

Bacterial Skin and Soft Tissue Infections-1

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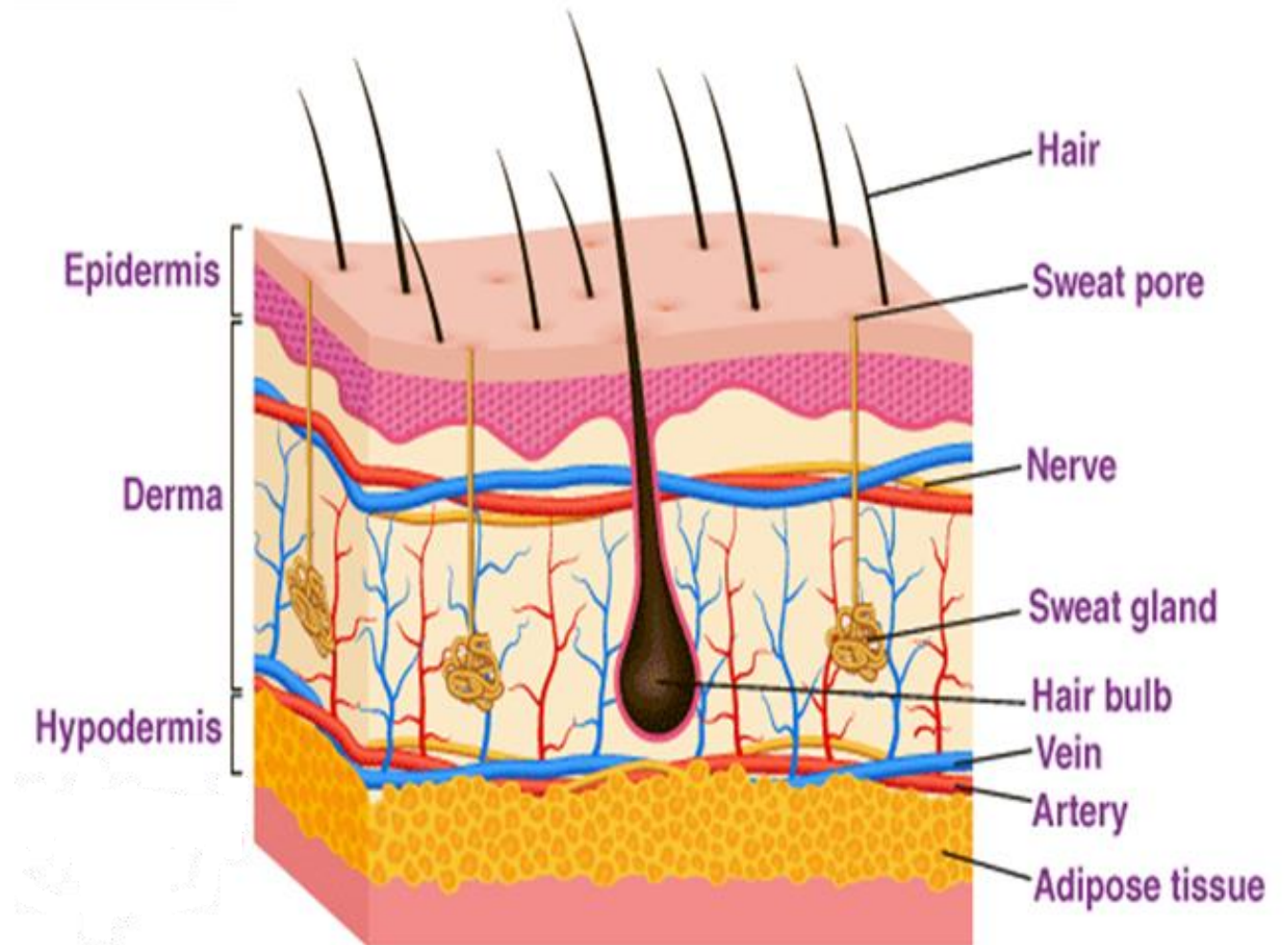
Outlines

- Introduction
- Skin's Defence System and Skin Microbiota
- Skin and soft tissue infections (SSTIs)
- Bacteria associated with SSTIs: *S. aureus*, and *S. pyogenes*
- Purulent, and Non-purulent SSTIs

1. Introduction: Skin Structure

Composed of three primary layers:

- Epidermis
- Dermis
- Hypodermis



The Skin's Defence System

1. Physical Barrier:

- Stratum Corneum: composed of tightly packed dead cells and lipids that shield against pathogens and environmental irritants.
- Continuous Renewal: Old cells are regularly shed and replaced, helping to remove microbes that adhere to the skin surface.

2. Chemical Barrier:

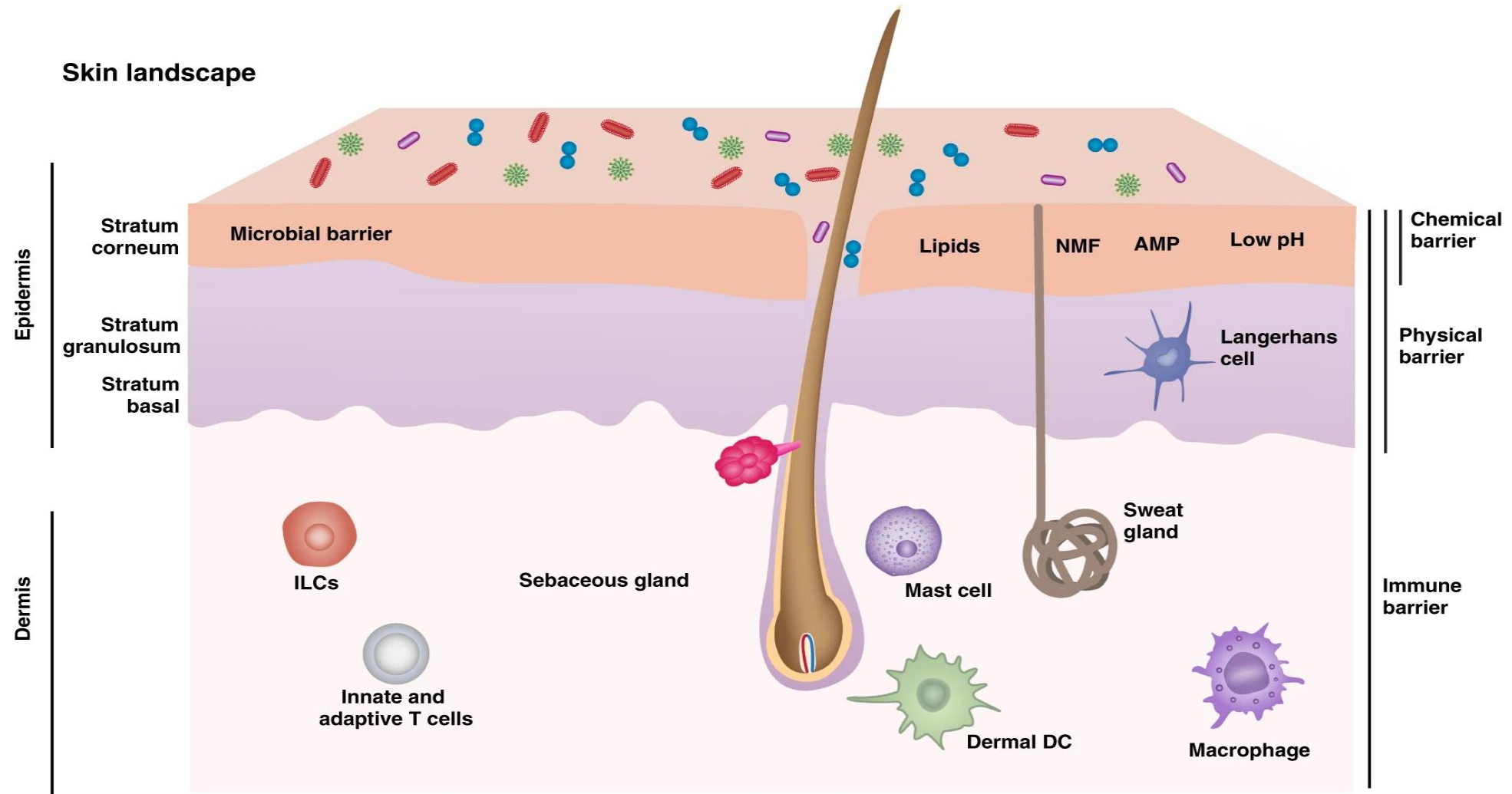
- Acidic pH: its slight acidity inhibits the growth of many harmful bacteria.
- Antimicrobial Peptides: a cationic peptides produced by keratinocytes and sweat glands that kill invading microbes such as Cathelicidins and Defensins
- Sebum Production: Oils secreted by sebaceous glands contain bactericidal properties.

