

# Bacterial Skin Infections

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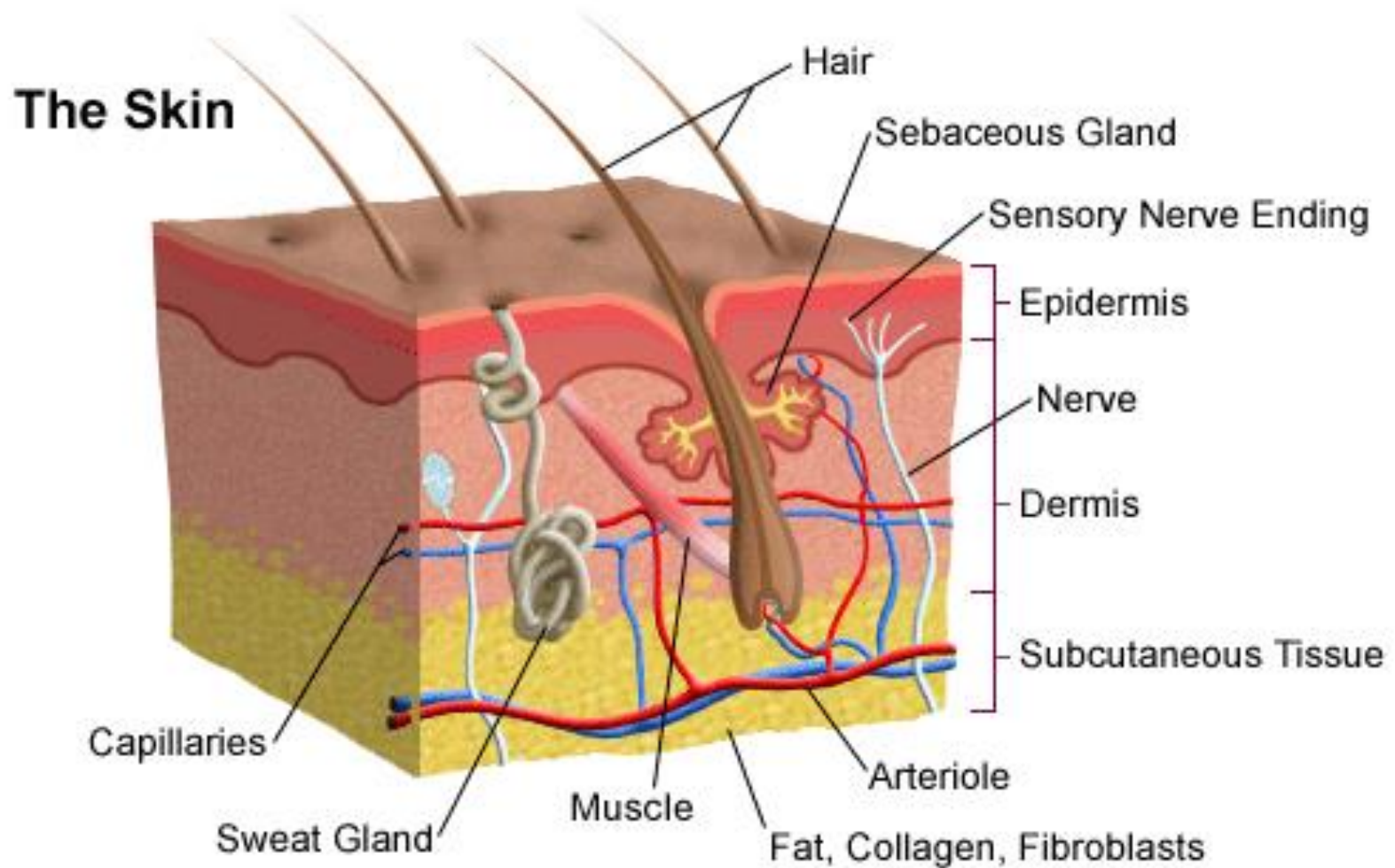
**Faculty of Medicine**

