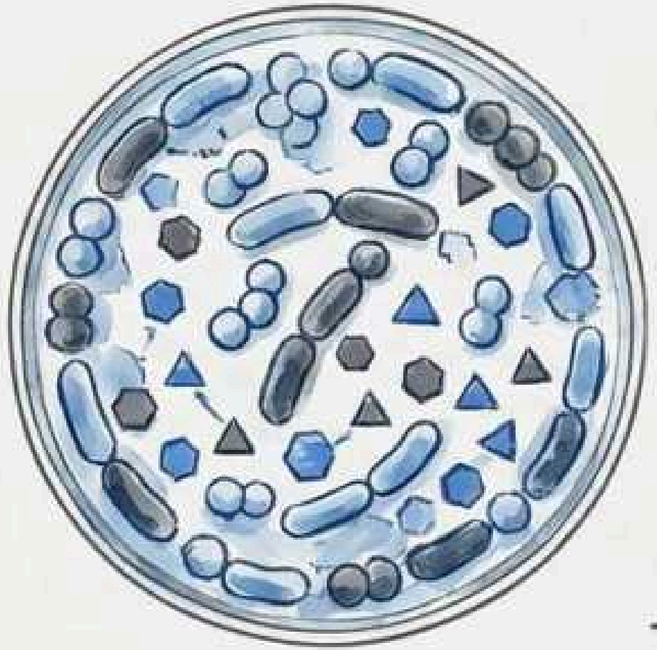
└ To be swallowed or coughed out

Stomach: Acid kills swallowed microbes

Eyes/Mouth: Tears & saliva contain enzymes that break down bacterial walls

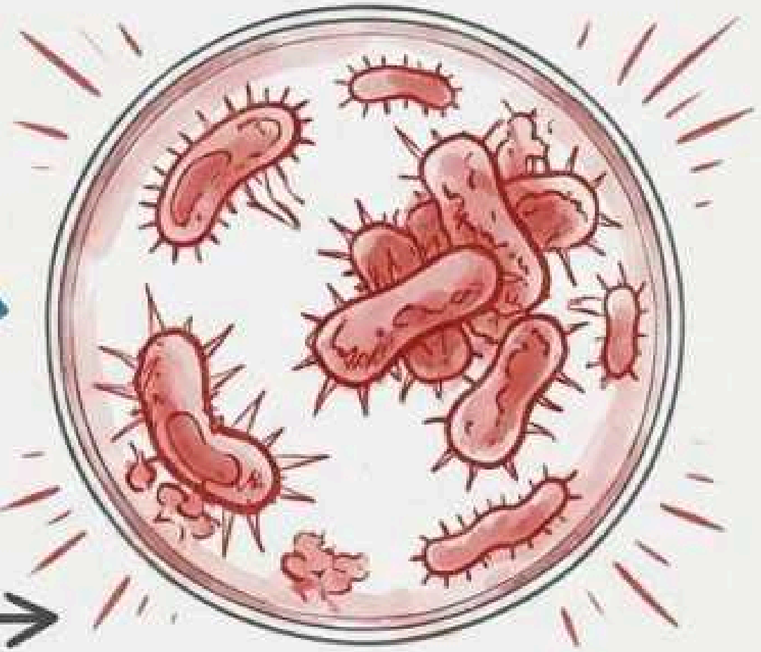
Space + Nutrients = Zero-Sum Game

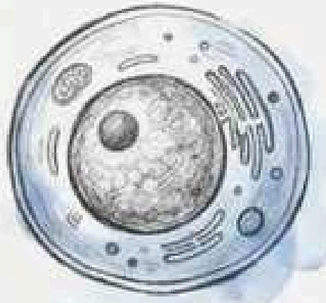
The Shield: Friendly bacteria in skin and gut make it harder for harmful microbes to settle.



Antibiotic Course

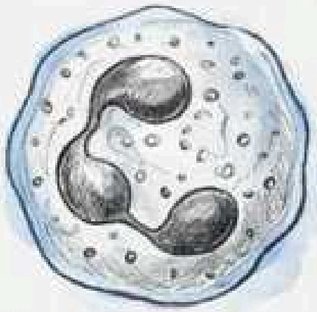
The Disruption: Overgrowth of harmful organisms due to disturbed communities.