The Skin's Defence System (Cont.)

3. Biological Barrier:

- Immune Cells: The dermis is rich in immune cells like Langerhans cells and macrophages that detect and fight infections.
- Microbiota: The skin hosts a diverse array of microorganisms, which compete with pathogens and prevent their colonization.

The Skin's Defence System (Cont.)



The Skin's Defence System: Skin Microbiota

- Skin microbiota are a **diverse community microorganisms** (e.g., bacteria, fungi, viruses, and mites) living on humans and **do not harm** the host under normal circumstances.
- The skin microbiota protects the skin by:
 - A. Competing with pathogens for resources
 - B. Producing antimicrobial substances
 - C. Maintaining an acidic pH



The Skin's Defence System: Skin Microbiota (Cont.)

Aspect	Resident microbiota	Transient microbiota
Definition	A relatively fixed types of microorganisms regularly found in a given area at a given age	Microorganisms that temporarily reside on the skin (hours, days, or weeks).
Composition	Mostly harmless microbes.	non-pathogenic or potentially pathogenic microorganisms
Origin	Established during early life and relatively stable over time.	Acquired from the environment, objects, or other individuals.
Function	• Protect against pathogens through competition. • Produces substances that inhibit pathogenic growth. • Educate and modulate the immune system.	• Do not typically contribute to physiological functions. • Presence can be beneficial or harmful depending on the context.

The Skin's Defence System: Skin Microbiota (Cont.)

Aspect	Resident microbiota	Transient microbiota
Removal	if disturbed, it promptly reestablishes itself	Can be removed by routine hygiene practices like washing.
Examples	<i>Staphylococcus epidermidis</i> , <i>Propionibacterium acnes</i> , Micrococci yeasts.	Bacteria: <i>S. aureus</i> , <i>S. pyogenes</i> <i>Clostridia</i> (gangrene) Fungi: <i>Candida albicans</i> Viruses: <i>Herpes simplex</i> viruse 1 and 2, <i>Papilloma</i> -warts

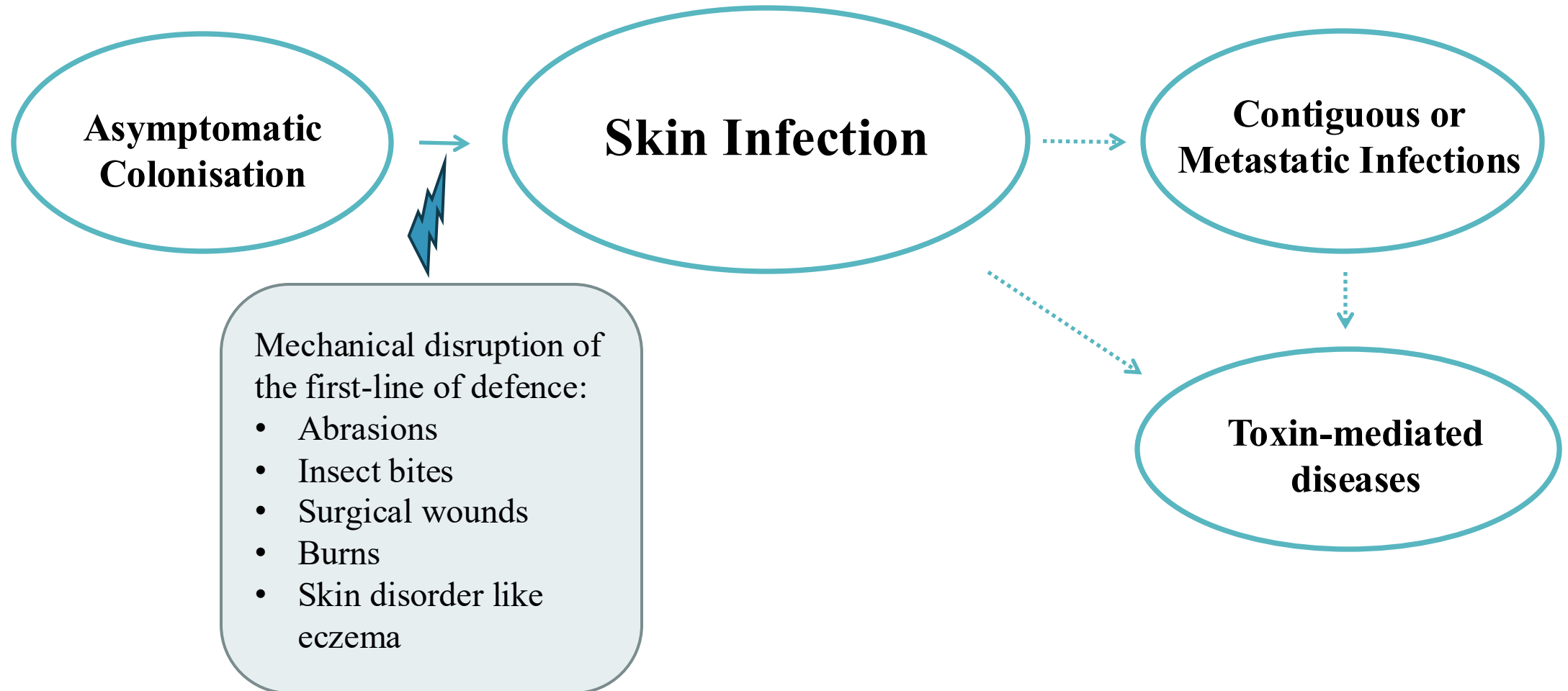
Bacterial Skin and Soft Tissue Infections

Introduction

- Skin and soft tissue infections (SSTIs) are a group of heterogeneous conditions affecting the epidermis, dermis, subcutaneous tissue, or superficial fascia.
- SSTIs range from mild infections, such as folliculitis, to serious life-threatening infections, such as necrotizing fasciitis.

