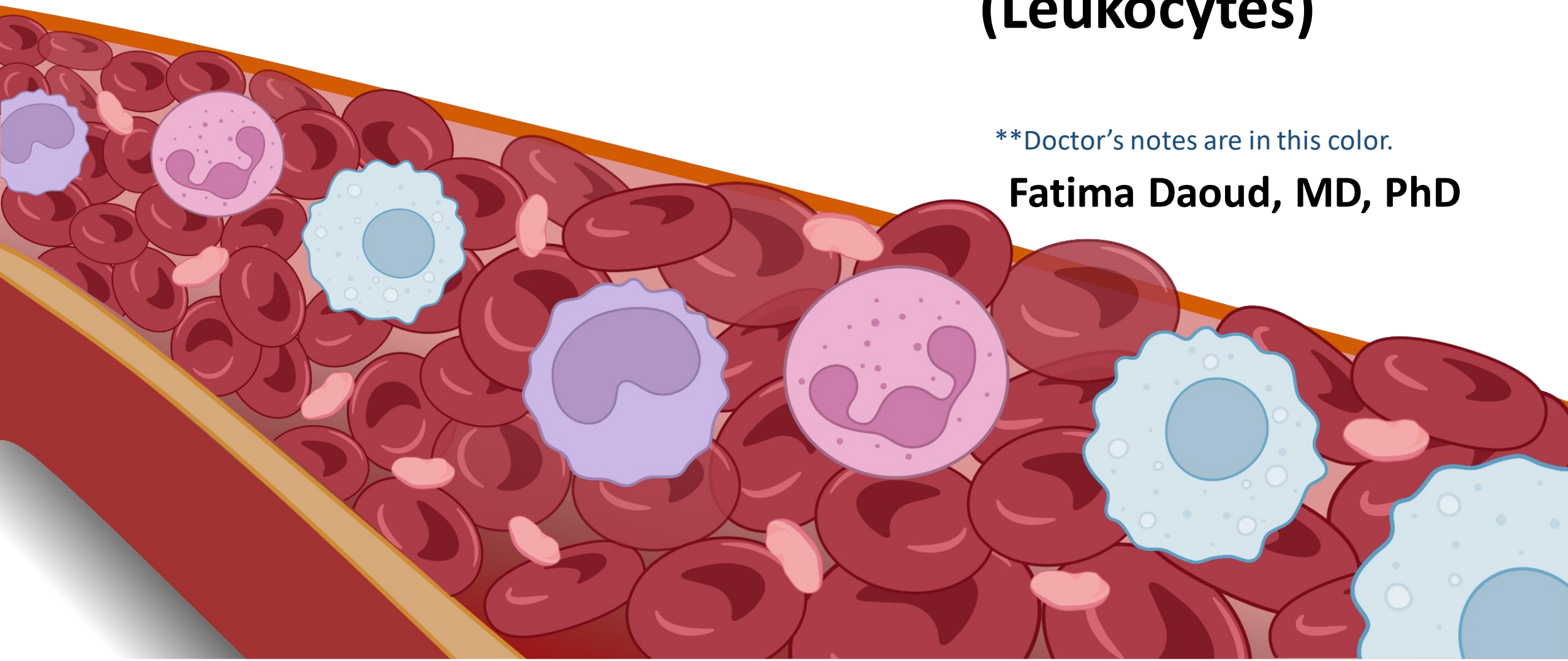
Hematology | Lymphocytes

White Blood Cells (Leukocytes)

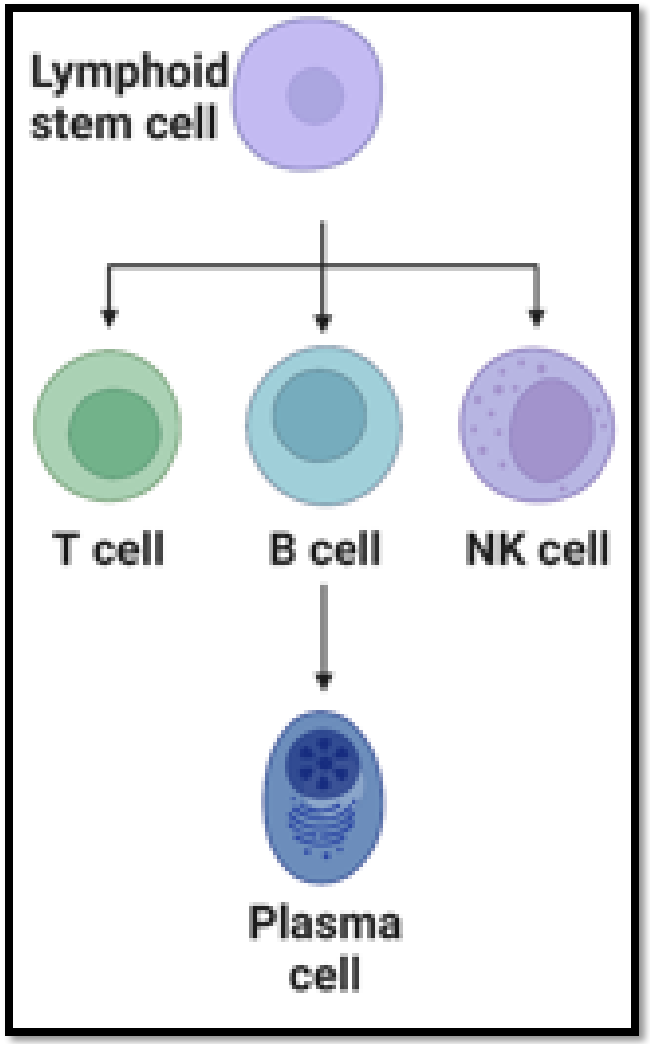


**Doctor's notes are in this color.

Fatima Daoud, MD, PhD

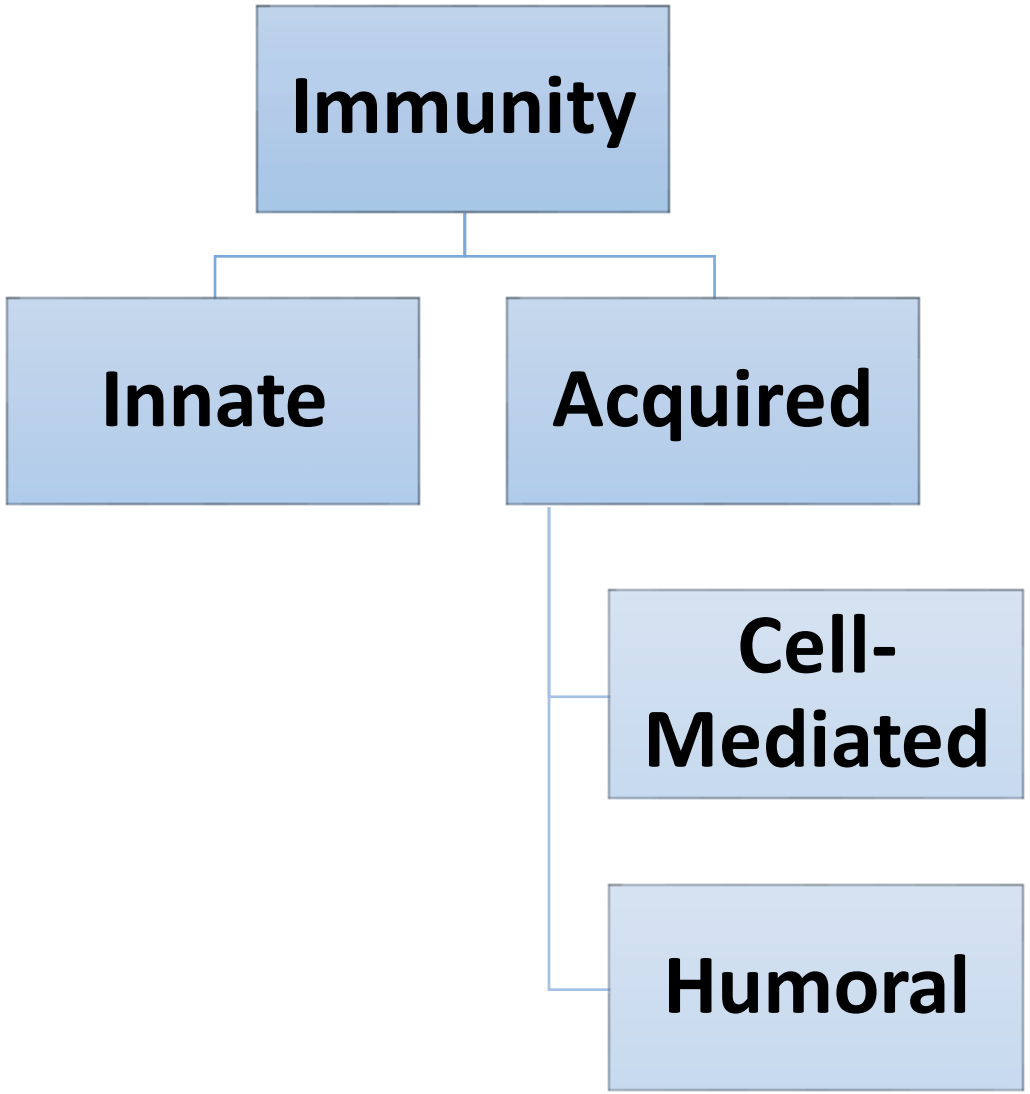
Hematology — Lymphocytes

- Lymphocytes are produced mainly in the various lymphogenous tissues.
- Some of the lymphocytes enter the circulatory system continually.
- Lymphocytes have life spans of weeks or months, depending on the body's need for these cells.