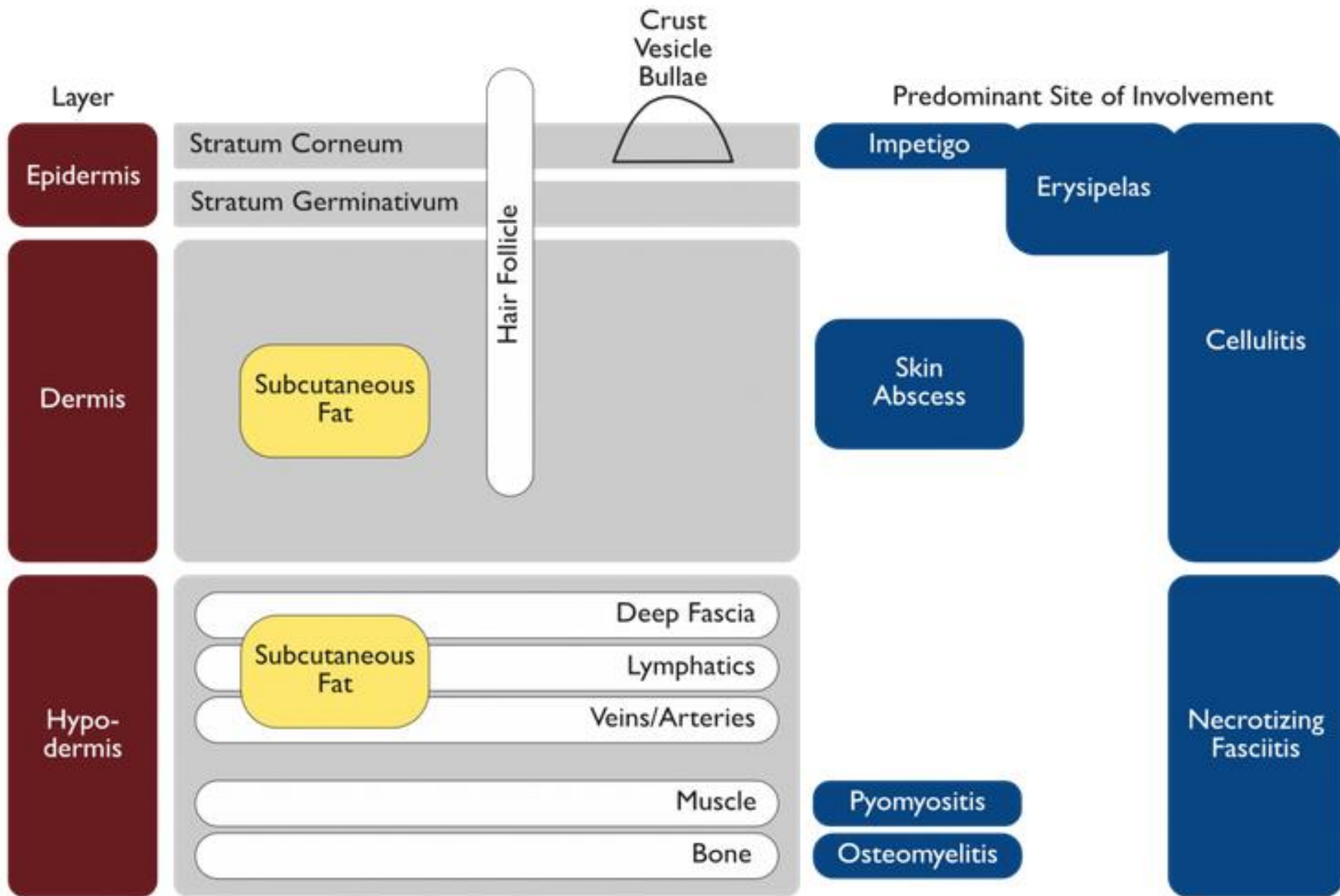
**Ragama**

# Outline

- Primary pyodermas
- Secondary bacterial infections complicating pre-existing skin lesions
- Cutaneous involvement in systemic infections

# Anatomy of the skin





# Bacterial Skin Infections

Primary pyoderms	Secondary bacterial infections	Other bacterial infections
<ul style="list-style-type: none"><li>• Impetigo</li><li>• Folliculitis</li><li>• Furuncles and carbuncles</li><li>• Paronychia</li><li>• Ecthyma</li><li>• Erysipylus</li><li>• Cellulitis</li><li>• Necrotizing fasciitis</li><li>• Gas gangrene</li></ul>	<ul style="list-style-type: none"><li>• Surgical wound infections</li><li>• Intravenous infusion sites</li><li>• Trauma</li><li>• Bites</li><li>• Decubitus ulcer</li><li>• Foot ulcer in diabetic pts</li><li>• Hydradenitis suppurativa</li><li>• Burns</li></ul>	<ul style="list-style-type: none"><li>• Mycobacterial skin infections</li><li>• Actinomyces and skin</li><li>• Spirochetal infections</li></ul>

# Primary pyoderms

# Impetigo

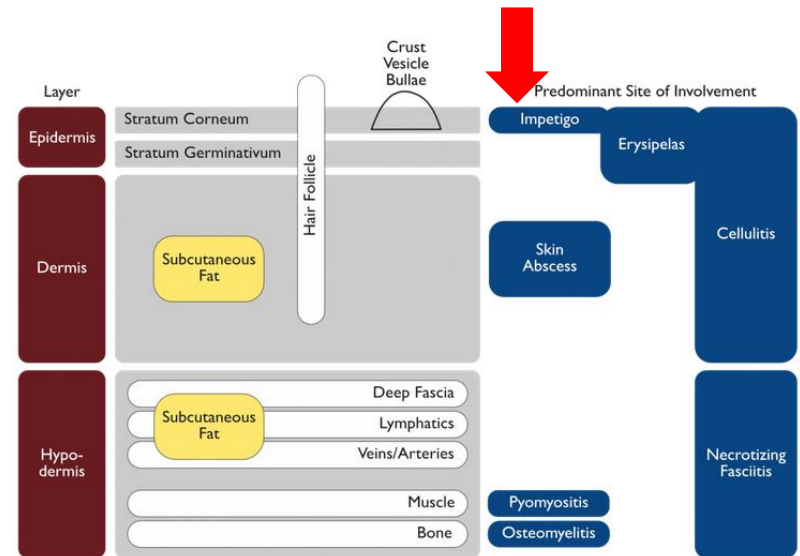
- Mostly caused by *S. pyogenes*
- Complicated with acute glomerulonephritis

A serious **non - suppurative**

**complications of**

*S. pyogenes* infections

- Occasionally (<10%) caused by *Staphylococcus aureus*
- Group B Streptococci – in newborns