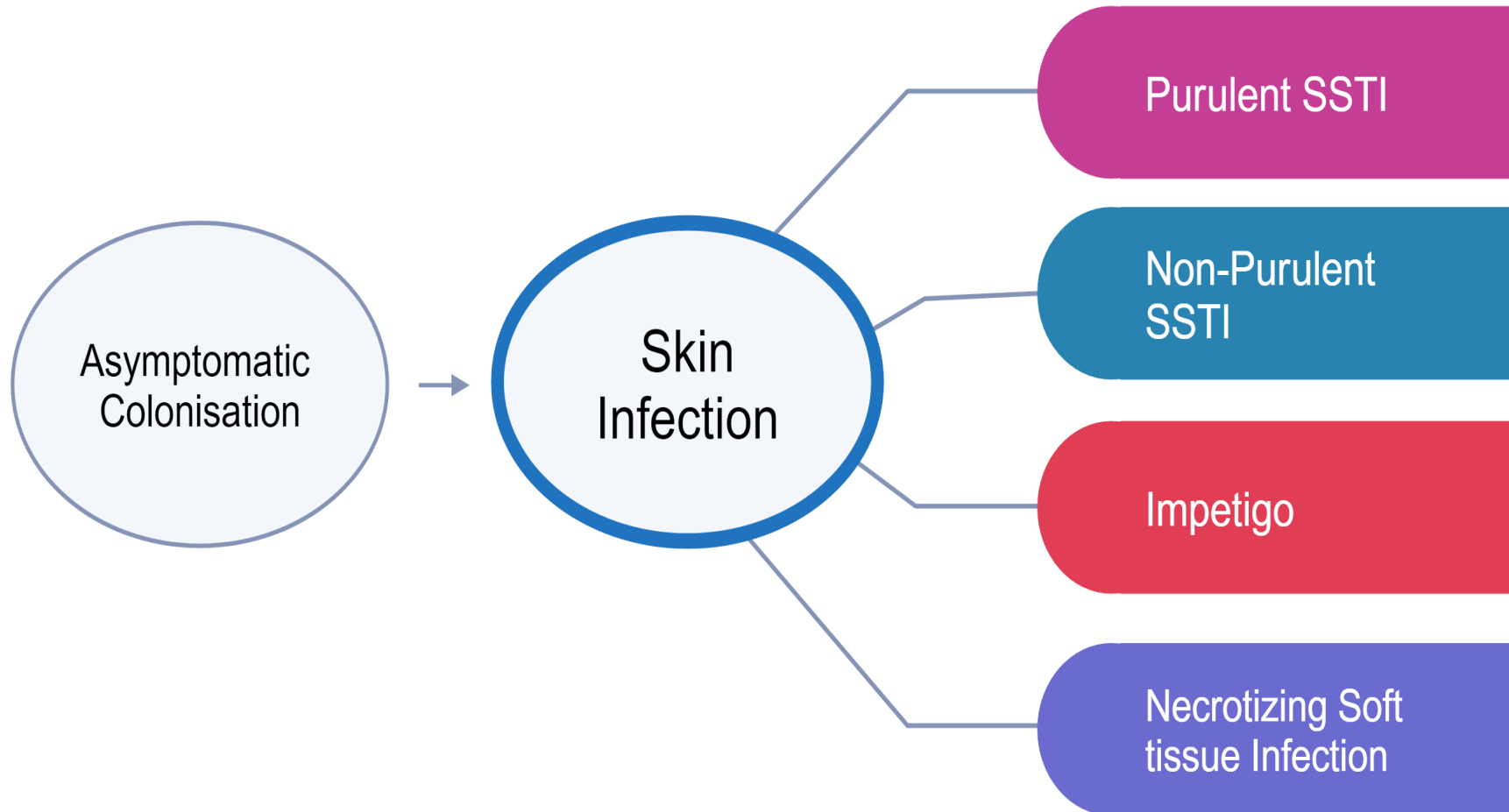
Introduction

Progression of Bacterial Skin and Soft Tissue Infections



Introduction

Skin Infections



Infectious agent:

Common:

S. aureus

S. pyogenes

P. aeruginosa

Uncommon:

Vibrio vulnificus

Aeromonas hydrophila

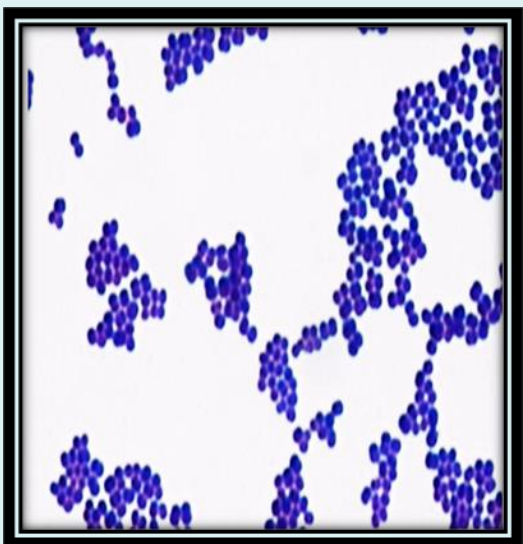
Infectious agent:

Common:

- *S. aureus*
- *Streptococcus pyogenes*
- *P. aeruginosa*

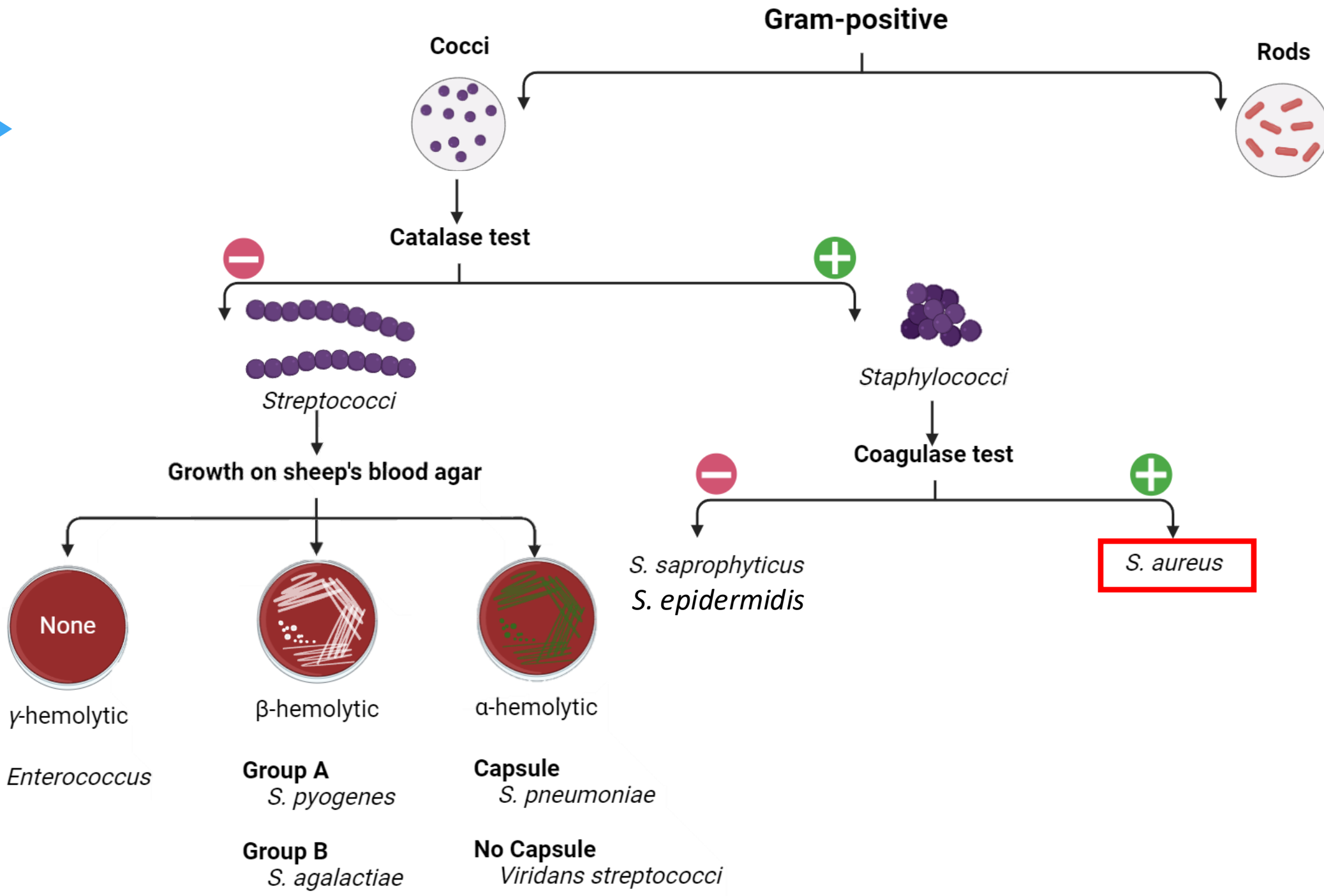
Uncommon:

- *Vibrio vulnificus*
- *Aeromonas hydrophila*



Infectious agents - *Staphylococcus aureus*

- Gram-positive cocci that clusters like grapes.
- Characteristics:
 - Coagulase-positive: distinguishes *S. aureus* from other less virulent staphylococcal species
 - Common inhabitant of the skin and mucous membranes
 - Salt-tolerant, can grow in high osmotic pressure and low moisture
 - Facultative anaerobe



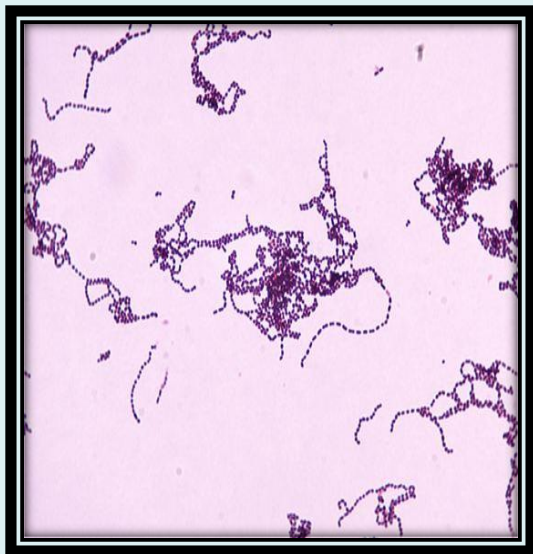
Infectious agent:

Common:

- *S. aureus*
- *Streptococcus pyogenes*
- *P. aeruginosa*

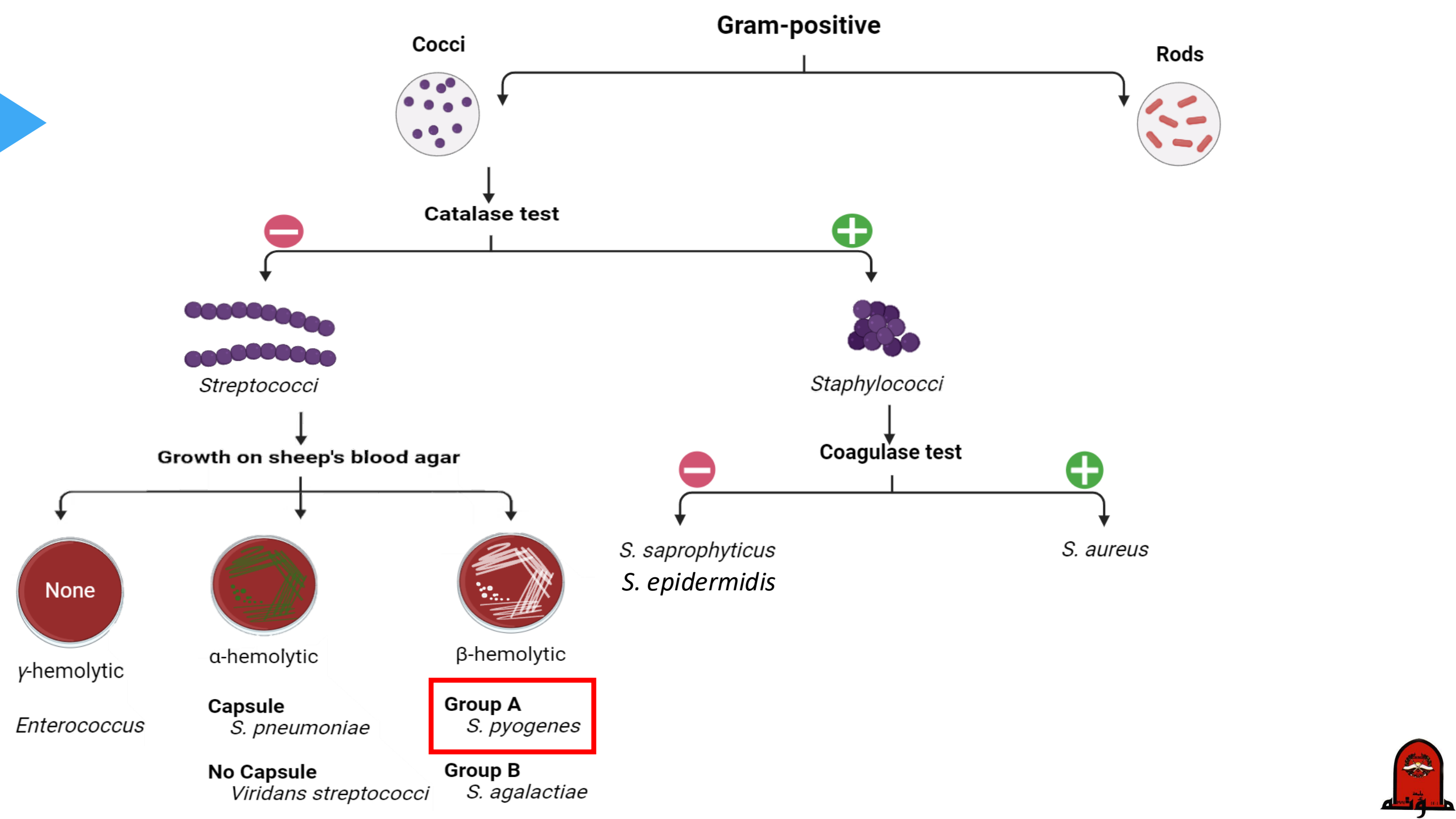
Uncommon:

- *Vibrio vulnificus*
- *Aeromonas hydrophila*



Streptococcus pyogenes

- Gram-positive cocci that typically arranged in **chains**.
- Its also known as Group A Streptococcus (**GAS**).
- Characteristics:
 - Catalase test-negative: distinguishes Streptococcus from Staphylococcus species.
 - Commonly colonise nasopharynx and skin
 - Facultative anaerobe
 - β - haemolytic: it produces streptolysin (Streptolysin O and S) , an exotoxin that lyses red blood cells, resulting in a clear zone around the colonies.