** Immunity is capability of human body to resist almost all types of organisms or toxins that tend to damage the tissues and organs.

** An antigen is a substance that can induce an immune response when introduced into an immunocompetent host and that can react with the antibody produced from that response.



Innate Vs. Acquired (Adaptive)

- Results from general processes.

- Results from processes directed towards specific disease organisms.
- Does not develop until the body is first attacked by a bacterium, virus, or toxin, often requiring weeks or months to develop the immunity.

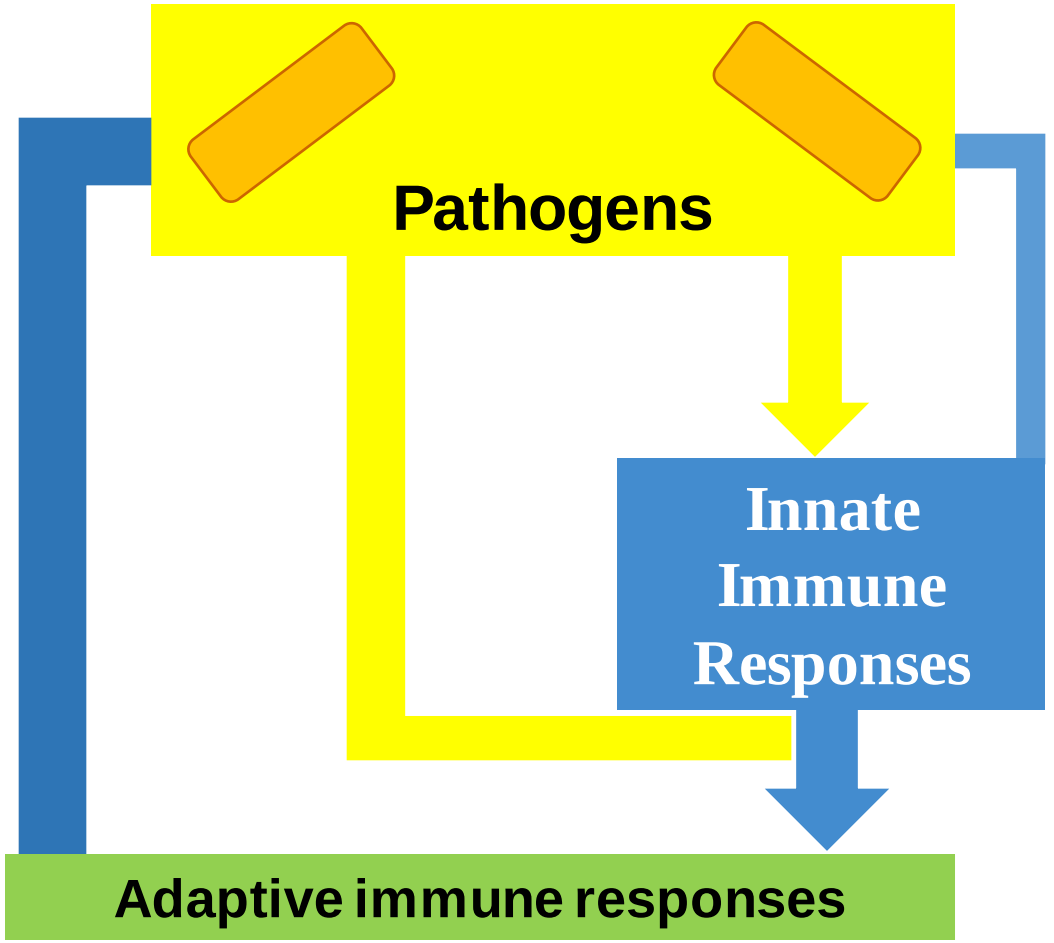
Innate Vs. Acquired (Adaptive)

- Phagocytosis
- Acid secretions of the stomach and the digestive enzymes.
- Skin (tight junctions).
- lysozyme
- Basic polypeptides
- Complement system
- Natural killer lymphocytes

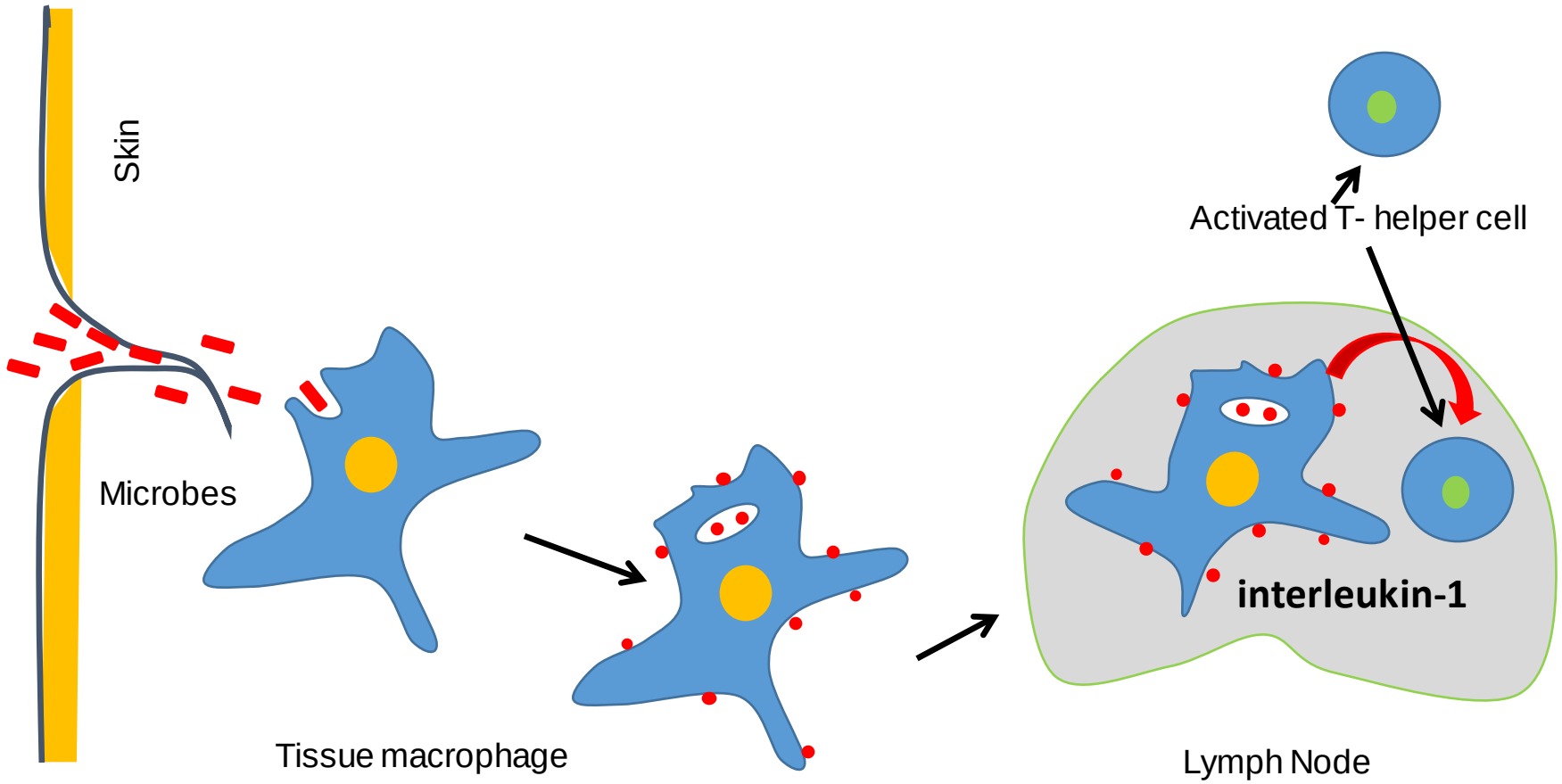
- Antibodies
- Activated lymphocytes

The innate immune system aims to :

- Prevent infection.
- Eliminate invader pathogens.
- Stimulate the acquired immune response.