# Impetigo

- Initiate as a small vesicle



Pustule



Rupture



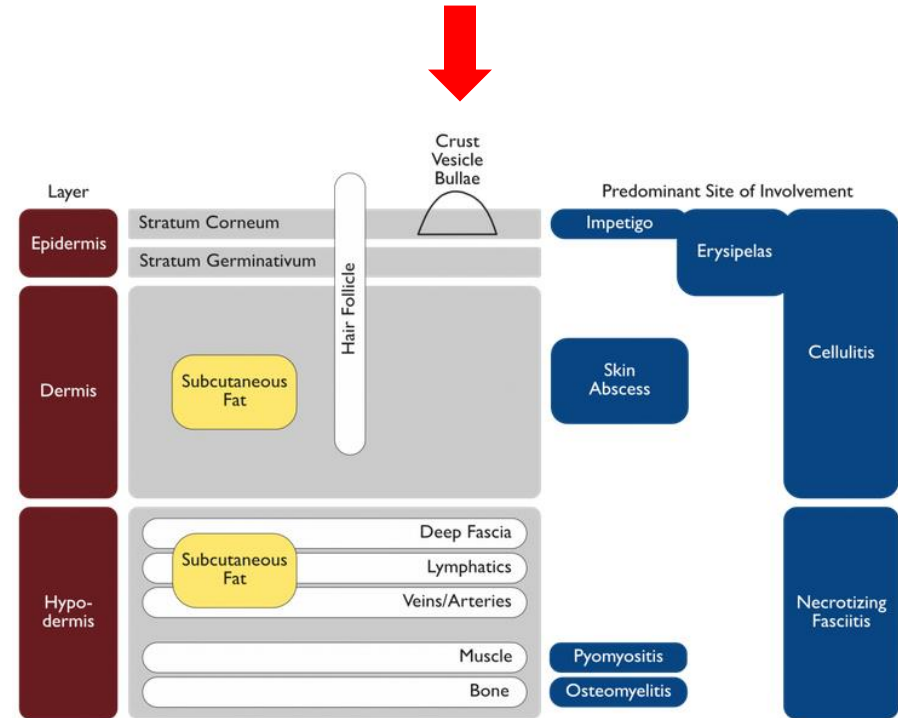
Thick yellow encrusted app



- Superficial Lesions
- Painless, but pruritic
- Easily spread by scratching

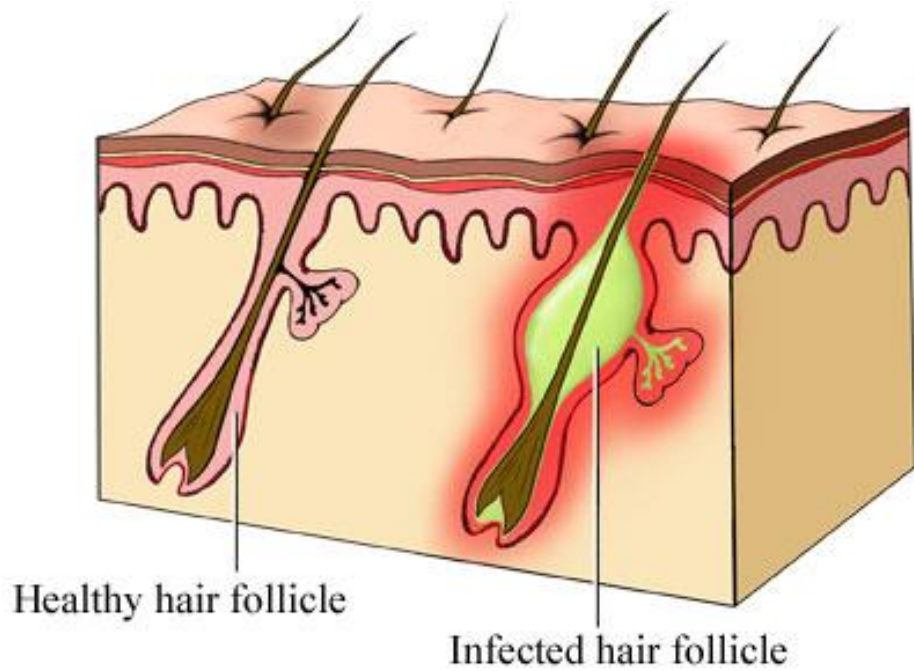


# Bullous form of impetigo



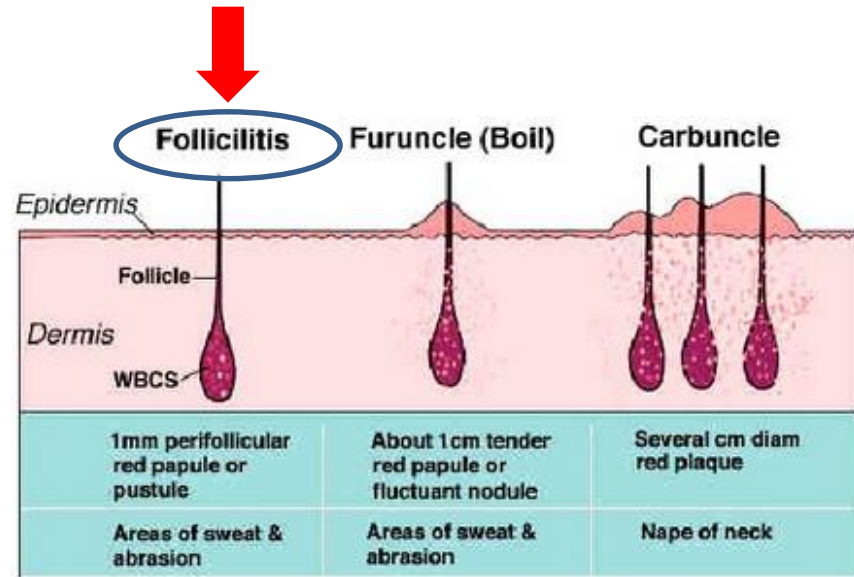
■ Caused by Phage 11 strain of *Staphylococcus aureus* that produce **exfoliative toxin**

# Folliculitis



# Folliculitis

- Inflammation and infection of hair follicles
- *S. aureus* – most common aetiology
- *P. aeruginosa* – from contaminated swimming pool
- In immunocompromised hosts
  - Candida spp
  - Gram (-) bacteria