Introduction

Primary raised skin lesions

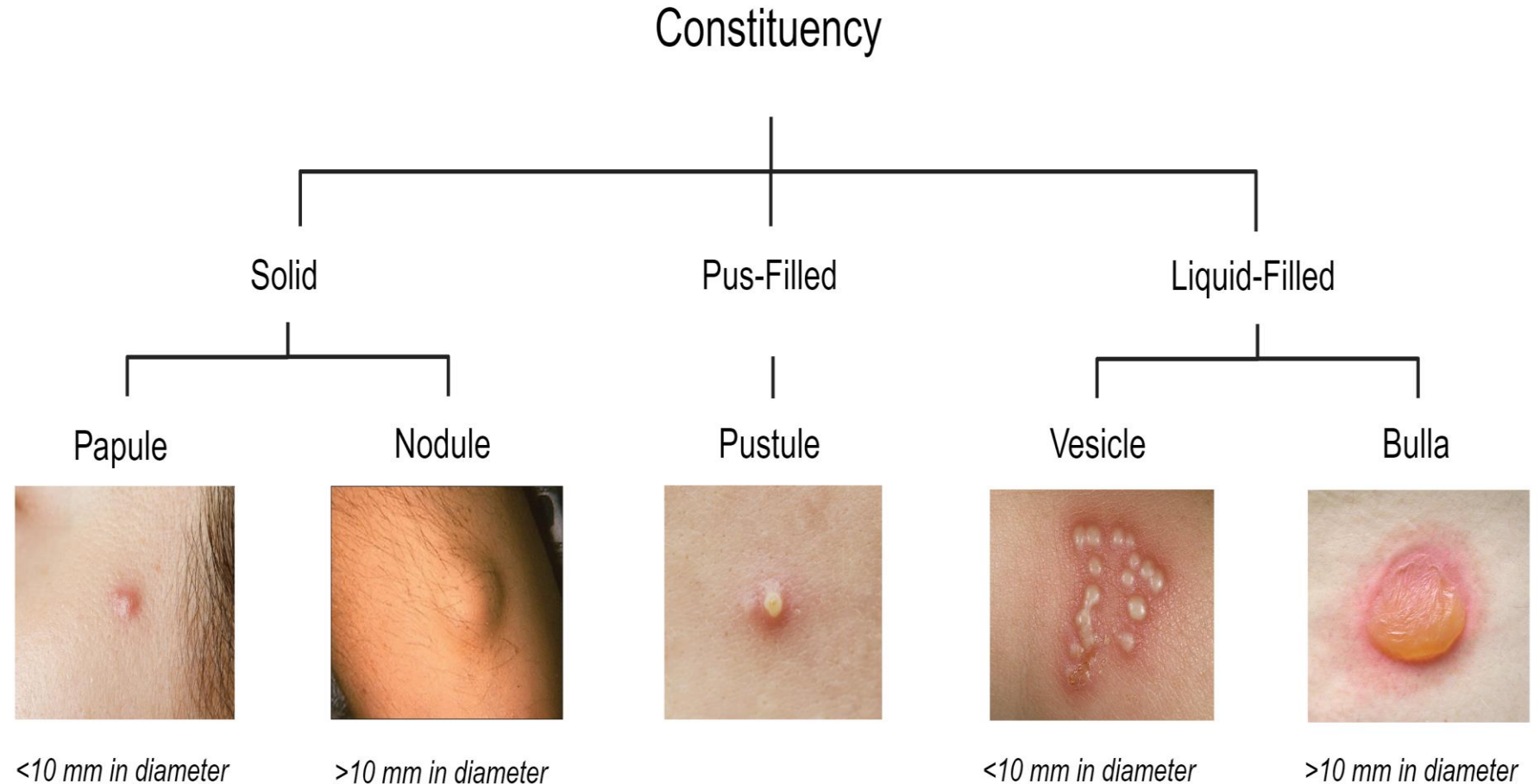
✓ Papule

✓ Nodule

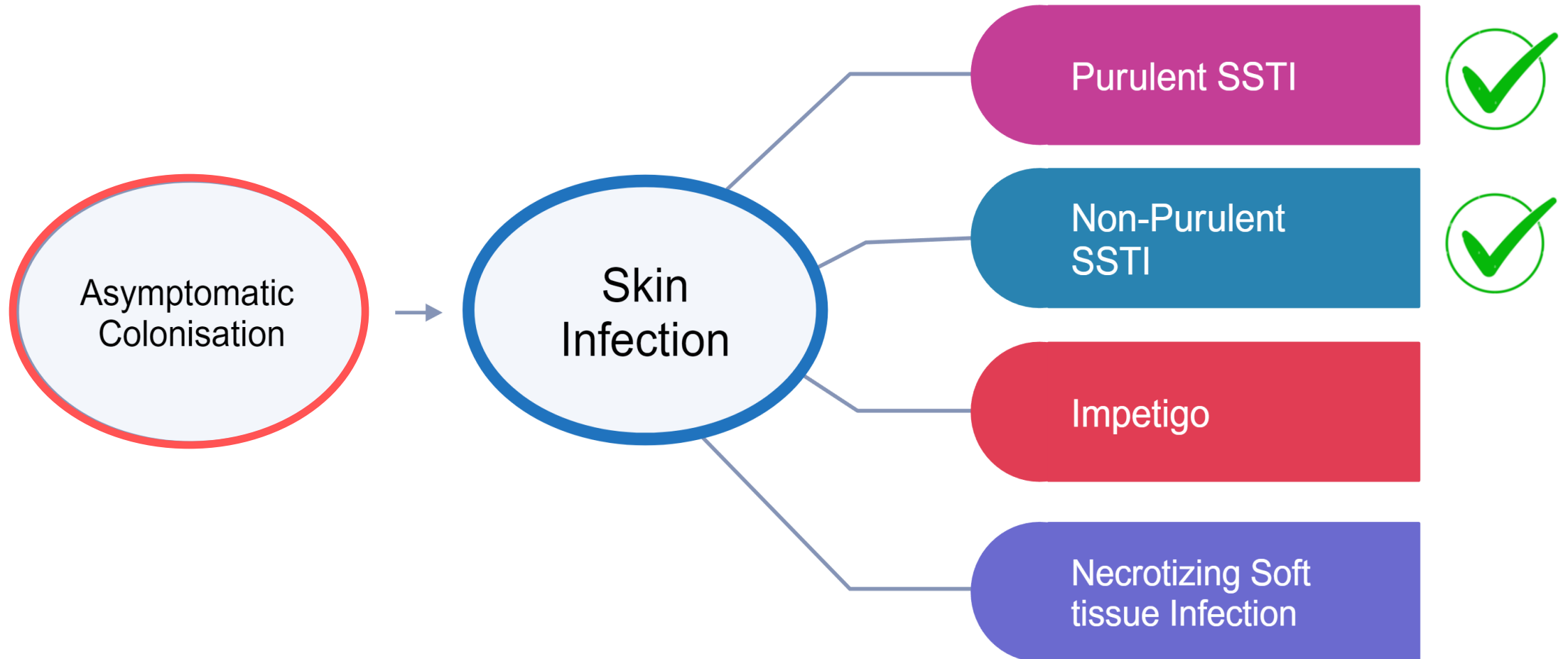
✓ Pustule

✓ Vesicle

✓ Bulla

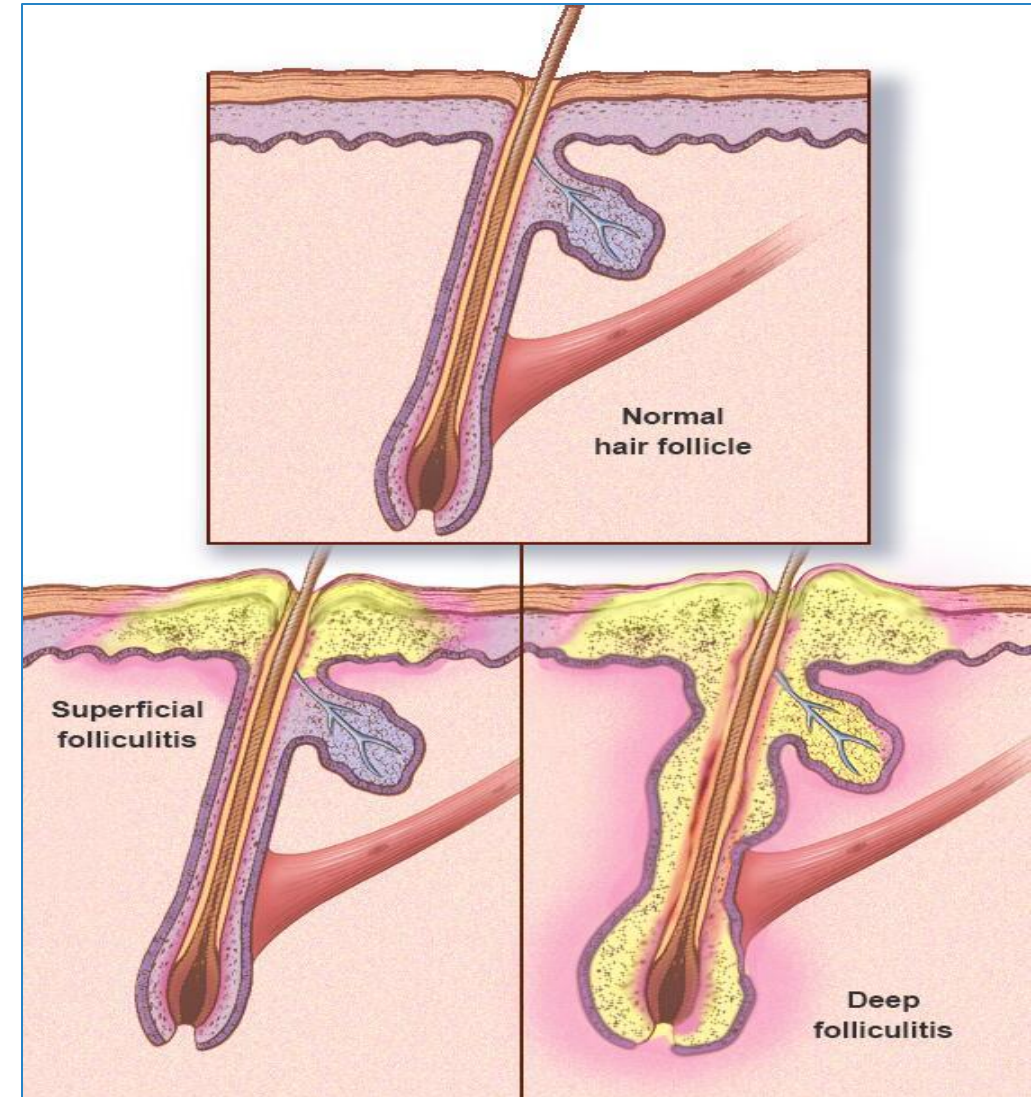


Skin Infections



Purulent SSTIs - Folliculitis

- A localized inflammation of the hair follicle or sebaceous glands.
- Could be superficial or deep infection in the hair follicle



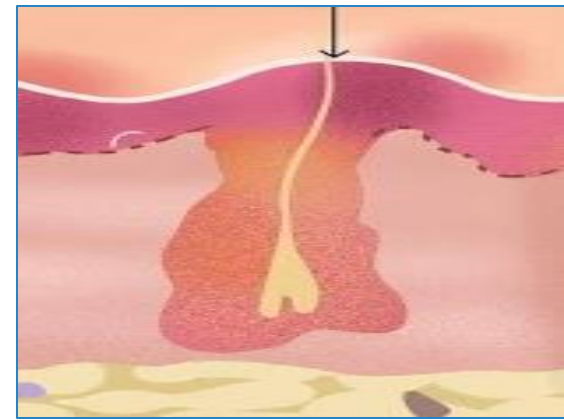
Purulent SSTIs - Folliculitis

- Characterized by erythema, tender papules, and/or pustules at the site of hair follicles.
- Causative agents:
 - *S. aureus* (primarily cause)
 - *Pseudomonas aeruginosa*: Hot tub folliculitis or pseudomonal folliculitis that appears after exposure to contaminated water.
- Self-limiting condition that does not require antibiotic treatment.



Purulent SSTIs - Furuncle

- Furuncle is a deep folliculitis extends beyond the hair follicle into the surrounding tissue. This deeper penetration leads to the formation of a larger, more painful nodule (or **boil**) that is filled with pus.
- A well-demarcated, firm, painful, purulent nodule.
- Commonly appears in areas prone to irritation and sweat, such as the neck, breasts, buttocks, and thighs.
- It affects **only one hair follicle** with single point of drainage.



Purulent SSTIs - Furuncle

- Lesions progress and becomes more swollen over time. After several days, the nodule may rupture releasing pus and eventually pain relieve. They often drain and heal spontaneously **without leaving a scar.**
- **Treatment:**
 - Warm Compresses: to facilitate drainage.
 - Incision and Drainage: if the furuncle does not drain on its own.
 - Antibiotics:
 - Topical antibiotics like mupirocin or fusidic acid creams
 - Oral antibiotics when infection is severe or if there are multiple boils