Macrophage- activation of lymphocyte



Innate Immune Response

Adaptive Immune Response

Basic Types of Acquired Immunity—Humoral and Cell-Mediated

- **Humoral (B-cell immunity)**
- Circulating antibodies, which are γ-globulin molecules in the plasma that are capable of attacking the invading agent.

- **Cell-Mediated (T-cell immunity)**
- Achieved through the formation of large numbers of activated T lymphocytes that are specifically crafted in the lymph nodes to destroy the foreign agent.

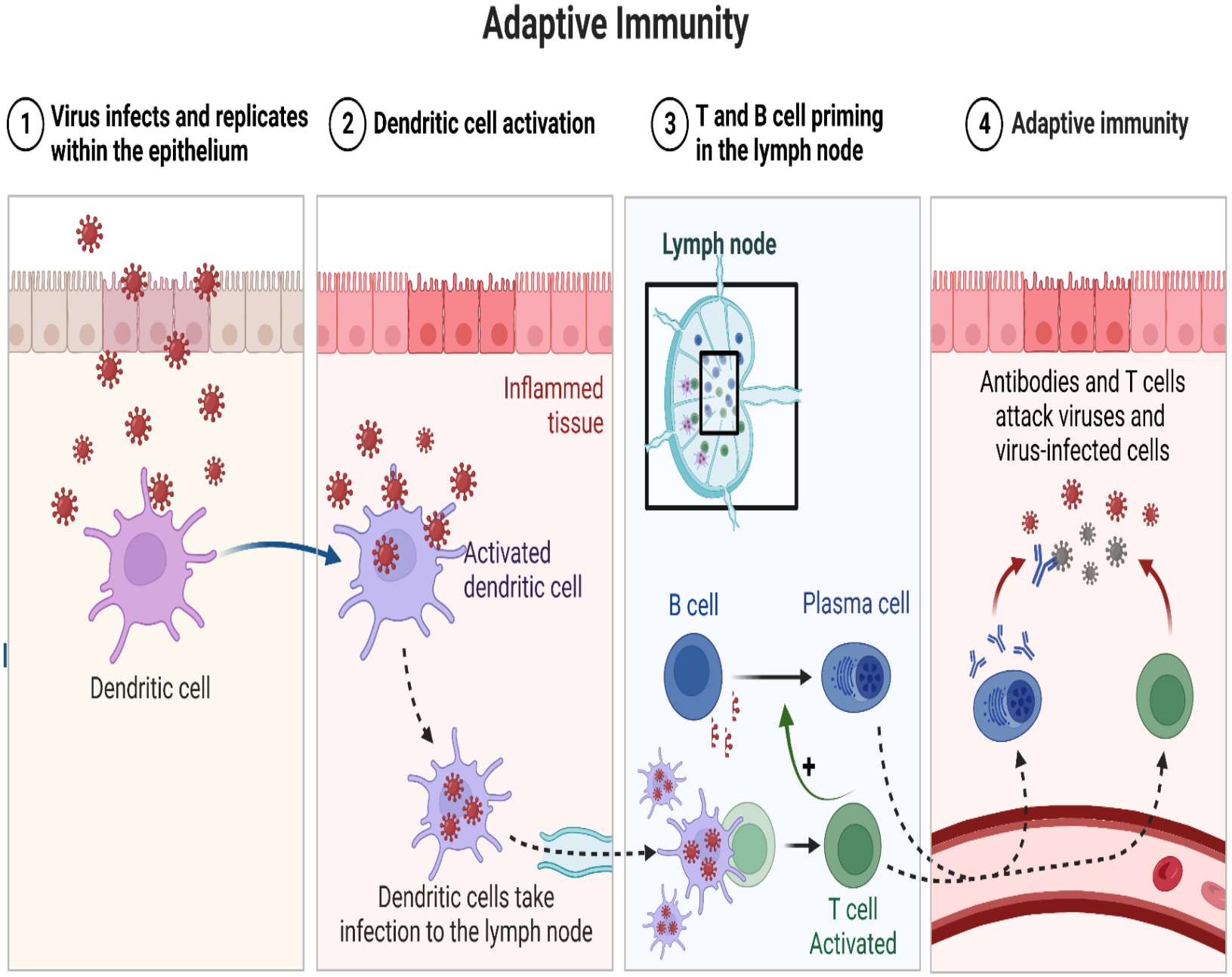
- (1) *helper T cells*
  (2) *cytotoxic T cells*
  (3) *suppressor T cells*

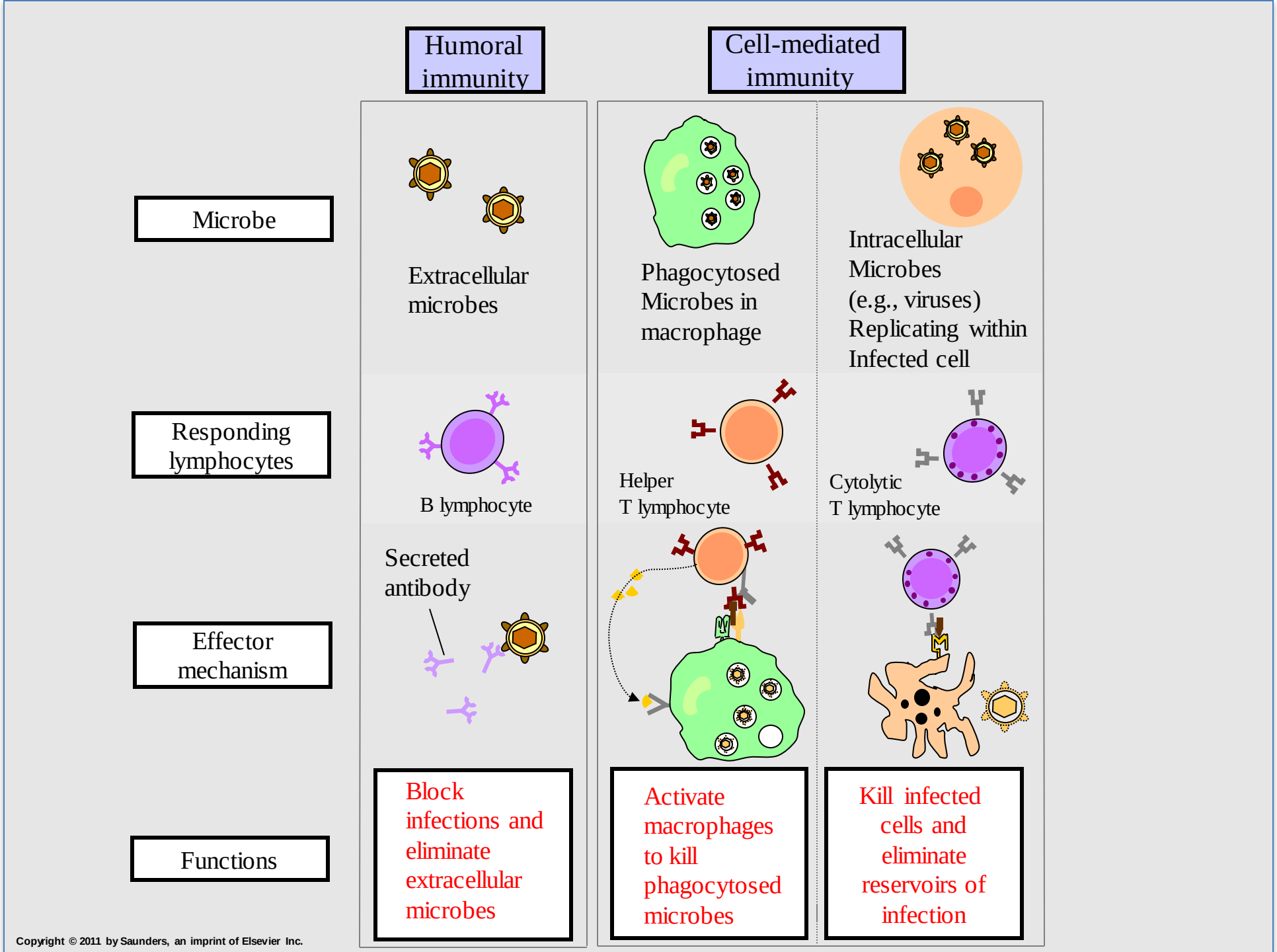
** Most antigens activate both T lymphocytes and B lymphocytes at the same time.

Before becoming exposed to a specific antigen, B lymphocyte clones lie latent in lymphoid tissue. When a foreign antigen enters the lymphoid tissue, macrophages phagocytize it and present it to T cells resulting in the formation of activated helper T cells. These helper cells release chemicals (known as lymphokines) that activate the specific B lymphocytes. Indeed, without the assistance of these helper T cells, the amount of antibodies produced by B lymphocytes is usually minimal.