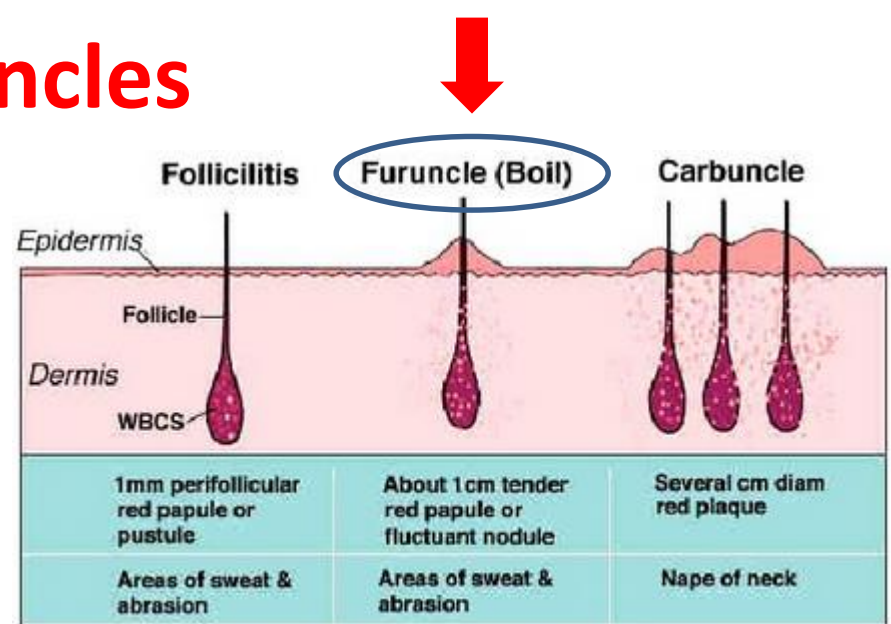
# Furuncles

## Furuncles

- Folliculitis when develop as deeper inflammatory nodule

- Most common cause –

*S.aureus*



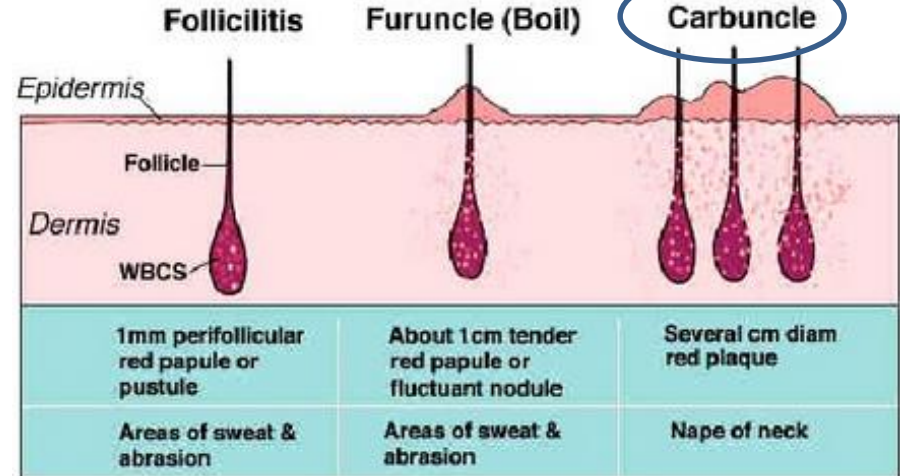


# Carbuncles



## Carbuncles

- An abscess that extends even more deeper into subcutaneous fat and may have multiple draining sites
- *S. aureus* - commonest causative pathogen

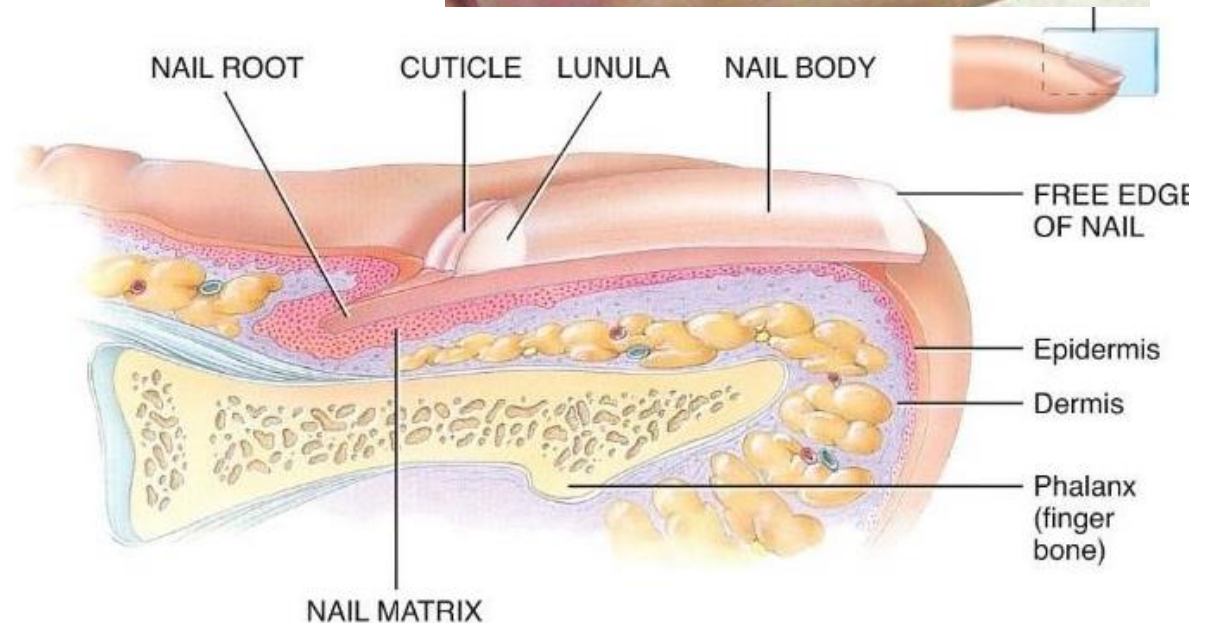


# Paronychia

- Infection of the **cuticle** surrounding the nail.