Bone Marrow
Stem Cell

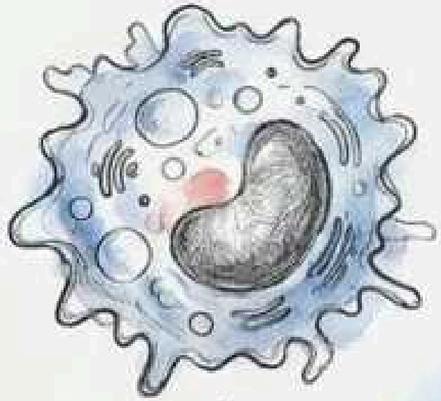
The Phagocytes (Eating Cells)



Neutrophils

First Responders

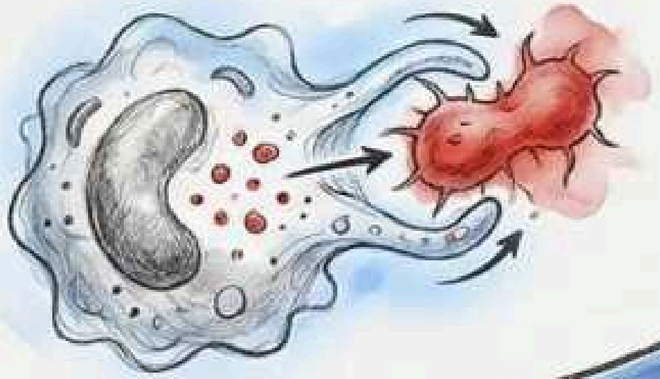
Most Numerous white blood cells in blood
Rush to infection site.