Purulent SSTIs - Carbuncle

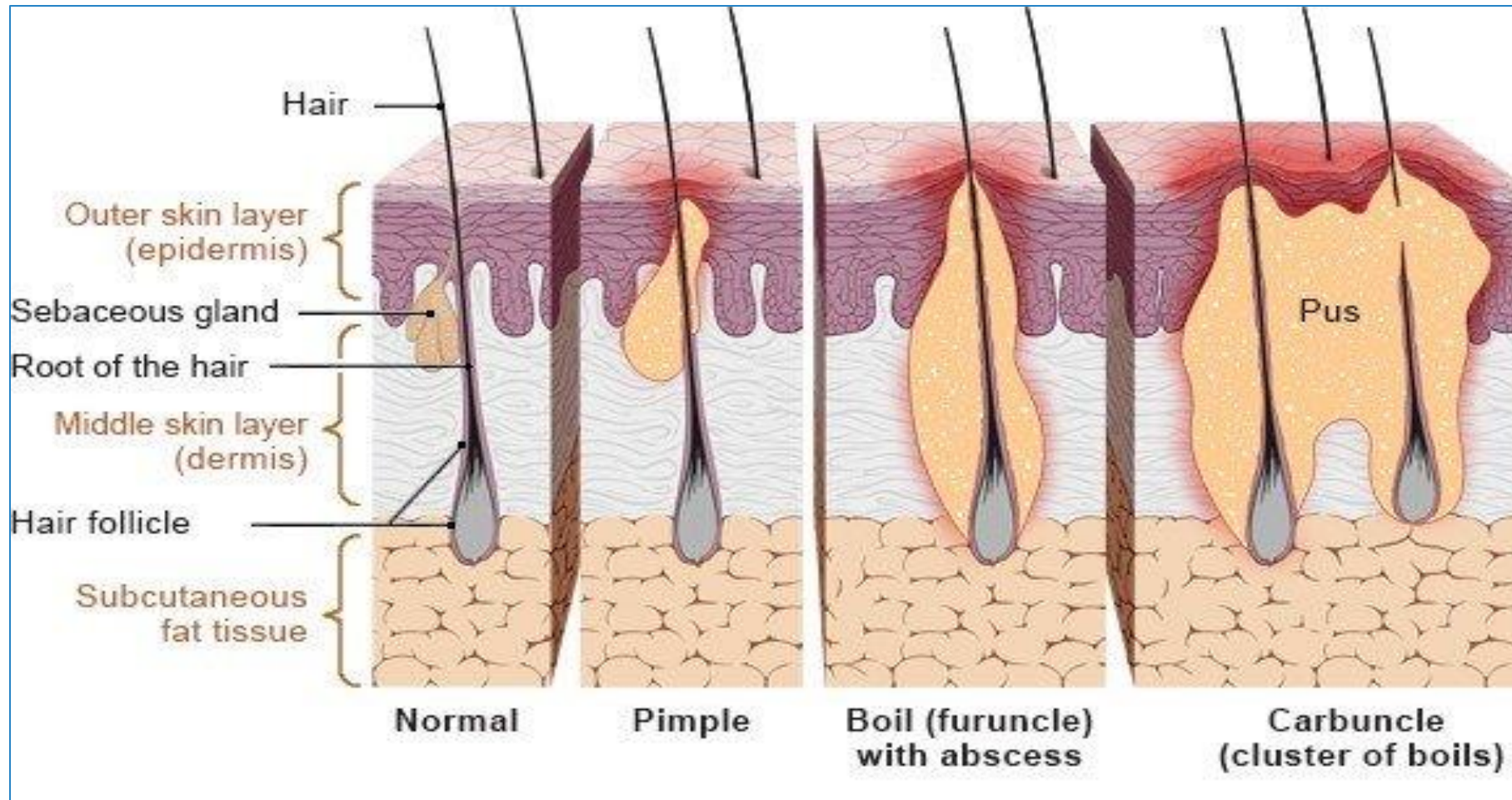
- Carbuncles are **clusters of furuncles** interconnected subcutaneously, creating a large, pus-filled pockets, which eventually **drain** from **several sites** to the surface.
- Carbuncles often associated with fever, fatigue, and swollen lymph nodes.
- Leave a scar when it heals.
- The locations are similar to furuncles



Purulent SSTIs - Carbuncle

- Treatment:
 - Incision and Drainage: Almost always necessary due to the depth and severity of the infection.
 - Oral or Intravenous Antibiotics: Necessary to treat the deeper infection and prevent spread, especially if systemic symptoms are present.
 - Antibiotics options include Trimethoprim/sulfamethoxazole, or Doxycycline

Purulent SSTIs - Folliculitis VS Furuncle VS Carbuncle



Question

- ✓ Folliculitis
- ✓ Furuncle
- ✓ Carbuncle
- ✓ Skin abscess



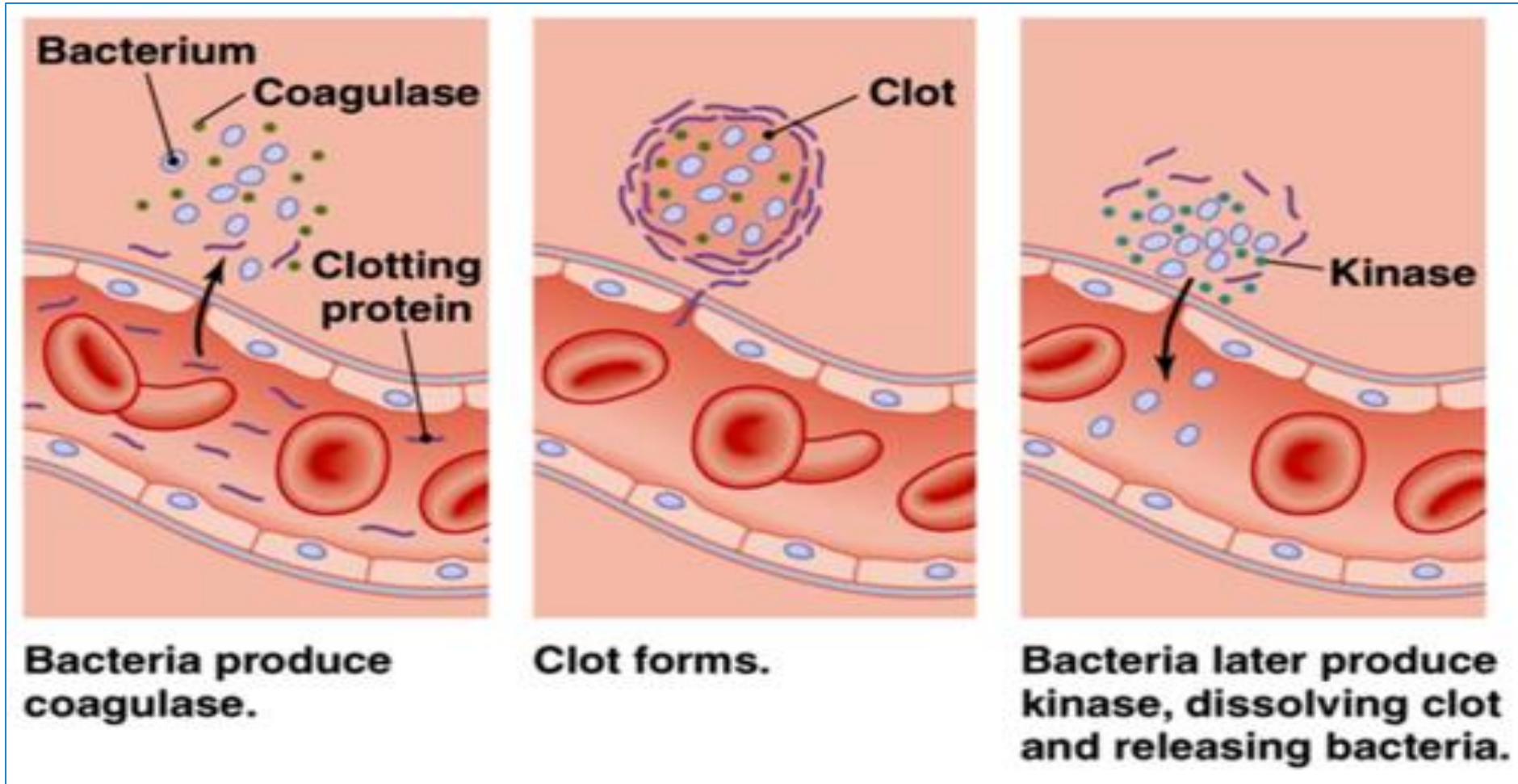
Q: Abscesses are a frequent manifestation of *S. aureus* skin and soft tissue infections, why?