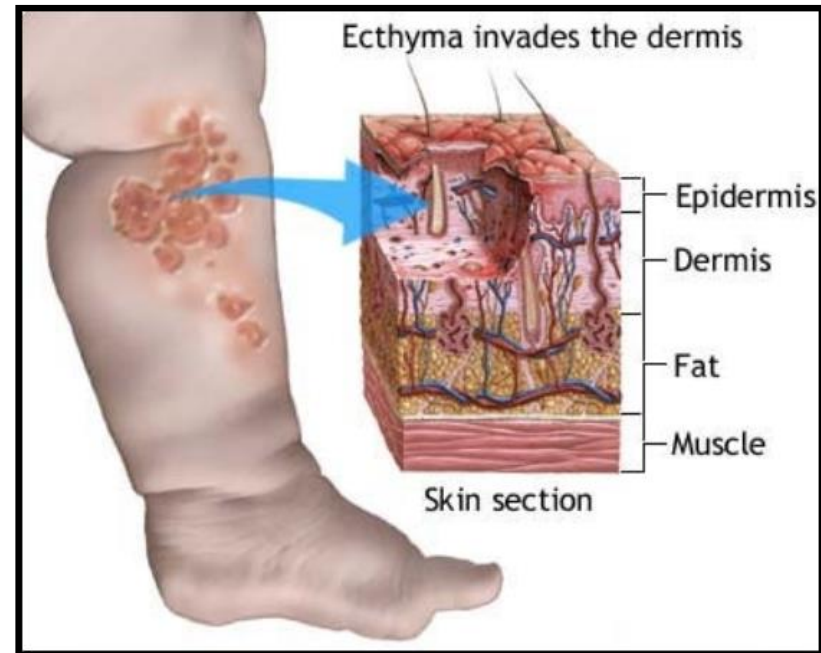
- Usual causative agent-

***S. aureus***



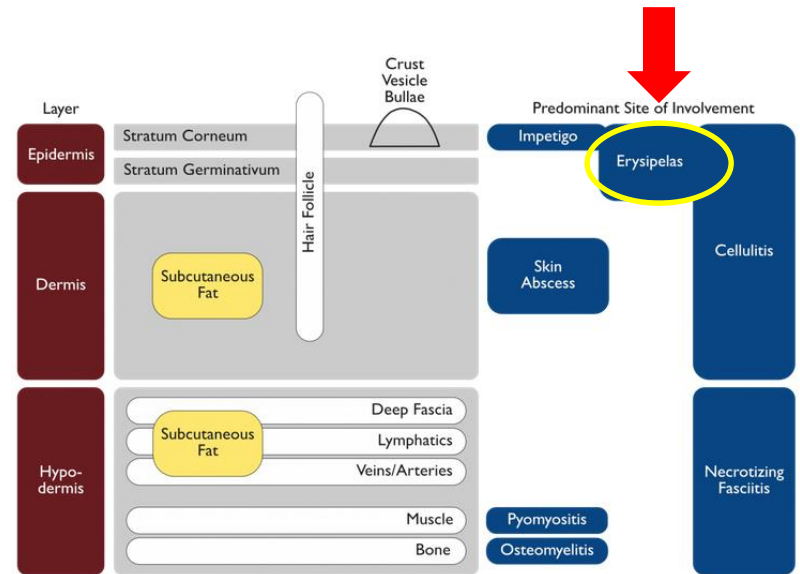
# Ecthyma

- Begin in a fashion similar to **impetigo** but penetrate through the epidermis.
- **Group A streptococci** produce the lesions or secondarily infect pre-existing superficial lesions
- most frequently occur on the **lower extremities**, particularly in **children** and **older adults**.
- consist of **punched-out ulcers**



# Erysipelas

- Distinctive type of superficial cellulitis prominent lymphatic involvement
- Almost always caused by group A streptococci
- Very rarely caused by *S. aureus*.





# Erysipelas

- Erysipelas is a painful lesion with a bright red, edematous, indurated (peau d'orange) appearance
- An advancing, raised border, sharply demarcated from the adjacent normal skin

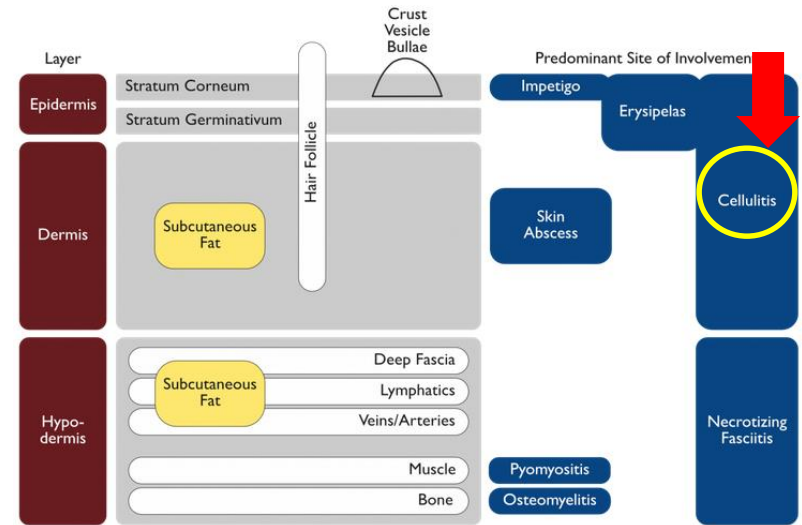


# Erysipelas

- Group A streptococci **usually cannot be cultured** from the surface of the skin lesion, and
- **Rarely** isolated from punch biopsy or tissue fluid

# Cellulitis

- Acute **spreading** infection of the skin
- Extends **deeper** than erysipelas and involves the **subcutaneous tissues**.
- Most common causative agents
  - S. pyogenes*
  - S. aureus*



# Clinical Findings

## Predisposing factors

- Previous trauma (laceration, abrasion, puncture wound), often minor (shaving or athletic abrasion) lesion
- Underlying skin lesion (furuncle, ulcer)

# Cellulitis

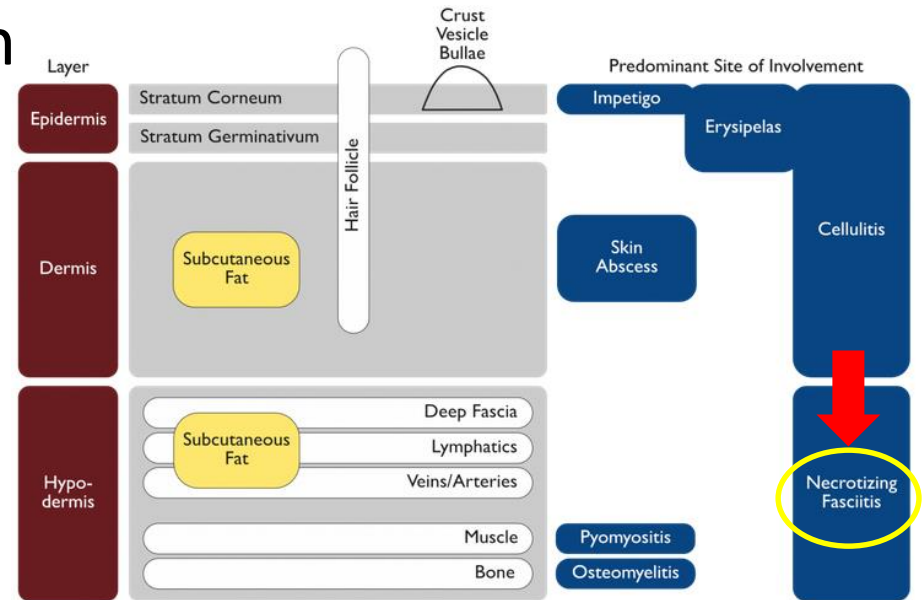
- In contrast to erysipelas, the borders of an area of cellulitis are **not elevated and sharply demarcated**
- Patchy involvement with **skip areas** may occur.
- Regional lymphadenopathy is common, and **bacteremia** can occur.
- **Local abscesses** may develop, and small patches of overlying skin may subsequently undergo **necrosis**.
- **Supe-infection** with **Gram-negative bacilli** may supervene.