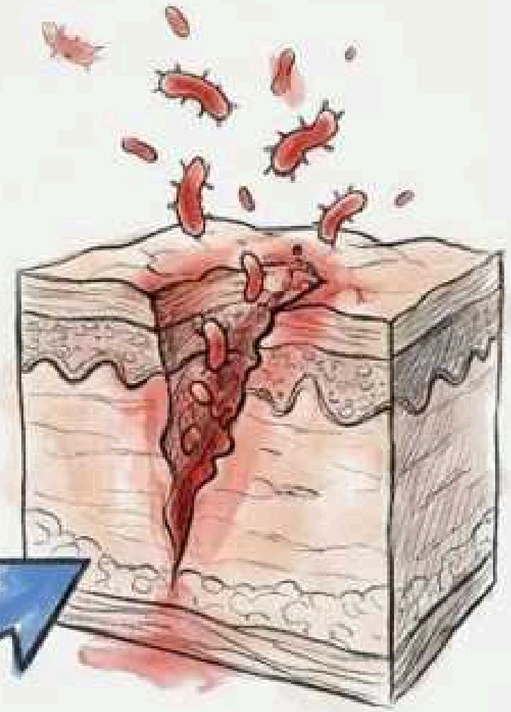


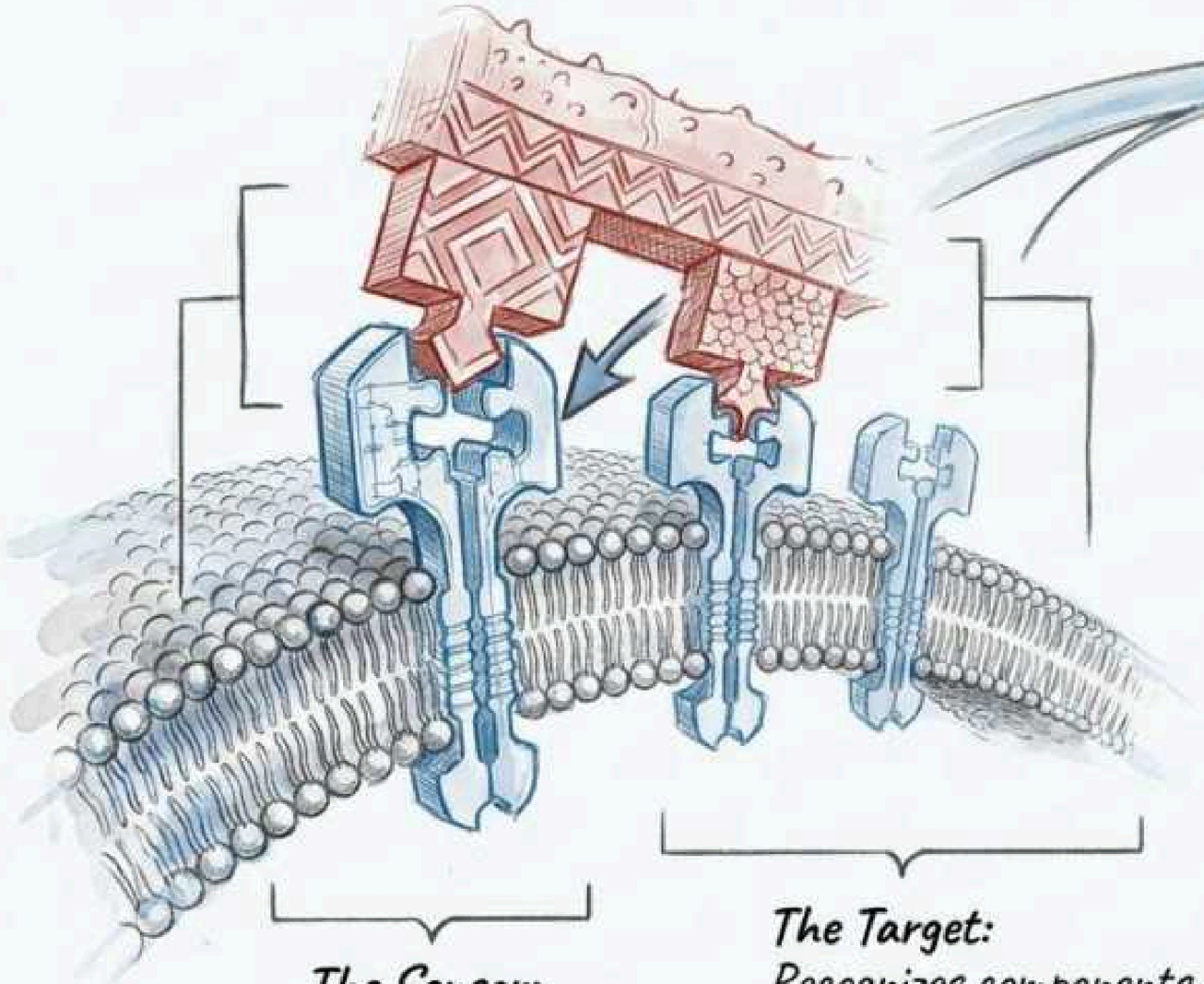
Macrophages

Tissue Residents

Larger & Long-lived
Clear away dead cells and debris.



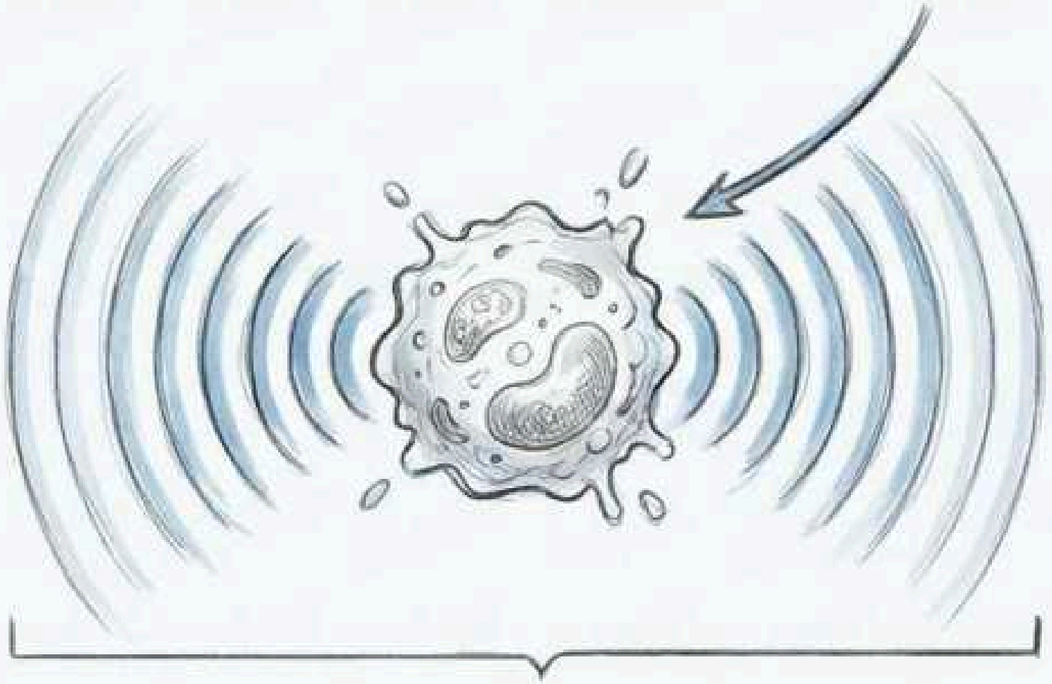




The Sensor:
Toll-like receptors (TLRs)

The Target:
Recognizes components of bacterial walls or viral genetic material absent from our cells