**The plasmablasts then begin to divide at a rate of about once every 10 hours for about nine divisions, giving in 4 days a total population of about 500 cells for each original plasmablast. The mature plasma cell then produces gamma globulin antibodies at an extremely rapid rate—about 2000 molecules per second for each plasma cell.

**The antibodies are secreted into the lymph and carried to the circulating blood.





Formation of Memory cells (B-lymphocyte)

**A few of the lymphoblasts formed by activation of a clone of B lymphocytes do not go on to form plasma cells but instead form moderate numbers of new B lymphocytes similar to those of the original clone.
**They also circulate throughout the body to populate all the lymphoid tissue; immunologically, however, they remain dormant until activated once again by a new quantity of the same antigen

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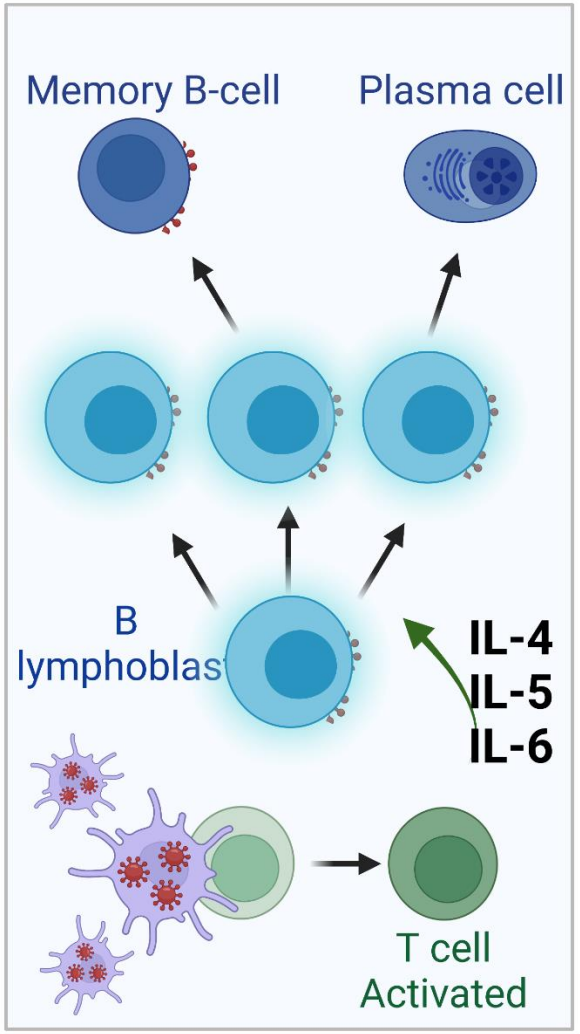
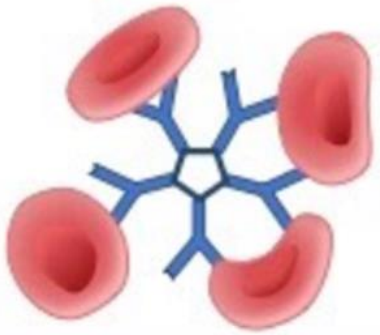


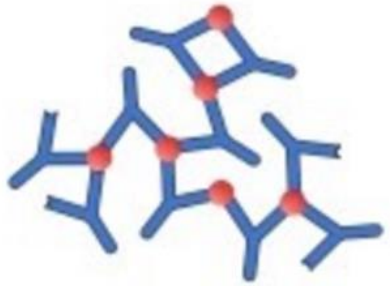
Mechanisms of Action of Antibodies

Agglutination



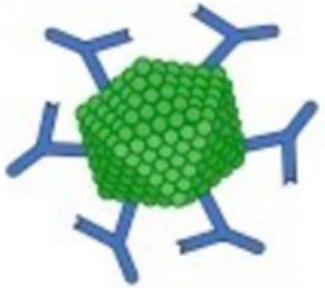
Links cell-bound antigens together, causing clumping

Precipitation



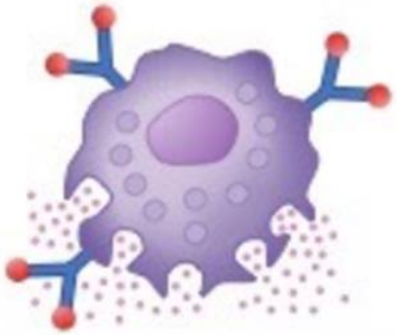
Makes soluble antigens insoluble, aiding elimination

Neutralisation



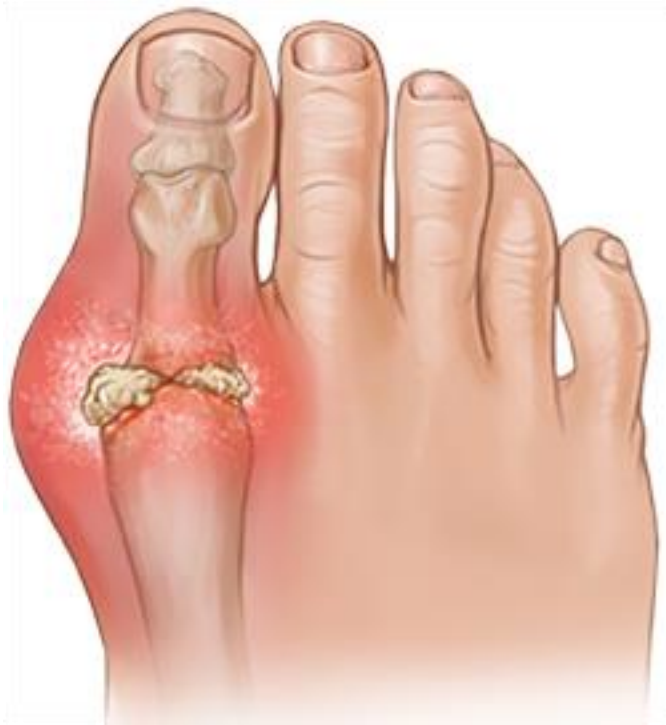
Masks dangerous parts of pathogen (e.g. exotoxins, etc.)