# Cellulitis

- Within several days develop local tenderness, pain, rapidly
- Malaise, fever, and chills
- The involved area is often extensive and the lesion is very red, hot, and swollen.
- Cellulitis is a serious disease because of the propensity of infection to spread via the **lymphatics and bloodstream.**
- May be complicated by **thrombophlebitis.**

# Necrotizing fasciitis

- **Uncommon** severe infection
- Involve the subcutaneous soft tissues, particularly the superficial (and often the deep) **fascia**.
- Usually an **acute** process
- most common on the extremities, particularly the legs.



# Necrotizing fasciitis

- The affected area is initially erythematous, swollen, without sharp margins, hot, shiny, **exquisitely tender**, and painful.
- **Lymphangitis** and **lymphadenitis** are infrequent.



# Chancriform syndrome

- An **ulcerative lesion at the site of primary infection** by microorganisms, with regional lymph node enlargement

*Treponema pallidum*

*Haemophilus ducreyi*

*Sporothrix, Bacillus anthracis*

*Francisella tularensis*

*Mycobacterium ulcerans*

*Mycobacterium marinum*

# Secondary bacterial infections

## ■ Surgical wound infections

### - Clean

*S. aureus*

Gram (-) ve bacilli

### - Contaminated eg : bowel

Anaerobes, Streptococci

## ■ Intravenous infusion sites

*S. aureus*

Coagulase Negative Staph

# Secondary bacterial infections cont--

## Trauma

- Soil contamination

*Pseudomonas aeruginosa*

Clostridia

- Fresh water contamination

Aeromonas

Plesiomonas

- Salt water contamination

*Vibrio vulnificus*

# Bites

## Human

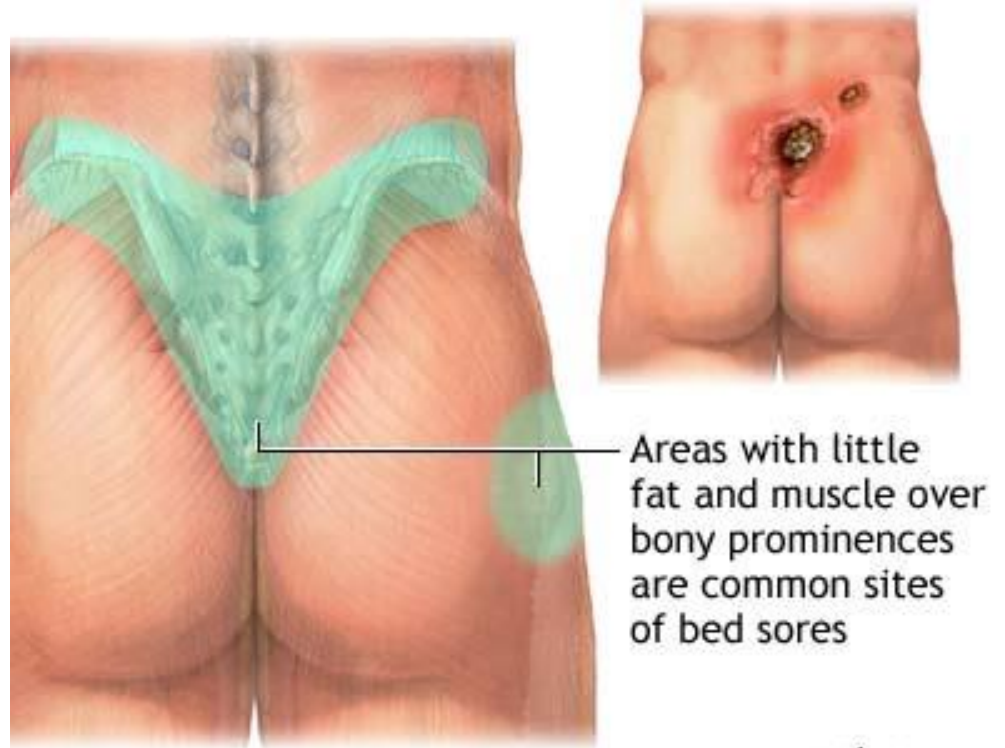
- Oral aerobes and anaerobes
- *S. aureus*

## Dog / cat

- *Pasteurella multocida*
- *S. aureus*
- Anaerobes

# Decubitus ulcer

- Streptococci
- *S. aureus*
- Coliform
- Pseudomonas
- Anaerobes Eg:  
*Bacteroides fragilis*