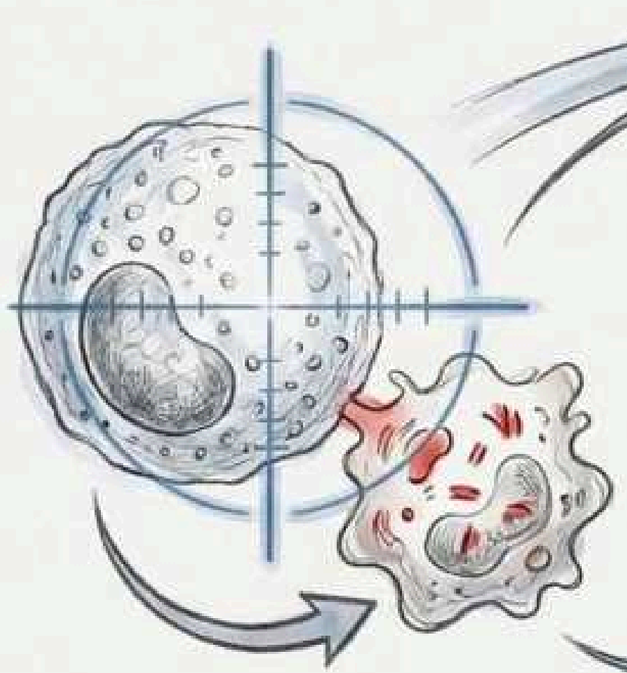
Receptor Binding + Signals from damaged cells → Cell Activation → Cytokine Release



The Alarm: Cytokines

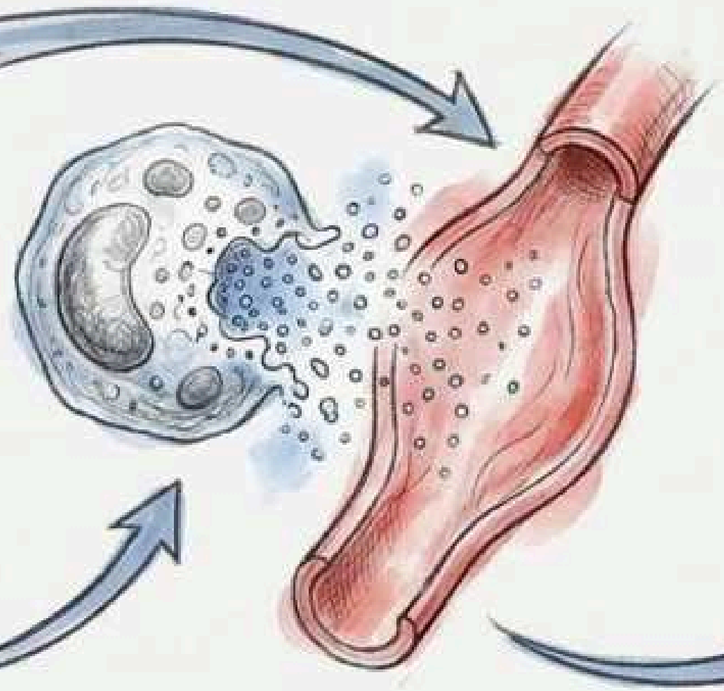
Chemical messengers that summon and direct other cells.

Natural Killer (NK) Cells



Patrols for and kills stressed, virus-infected, or cancer cells.

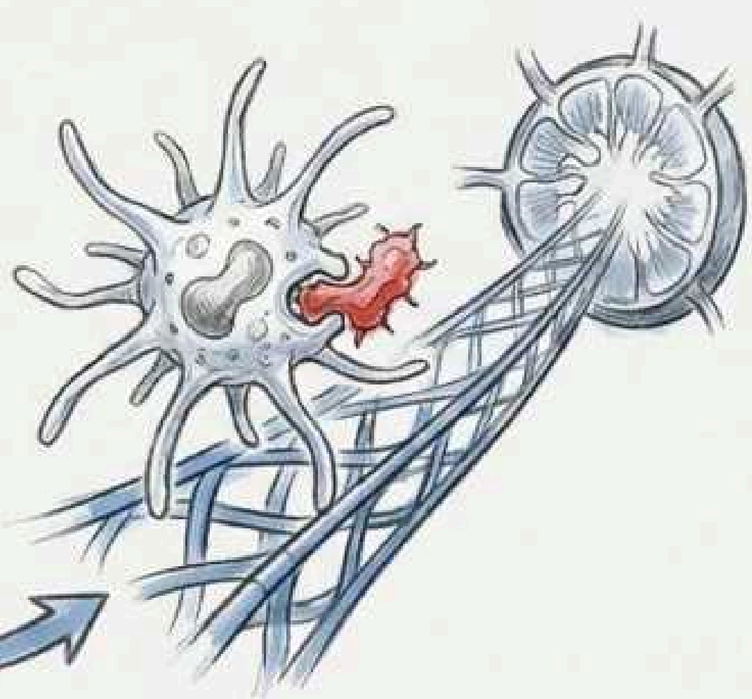
Mast Cells



Releases histamine → Opens blood vessels.