- The tendency of *S. aureus* to cause localized infections primarily results from its **Coagulase** enzyme.
- This enzyme converts fibrinogen to fibrin, leading to the formation of localized blood clots (thrombi) around the infection site.

Fibrinogen → Fibrin → Clot formation around the infection site.

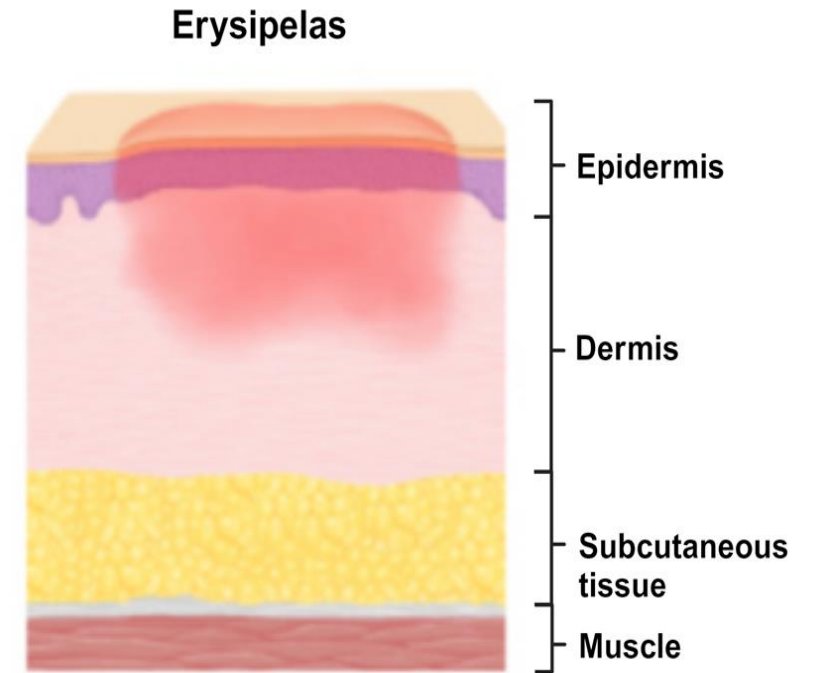
→ The clot acts as a barrier, both **protecting** the bacteria from the **immune system** and physically **preventing the spread** of the bacteria.

Question: answer (Cont.)



Non-Purulent SSTIs – Erysipelas

- **Erysipelas** is an acute bacterial infection of the **upper dermis** and **superficial lymphatics**.
- **Microbiology:** The causative organism is *Streptococcus pyogenes* (Group A Streptococcus, GAS).



Non-Purulent SSTIs – Erysipelas (cont.)

Clinical features:

- **Systemic symptoms:** (Fever, chills, and malaise) are prominent and frequently precede the skin findings.
- An abrupt onset of **fiery-red** swelling of the **face or extremities** → **sharply demarcated, raised border.**
 - **The step sign**- the sharply raised border with abrupt demarcation from healthy skin
 - Surface is tense and painful
- Peau d'orange (orange peel) appearance.
- **Involvement of the ear** → **Erysipelas**
 - there is no deep dermis and subcutaneous tissue in the ear's pinna → **Milian's ear sign**
- Flaccid bullae may develop during the 2nd or 3rd day → Desquamation of the involved skin occurs 5–10 days

Non-Purulent SSTIs – Erysipelas (cont.)



Erysipelas



Butterfly sign” on the face



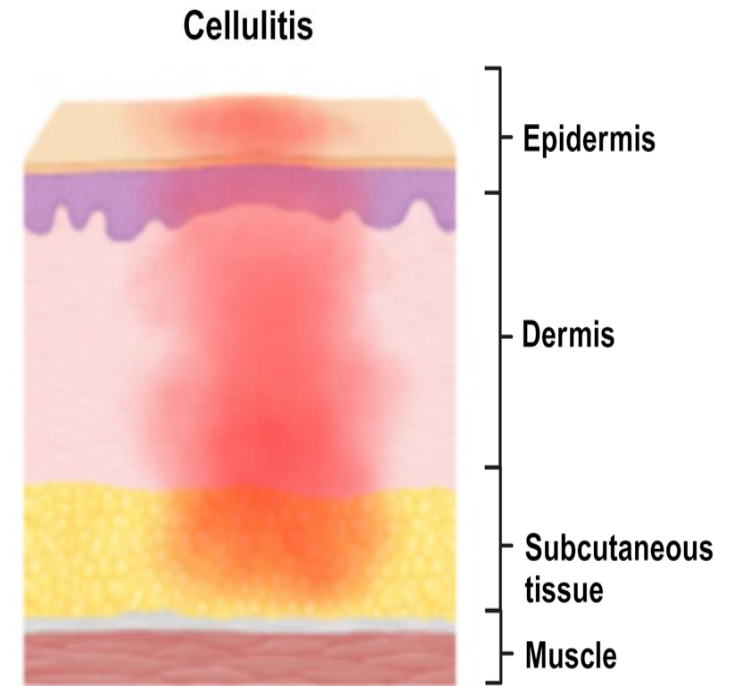
Peau d'orange appearance



Milian's ear sign

Non-Purulent SSTIs – Cellulitis

- Acute infection involve the **deep dermis** and **subcutaneous adipose tissue**.
- **Etiology:**
 - Most common organisms:
 - *S. aureus* (including MRSA) — the most frequent single causative agent
 - *S. pyogenes* (Group A Strep)
 - Certain clinical scenarios point to specific organisms
 - Dog or cat bite → *Pasteurella multocida*
 - Freshwater exposure → *Aeromonas hydrophila*
 - Saltwater exposure → *Vibrio vulnificus*



Non-Purulent SSTIs – Cellulitis (cont.)

Clinical Features

- Onset may be more **gradual** compared to erysipelas
- **Systemic symptoms** — fever, malaise, and feeling unwell are common but may develop more progressively compared erysipelas.
- The affected area shows diffuse, **erythema** that is pink to red in colour.
- The skin is warm, swollen, and tender.
- The borders are **poorly demarcated**

Non-Purulent SSTIs – Cellulitis (cont.)



Non-Purulent SSTIs – Erysipelas and Cellulitis (cont.)

- Diagnosis is usually clinical.
- Treatment:
 - Empiric antibiotic therapy active against:
 - streptococci → Penicillin V
 - *S. aureus* → Flucloxacillin
 - **Supportive care:** Elevation of the affected limbs, rest and acute pain management as needed
 - **Mark the border of erythema** with a skin marker pen and note the time and observe whether the infection is progressing or responding to treatment

Thank you