Lysis



Directly attacking membranes cause rupture

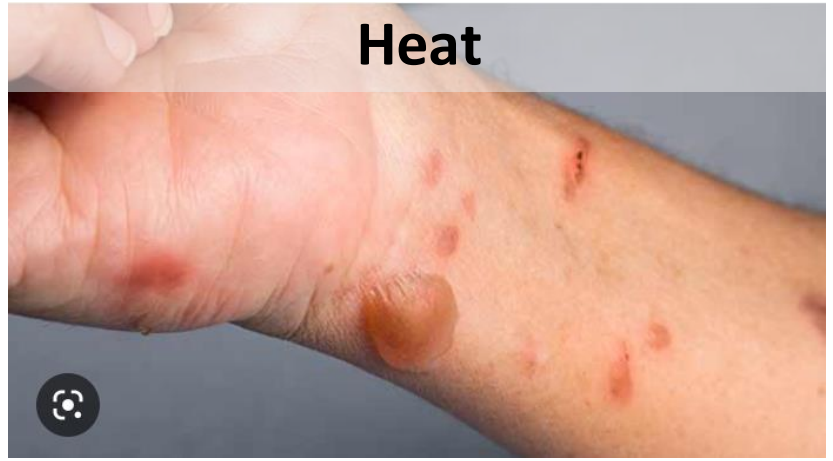
Inflammation



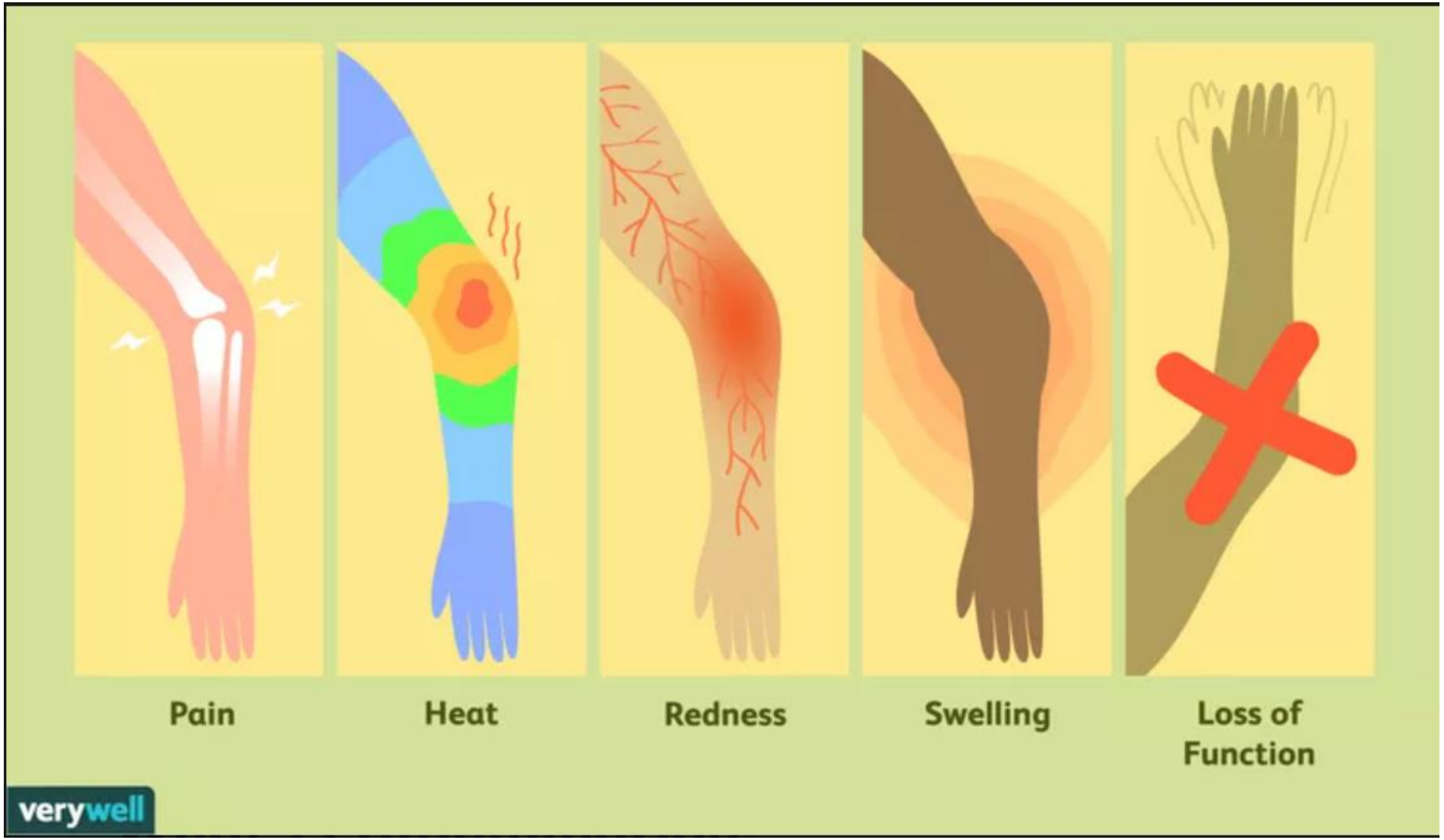
Inflammation

- The complex of changes that accompany tissue damage including vascular and cellular events that aim to clean up any cellular debris or pathogen and initiate repair.

Types/causes of Inflammation:



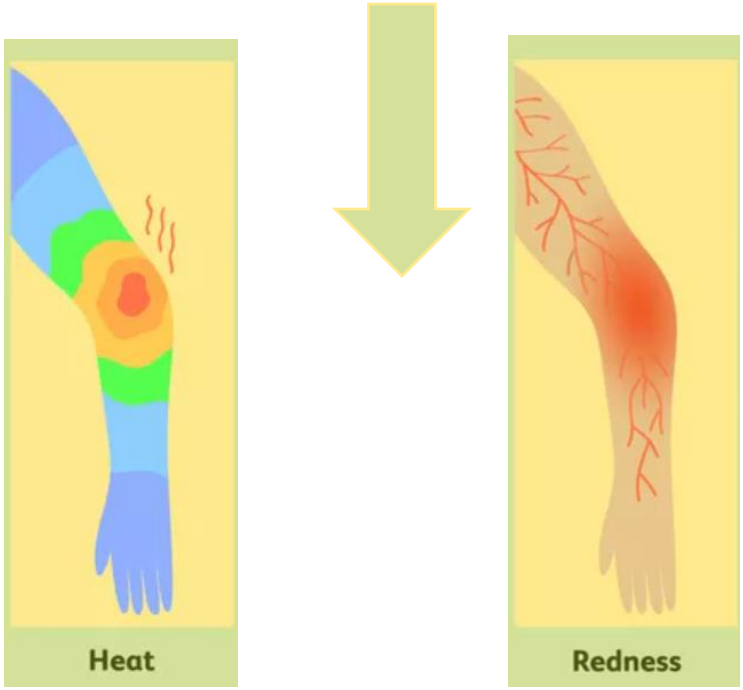
Signs of Inflammation

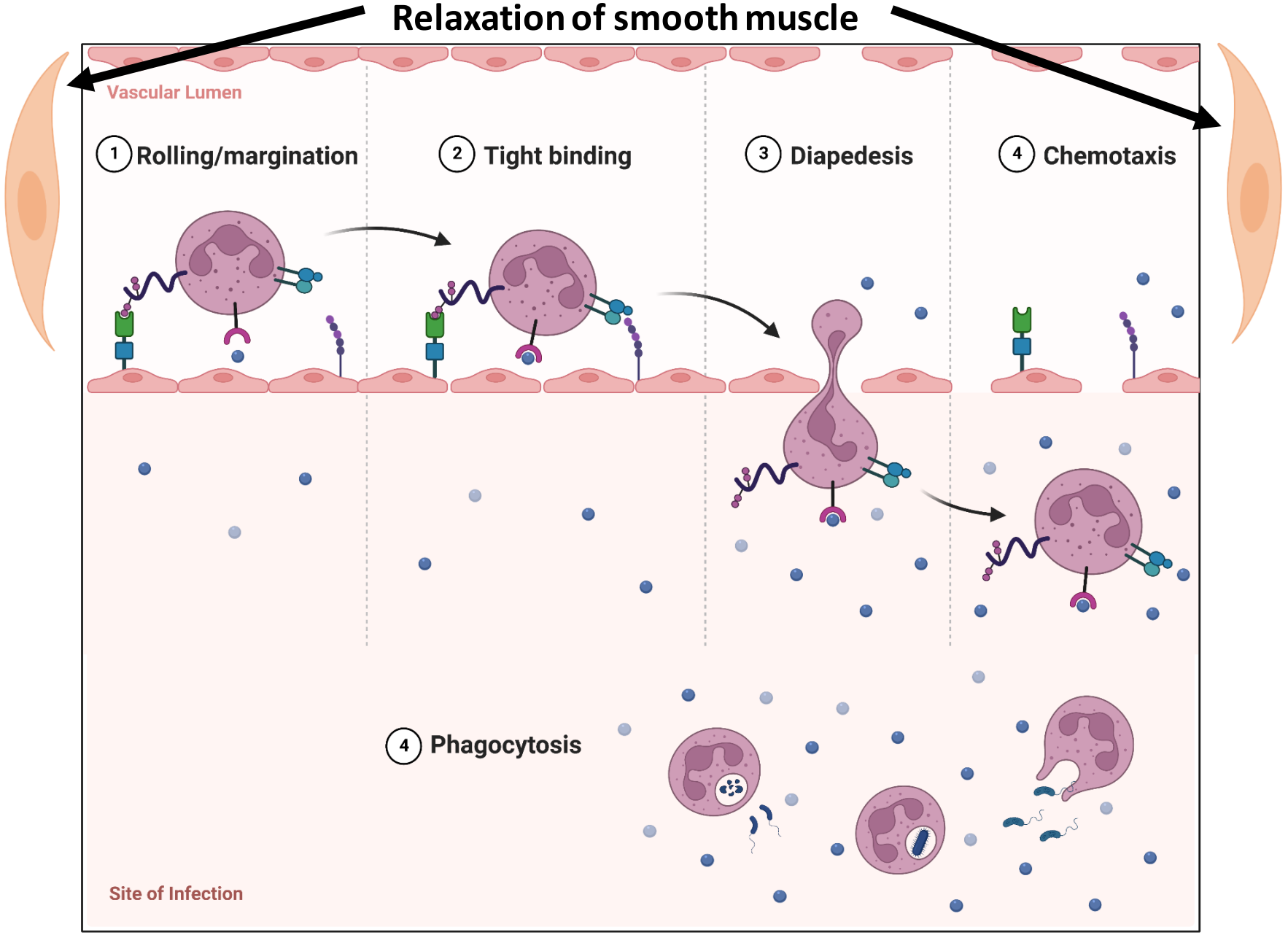


5 Signs of Inflammation: Pain, Heat, Redness, Swelling, and Loss of Function. By Lana Barhum

Inflammation is characterized by:

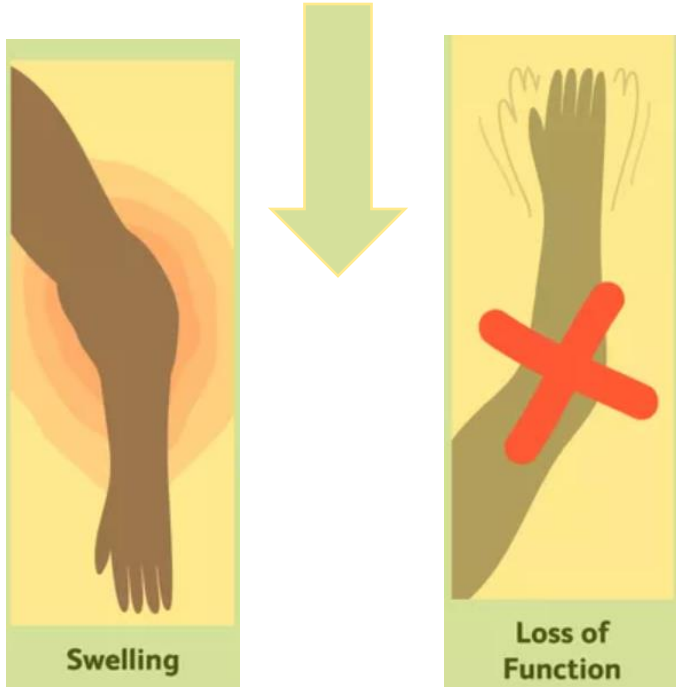
1. Vasodilation of the local blood vessels.