Plays a large part in allergy (covered in Lecture 6).

Dendritic Cells



Captures invader fragments → Travels to lymph nodes.

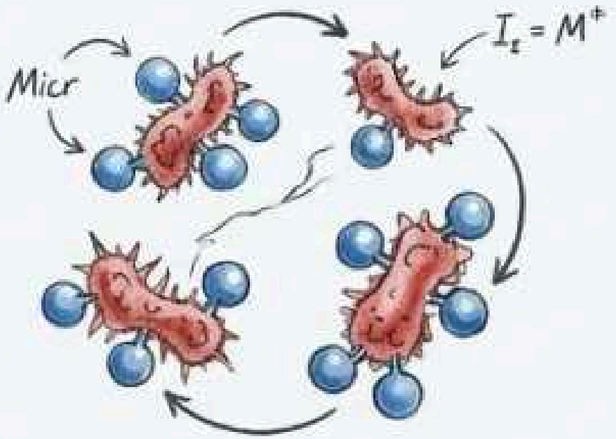
The crucial bridge alerting the adaptive immune system.

Trigger: Complement: A chain reaction of blood proteins.

Antibodies
(Lecture 3)

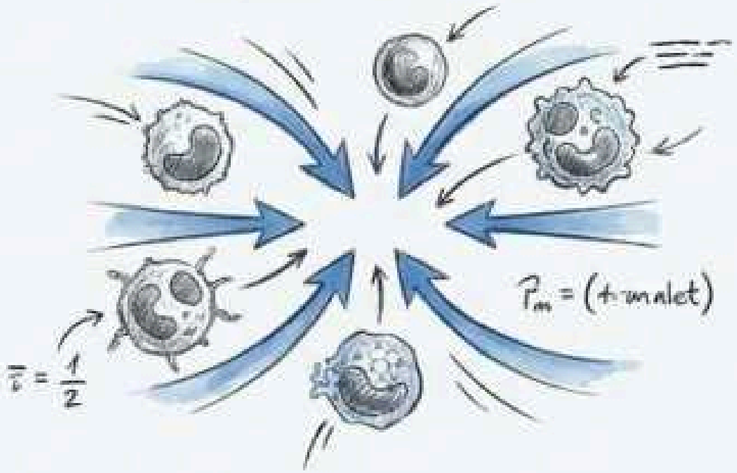


Opsonization



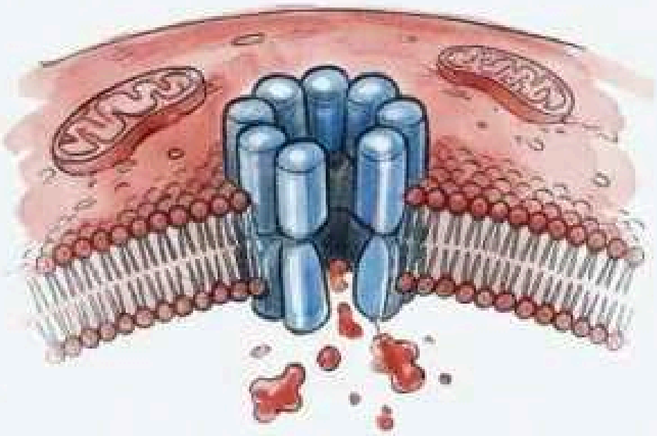
Microbes coated so phagocytes can grab them more easily.