# Foot ulcers in diabetic patients

- *S. aureus*
- Streptococci
- Coliform
- *P. aeruginosa*
- Anaerobes

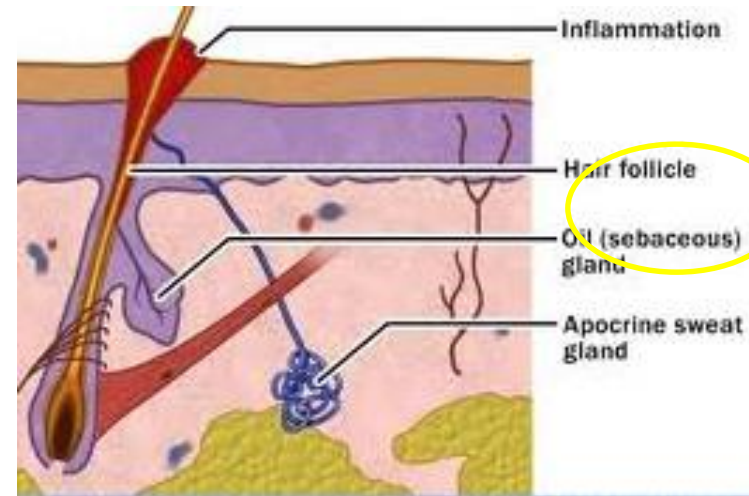


# Burns

- *S. aureus*
- Candida
- *P. aeruginosa*

# Hydradenitis suppurativa

- Associated with genetic defect of apocrine sweat glands
- **Chronic obstruction of these glands**, predispose to **mixed bacterial** superinfection of skin and skin structures
- Multiple **recurrences** cause
  - Tissue necrosis
  - Sinus tract formation
  - Scarring and disfigurement





# **Cutaneous manifestations of systemic illnesses**

# Cutaneous manifestations as result of toxin production

## Staphylococcal scalded skin syndrome (SSSS)

- Exfoliative toxin produced by *S. aureus*
- Initially cause fever, skin tenderness and scarlatiniform rash
- Followed by extensive bullae formation and exfoliation
- Rx – IV antistaphylococcal agents



# Toxic shock syndrome

- Caused by

Exotoxin F produced by *S. aureus*

*Strep. Pyogenes*

- Associated with fever, hypotension and multiorgan dysfunction

- Coetaneous desquamation may occur in later stage of infection



# Scarlet fever

- Caused by Group A streptococci –  
erythrogenic / scarlatiniform toxin

- Clinical characteristics

Streptococcal sore throat / other

Strep infection

Erythroderma

Strawberry tongue



# Scarlet fever cont --

- Bright red rash
  - Typically seen in neck, chest and skin folds
  - Typically, rash does not involve face
- During convalescence desquamation of skin occurs, especially on hands and feet



# Skin lesions associated with infective endocarditis

## Osler nodes

- Painful, palpable skin lesions
- Located on the
  - pads of the fingers and toes
  - thenar eminences
- Reflect soft **tissue immune – complex deposition**



# Skin lesions associated with infective endocarditis

## Janeway lesions

- Painless, flat lesions
- Located on the palms and soles
- Represent **microembolic** seeding of the skin





# Rose spots

- Associated with typhoid fever (*Salmonella typhi*)
- Erythematous maculopapular lesion
- Observed in 25% of patients with typhoid fever
- Appear characteristically on upper abdomen





# **Cutaneous manifestations as result of sepsis**

# Skin lesions of meningococemia

- Erythematous, macules, petechiae and purpura
- Located on trunk and extremities
- Progress to gray, haemorrhagic necrotic areas



# Ecthyma gangrenosum

- Ass/with bacteraemia due to *Pseudomonas aeruginosa*
- Painless ulcer with central black eschar and gangrenous cellulites
- Most frequently seen in neutropenic patients



# **Mycobacterial skin infections**

# Mycobacterial skin infections

## Fish tank granuloma

- Caused by *Mycobacterium marinum*
- In individuals cleaning fish tank / swimming pools
- Microbes enter through an open wound / traumatic inoculation of intact skin
- Lesion appear as **tuberculoid granuloma**



# Buruli ulcer

- Single, painless ulcer with undermined edges
- Caused by *Mycobacterium ulcerans*



# Leprasy

- Caused by *M. leprae*
- Circumscribed, hypopigmented / hyperpigmented (less common) macules
- Single / multiple

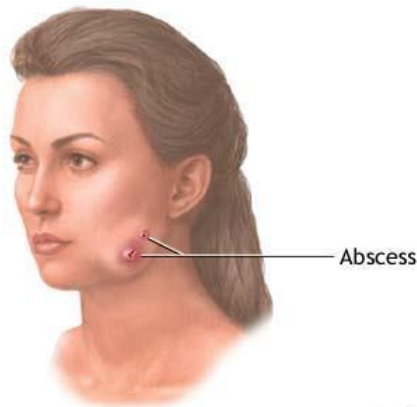


## **Other bacterial infections**



# Actinomycosis

- Caused by *Actinomyces* spp (*A. israelii*)
- Characterized by formation of abscesses, fibrosis of tissue and draining sinuses that discharge sulfur granules



ADAM.

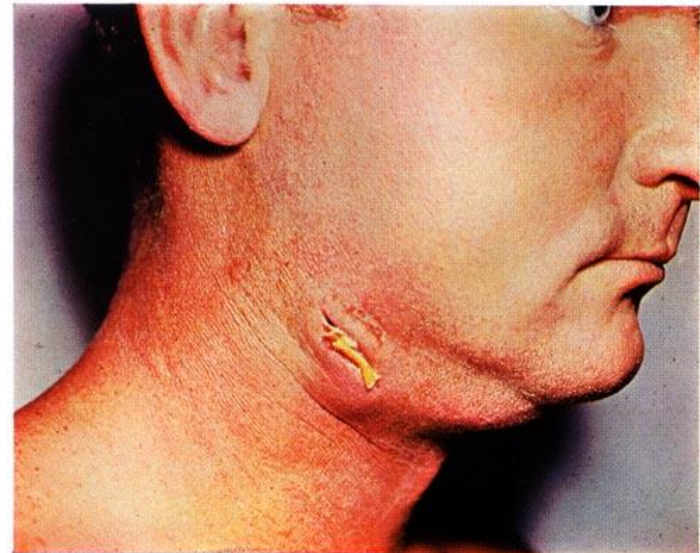


FIGURE 1.—Actinomycosis, jaw, observed at Letterman General Hospital, San Francisco, Calif., in a sergeant who had punctured the floor of his mouth with a weed stem while picking his teeth.