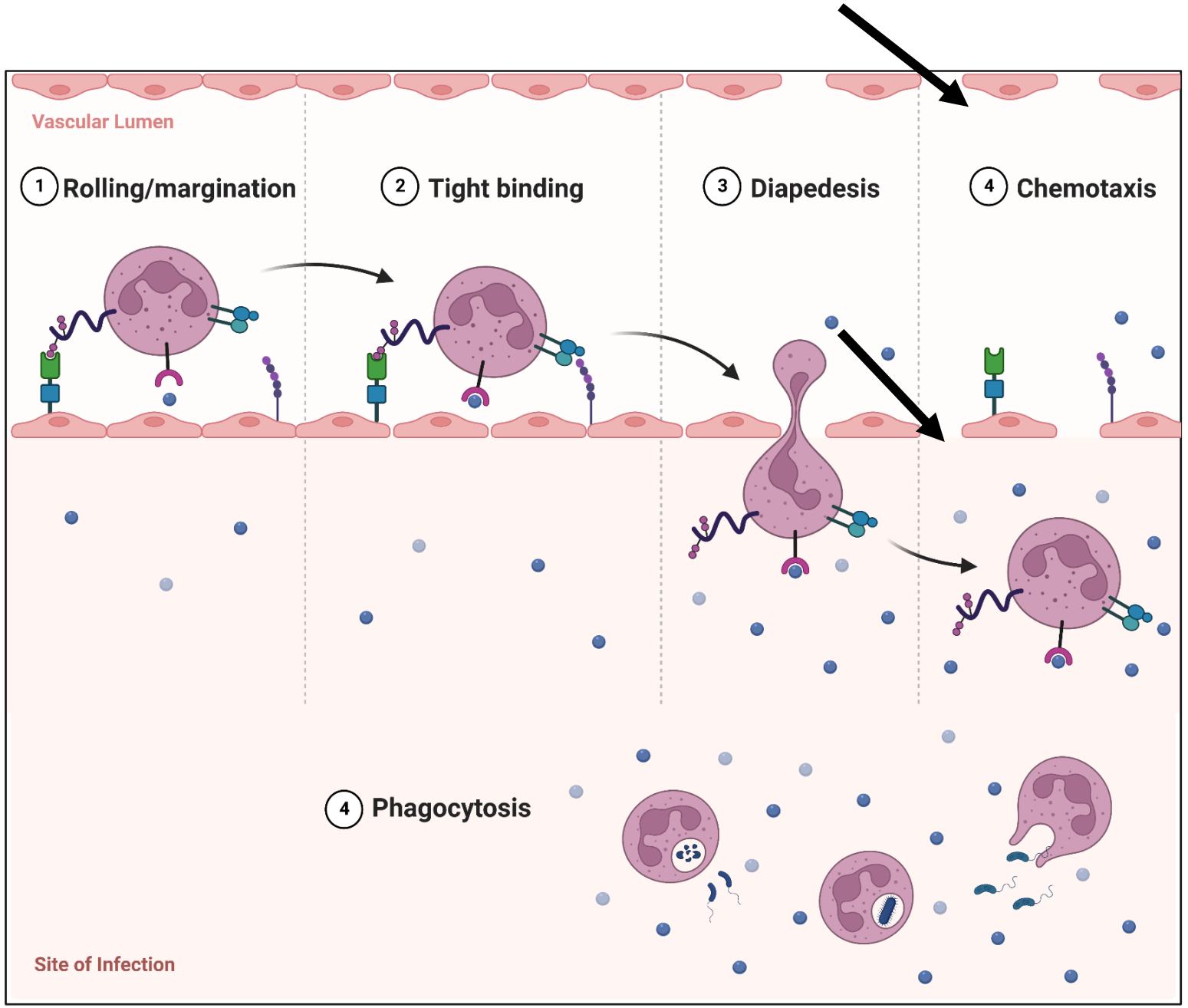




Inflammation is characterized by:

2. Increased permeability of the capillaries.





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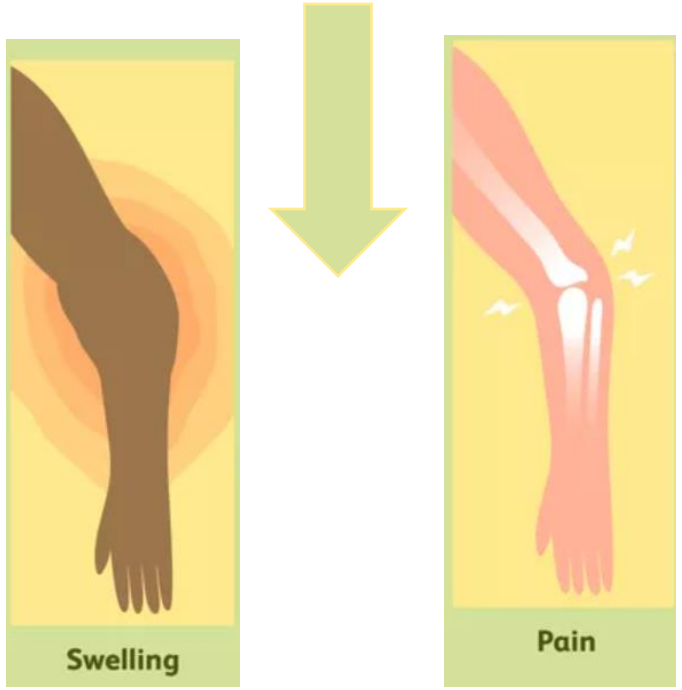
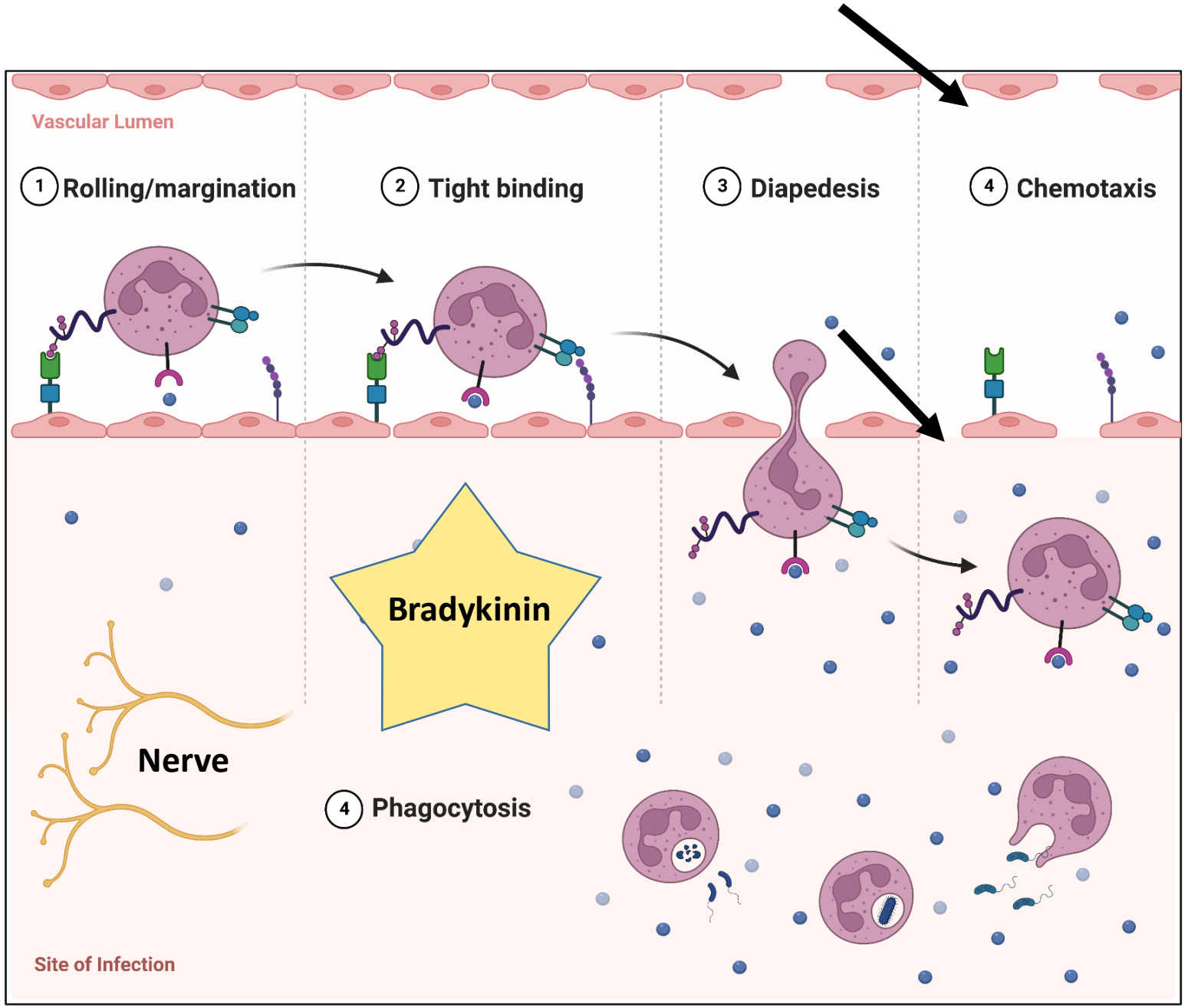
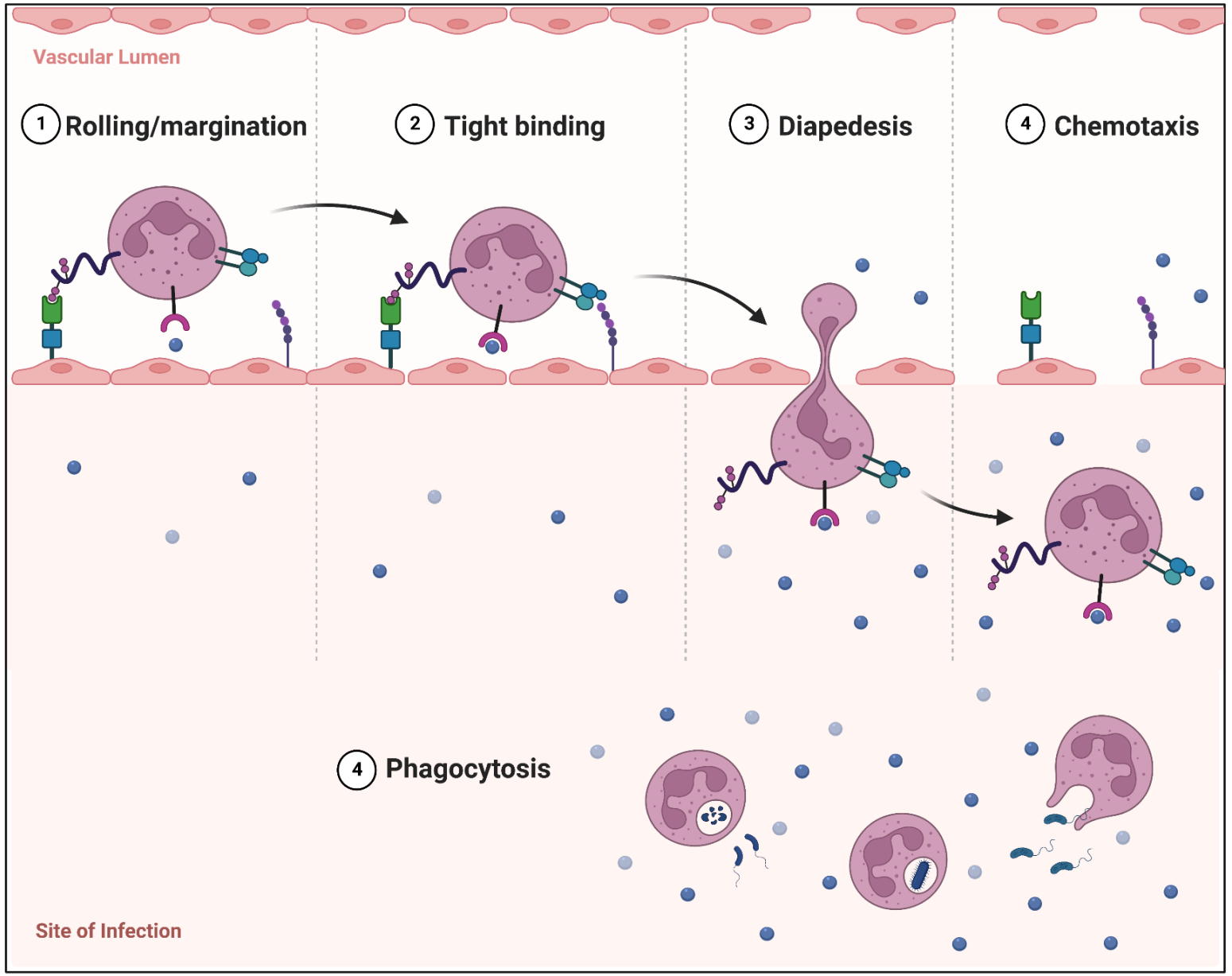




Inflammation is characterized by:

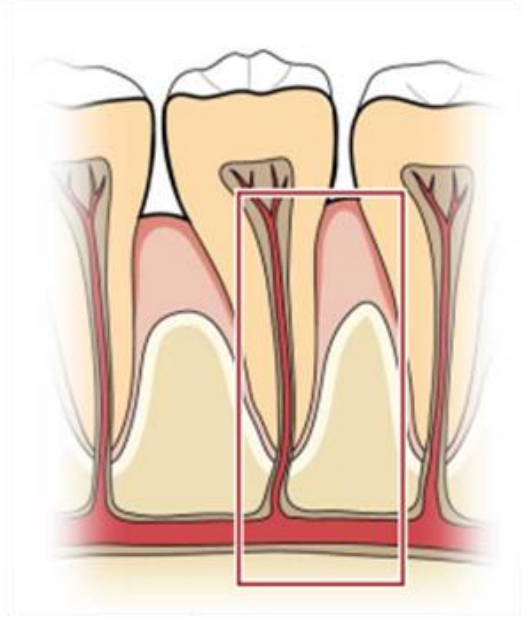
3. Migration of large numbers of granulocytes and monocytes into the tissue.

Leukocytosis

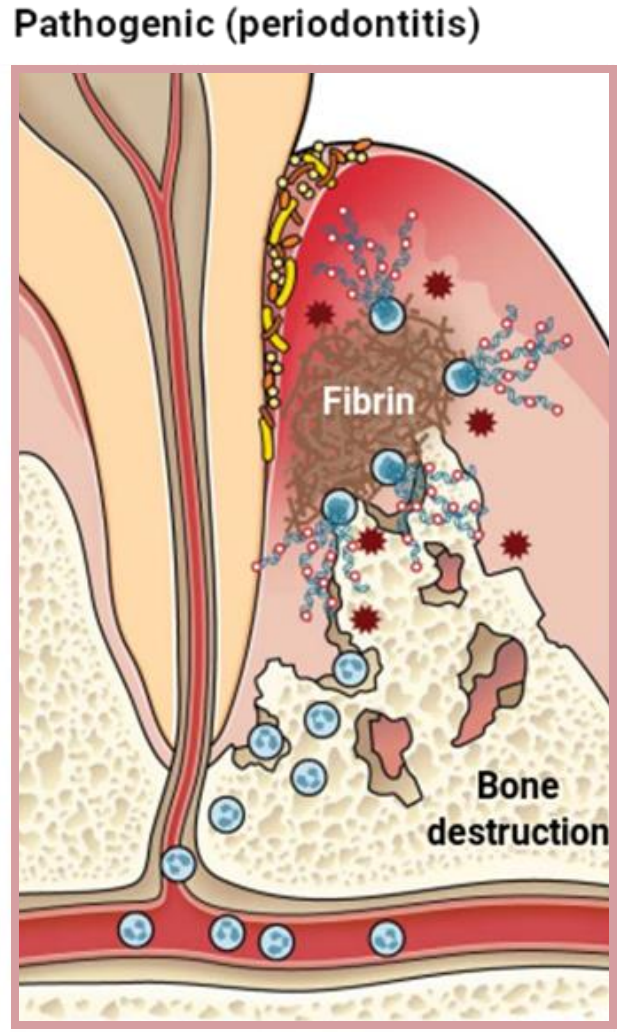


Inflammation is characterized by:

4. Increased amounts of fibrinogen and other proteins leaking from the capillaries.

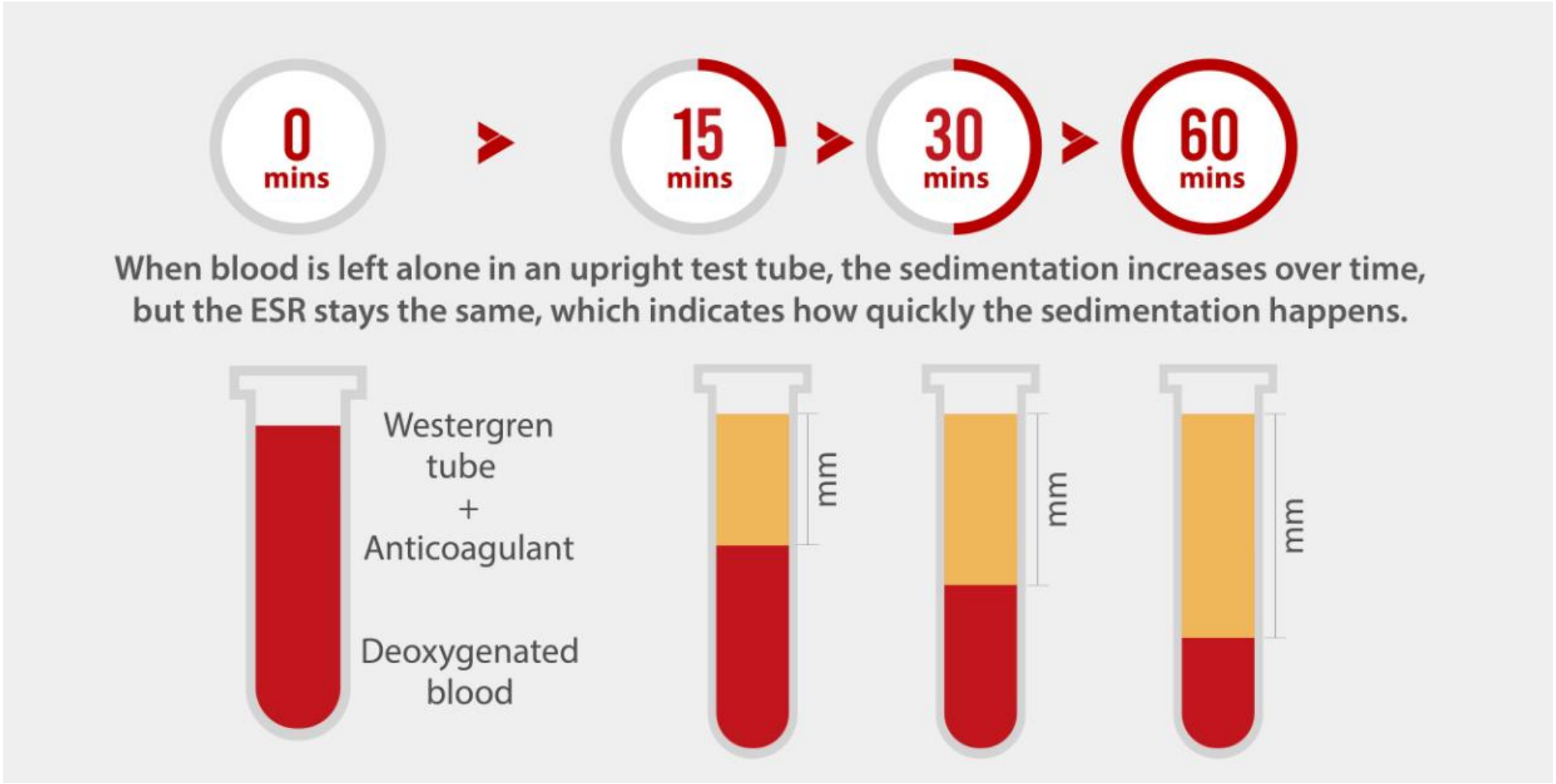


Walling-Off

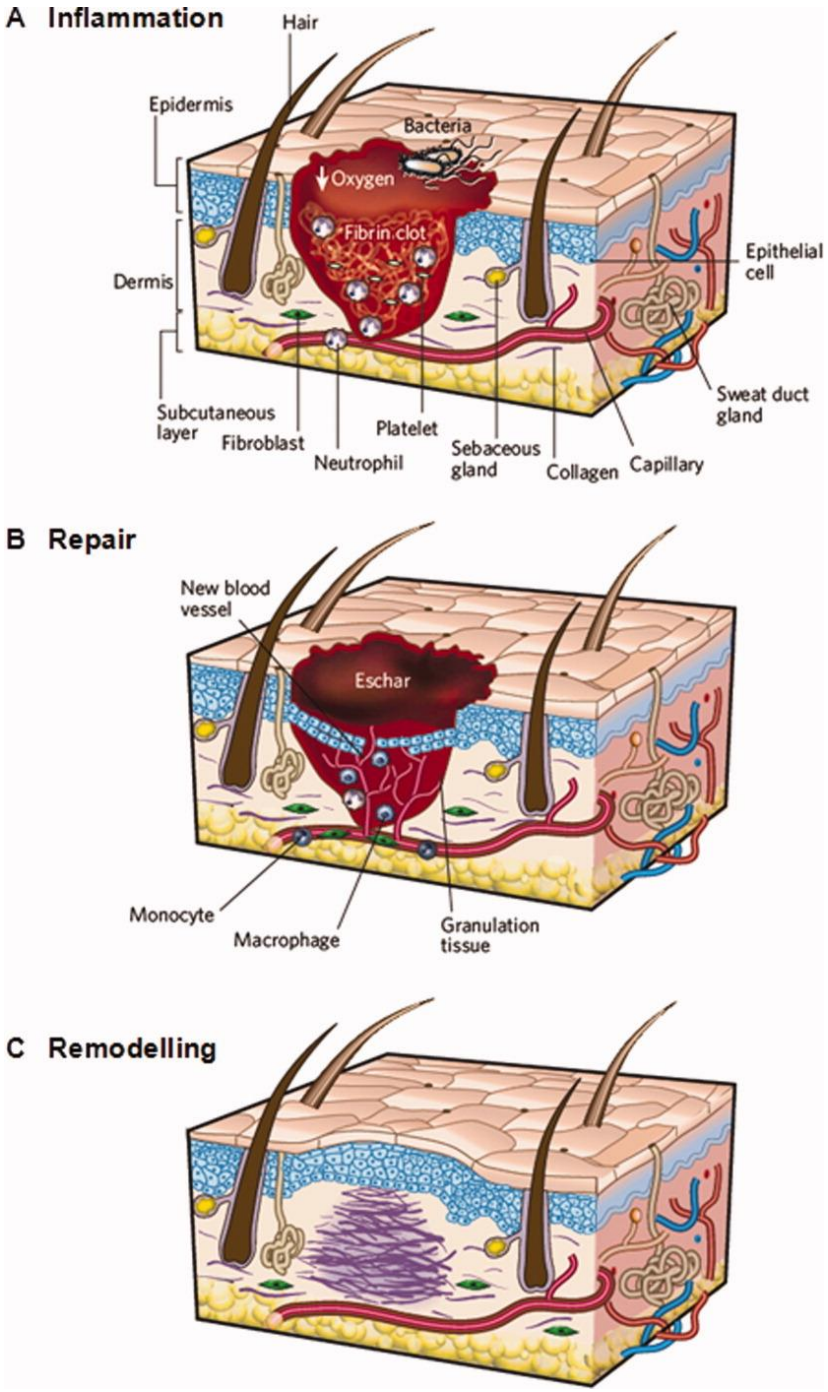


Fibrin sparks inflammation in the oral mucosa, Volume: 374, Issue: 6575, Pages: 1559-1560, DOI: (10.1126/science.abn0399)

Erythrocyte sedimentation rate (ESR)



Increase in plasma fibrinogen levels → Sedimentation↑ → ESR↑



- (A) A fibrin clot is formed and inflammatory cells enter the wound site.
- (B) Re-epithelialization
- (C) Remodeling is the final stage of wound healing. ECM remodeling factors modulate and revise the scar tissue.

The first phase is dominated by thrombin cleavage of fibrinogen integrated with an acute inflammatory response that functions to contain tissue damage, stop the loss of blood, and prevent microbial infection. The second phase is dominated by plasmin dissolution of fibrin and other matrix proteins integrated with reparative inflammatory cells working to remodel and repair damaged tissue