Chemotaxis



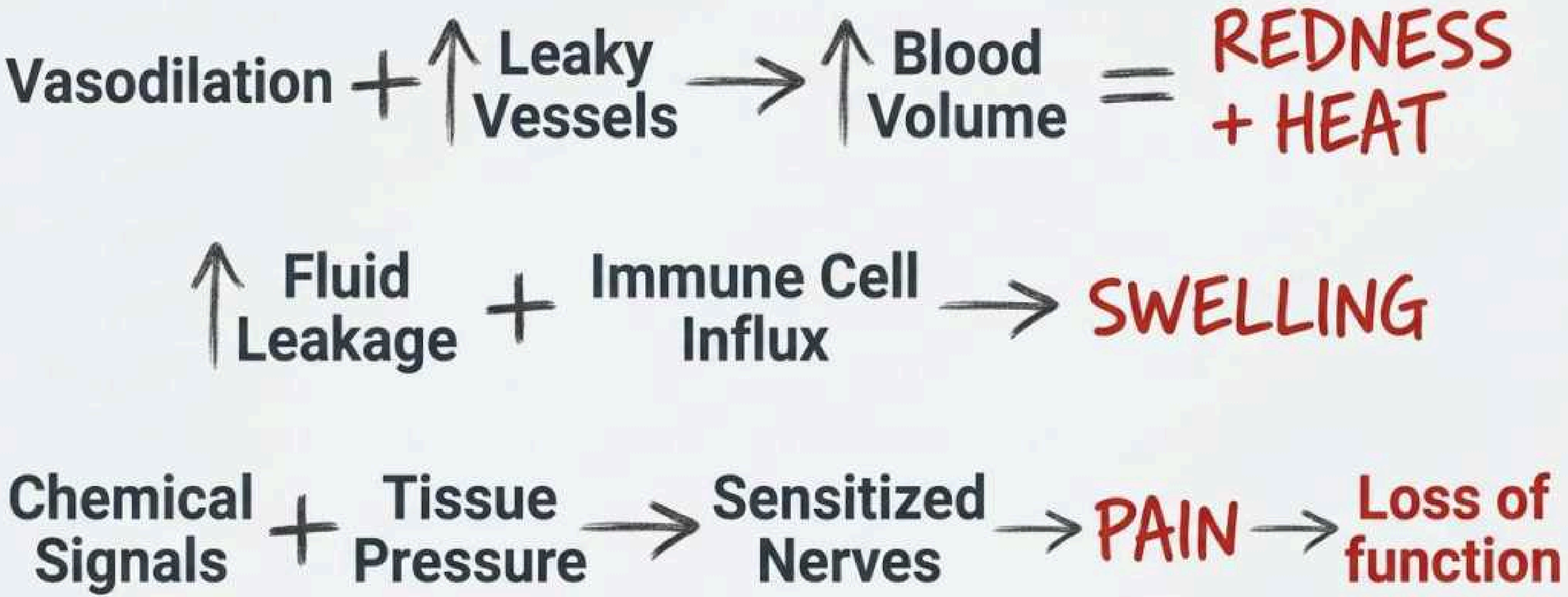
Attracts immune cells to the site.

Membrane Attack



Punches holes in membranes, killing bacteria directly.

Inflammation: The body's local response to injury or infection, described since ancient times.