# Nocardiosis

- Primarily caused by  
*Nocardia brasiliensis*
- Clinical forms include
  - subcutaneous abscess
  - cellulites
  - mycetoma



# Laboratory diagnosis

# NORMAL OR RESIDENTSKIN FLORA

Skin normally colonized predominantly with

- Coagulase negative Staphylococci
- *Corynebacterium spp*
- *Micrococcus spp*
- *Propionibacterium spp*

## Helpful information that should be mentioned in the request

- Origin of the lesion

trauma, animal or human bite, gardening wound,  
decubitus ulcer, genital ulcer  
post surgical infection

- Duration of the illness : acute vs chronic

- Location of the lesion

- Underlying disease: diabetes, HIV, immunocompromised

# Specimens

**NEVER USE A SWAB IF PUS OR LIQUID**

**SECRETIONS ARE AVAILABLE**

# Specimens

## ■ Deep aspirates from involved tissues

- Specimens taken from closed skin lesions are more responsible
- If pustules / vesicles are present
  - \*remove the roof /crust with sterile blade
  - \*Aspirate any pus/exudates

## ■ Blood for culture

# Wound samples

- Superficial wounds are always colonized by commensal flora
- Prefer pus or fluid aspirate in a syringe, deep swabbing

Syringes with needles in place are unacceptable

- If unable to aspirate, take 2 swabs from wound

Before swabbing,

Clean wound surface with **sterile normal saline**

Use sterile moisten swabs to prevent drying of the specimen and to preserve the bacteria



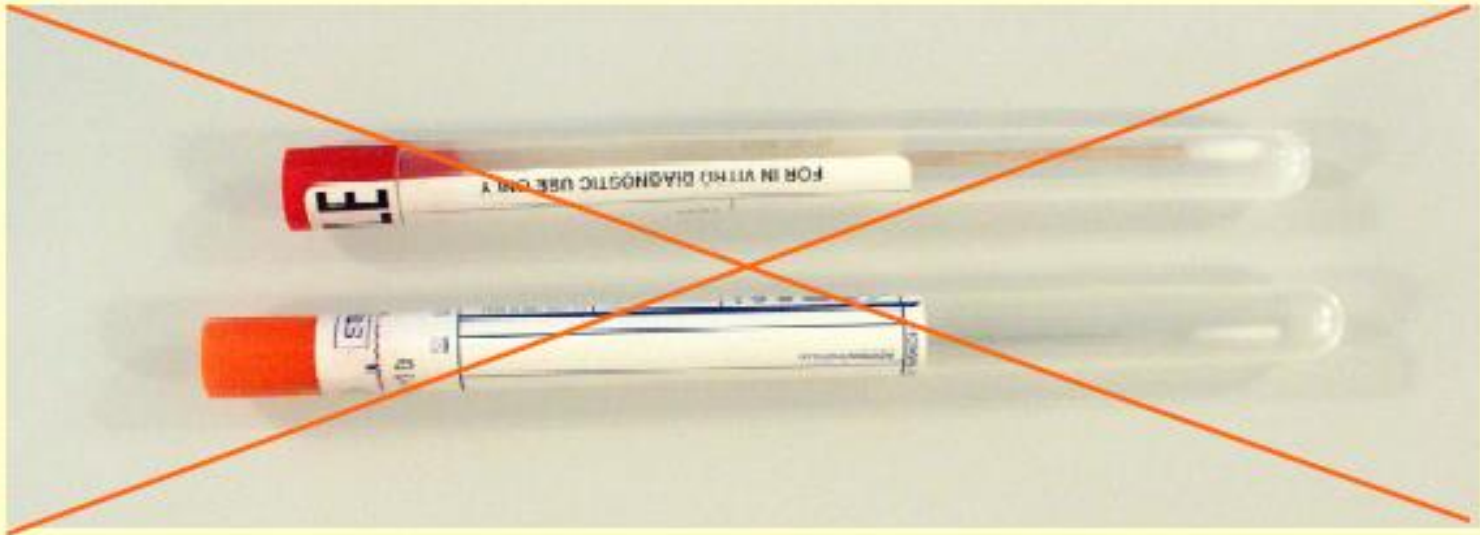
## Diabetic foot infection

- Culture for infecting organisms remains problematic
- Ulcer swabs, draining materials yield several isolates, all of them are not involved in the infective process
- Deep tissue cultures (surgically obtained) provide most accurate results

# Mycetomas

- Pus is collected from closed lesions by aspirations with a sterile needle and syringe
- If granules are present, they should be crushed for culture of actinomycetes
- If granules are not present, an excisional biopsy for culture and histopathologic examination

## DRY SWABS



SHOULD **NEVER** BE USED FOR  
BACTERIOLOGICAL CULTURE

# BEST SPECIMENS FOR BACTERIAL CULTURE

- From clinically infected or **deteriorating wounds**
- Whose result will influence therapy
- Specimens collected **prior to initiation of therapy**
- Tissues collected during **surgery**
- **Aspirates** through intact skin by needle and syringe or fine-needle biopsy / after irrigation with non bacteriostatic saline.
- Samples from viable, infected **tissues**

# WORST SPECIMENS FOR BACTERIOLOGICAL CULTURE

- **Superficial** swabbing of a wound
- **Decubitus ulcers** swabs in order to establish an aetiological diagnosis

These wounds are always colonized with resident, transient or fecal flora

But this culture is useful to look for presence of MRSA

# REJECTION CRITERIA FOR MICROBIOLOGICAL SPECIMENS

- Specimens received in **fixative**
- **Dry** swab
- Only **one swab** for multiple requests
- Anaerobic cultures on **Decubitus ulcer** material

# Principles of diagnosis (bacterial infection)

- **Clinical** : infection VS colonization / contamination

- **Investigations** :

  - Direct microscopy

    - Presence of epithelial cells indicates contamination of the specimen with skin microbes and compromises the significance of the culture results

  - Gram stain

# Investigations cont--

## Culture

- The greater amount of microorganisms,  
the better recovery of them in culture
- Insufficient material may yield false-negative  
results



# Investigations

- Histology/cytology : leprosy
- Serology : syphilis
- Molecular technique : TB
- Others : skin test

# Treatment

Refer the guideline