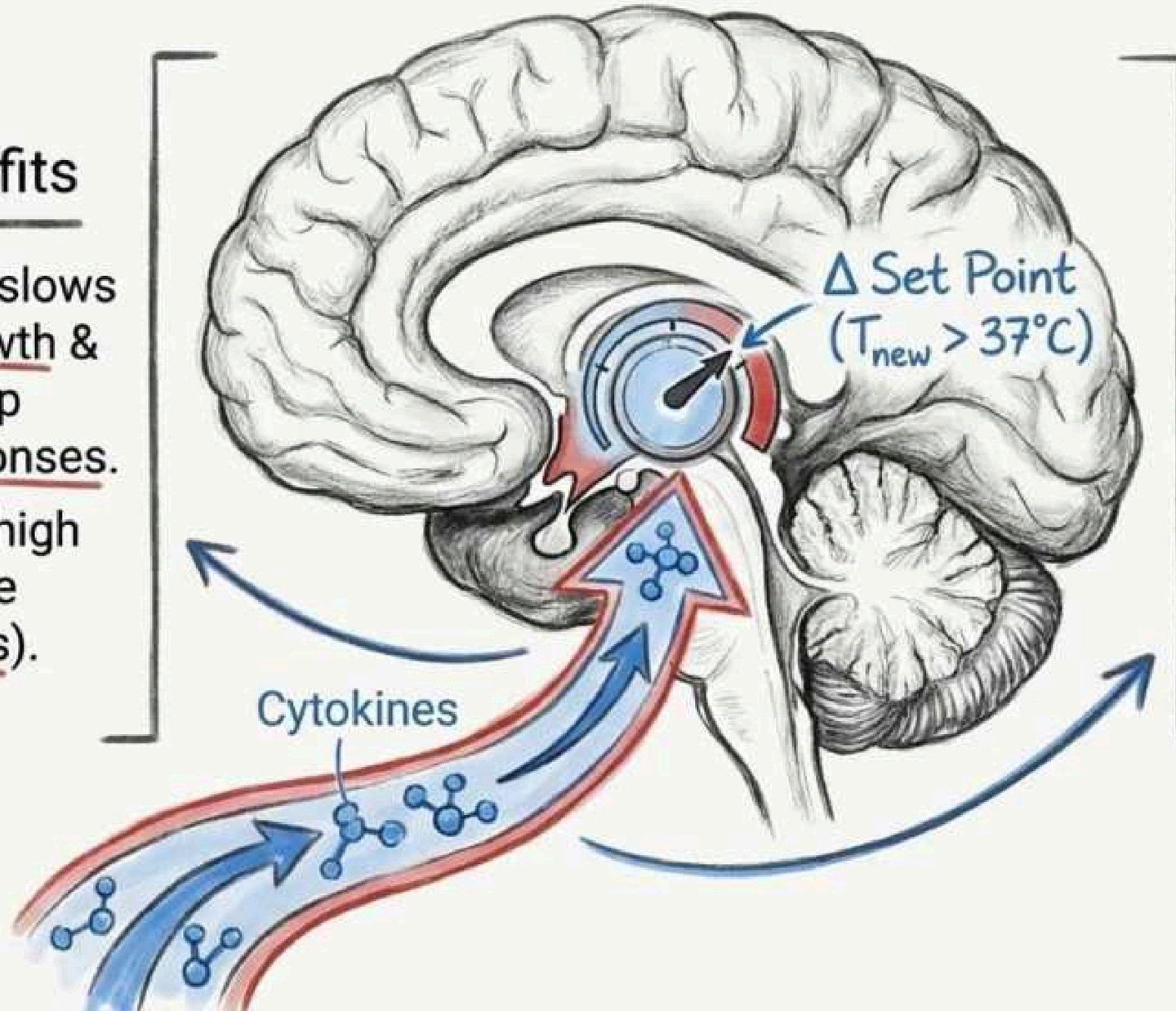
The Cost of Defense

Severity Tier	Duration	Effect & Clinical Examples
Acute Inflammation	Short-lived	Clears infections, initiates healing. (Protective status)
Chronic Inflammation	Months or Years	Damages tissues. Examples: Rheumatoid arthritis, Hardening of arteries (MED 502 B).
Sepsis (Systemic)	Rare, overwhelming systemic response	Widespread inflammation → ↓↓ Blood Pressure + Organ Failure.

The Benefits

Modest fever slows microbe growth & speeds up immune responses.

(Note: Very high fevers are dangerous).



The Side Effects

Sickness Behaviour: Feeling unwell, tired, and without appetite during infection, driven directly by cytokine activity.

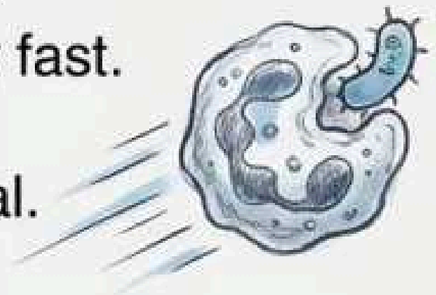
The Innate Immune System: A Cost-Benefit Analysis

¶ 1.10

Strengths

Extremely fast.

Essential for survival.



(Defects, like non-functioning neutrophils, lead to repeated severe infections.)

Limits

Recognizes only broad categories of invaders.

ZERO memory (does not improve with experience).



For Precision and Memory → The Body Needs the Adaptive Immune System.

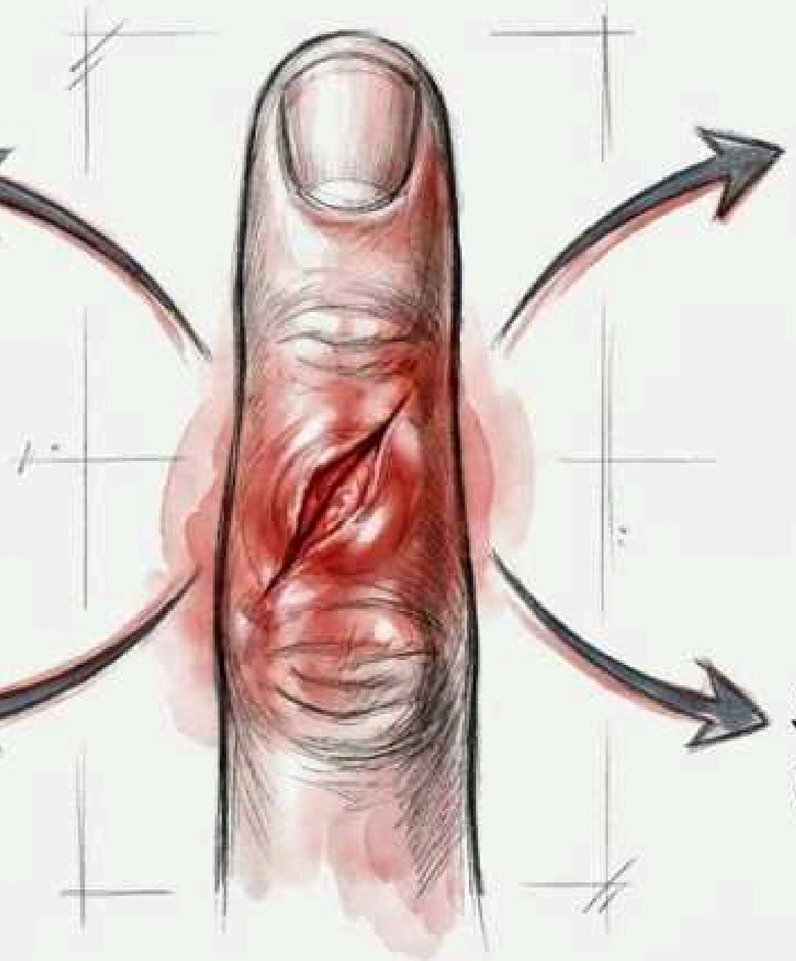
Applied Clinical Case Study

¶ 1.11

You cut your finger. A day later, it presents four classic signs.
Explain the cause of each based on the innate response:

Redness = _____
(Hint: Blood vessel changes)

Swelling = _____
(Hint: Fluid & cell influx)

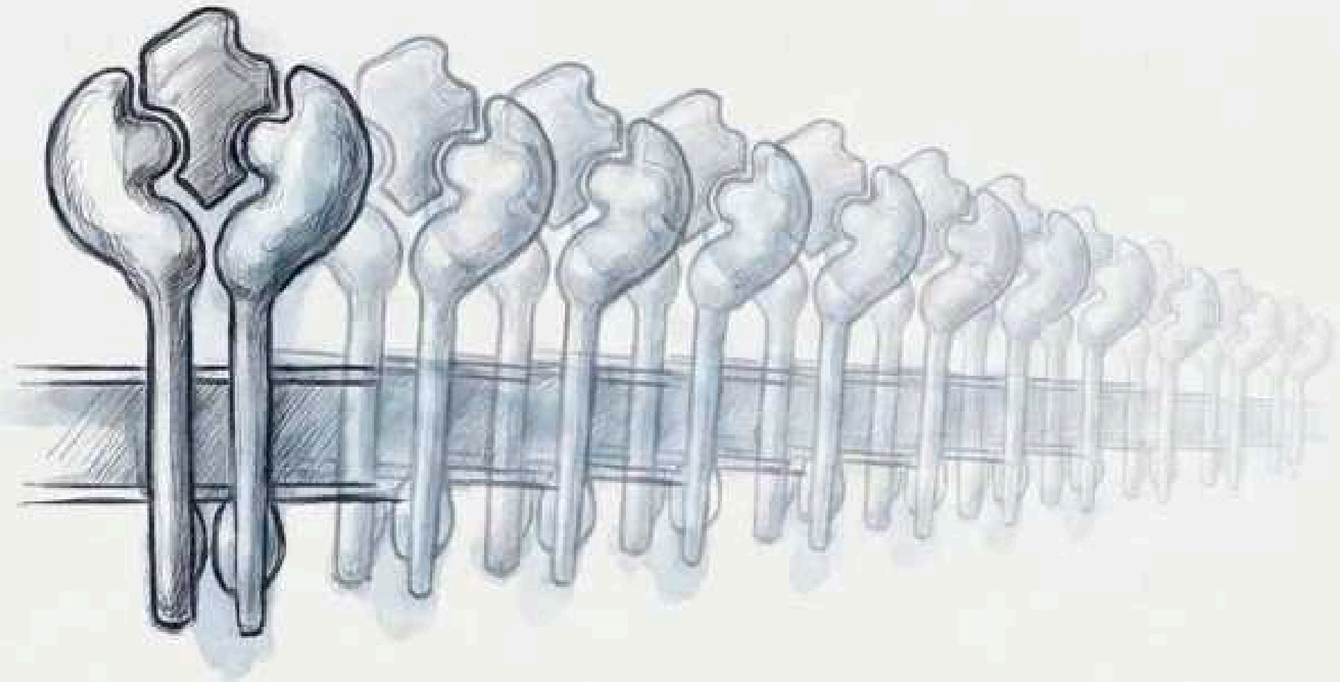


Warmth = _____
(Hint: Blood flow)

Soreness = _____
(Hint: Chemical signals & nerves)

¶ 1.12

The Horizon



Coming in Lecture 2: The Adaptive Immune System & Clonal Selection.