

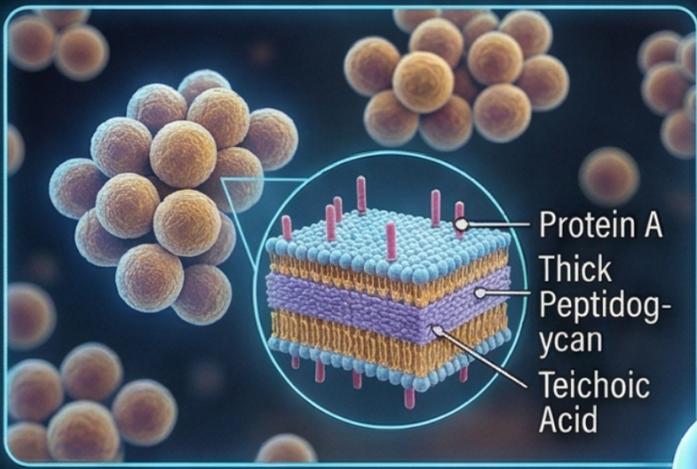
Microbiology Laboratory Aspects in

the Diagnosis of Musculoskeletal and Skin Infections

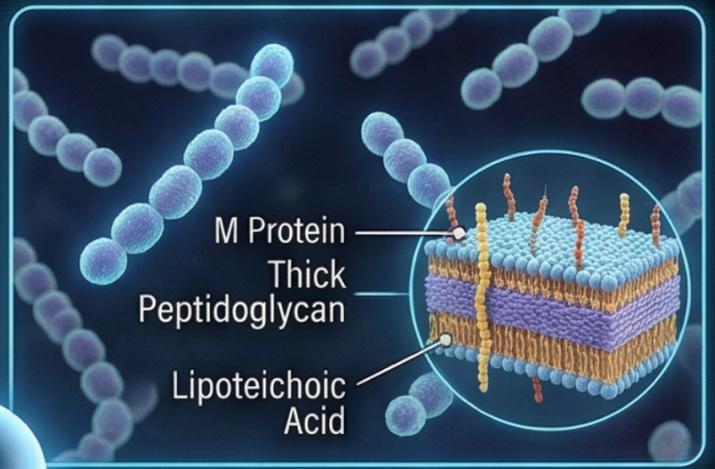
عبدالله ميثاق

GRAM-POSITIVE BACTERIA: STAPHYLOCOCCUS AUREUS vs. STREPTOCOCCUS PYOGENES (GROUP A STREP)

Staphylococcus aureus



Streptococcus pyogenes



HEMOLYSIS

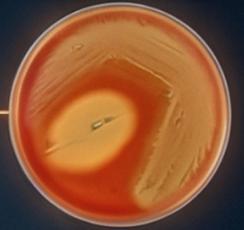
Sheep Blood Agar Plate



Beta-hemolysis

HEMOLYSIS

Sheep Blood Agar Plate



Clear zone

CATALASE TEST

Tube with positive (bubbling) result
Positive



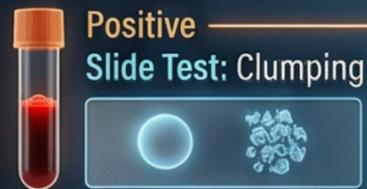
CATALASE TEST

Tube with negative result
Negative



COAGULASE TEST

Tube with clot



Positive

Slide Test: Clumping

BACITRACIN TEST

Plate with disk and clear zone



Sensitive

Sensitive

Sensitive

MANNITOL SALT AGAR (MSA):

Plate showing yellow colonies



Ferments Mannitol

ANTIGEN TEST

Latex Agglutination



Group A antigen

CONDITIONS CAUSED:

- Cellulitis 
- Folliculitis 
- Furuncles 
- Carbuncles 
- Impetigo 
- Scalded Skin Syndrome 
- Toxic Shock Syndrome 
- Burn/Wound Infections
- Surgical Site Infections
- Osteomyelitis 
- Septic Arthritis 
- Infective Endocarditis 

CONDITIONS CAUSED:

- Scarlet Fever 
- Toxic Shock Syndrome 
- Cellulitis 
- Erysipelas 
- Subcutaneous Necrotizing Infections 



1. Gram-Positive Bacteria

Staphylococcus aureus

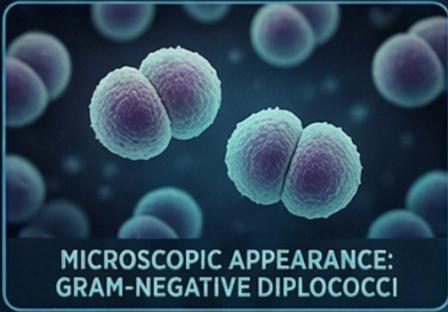
- **Conditions it causes:** Cellulitis, folliculitis, furuncles, carbuncles, impetigo, scalded skin syndrome, toxic shock syndrome, burn/wound infections, surgical site infections, osteomyelitis, septic arthritis, and infective endocarditis.
- **Microscopic Appearance:** Gram-positive cocci arranged in clusters.
- **Key Laboratory Tests:**
 - **Hemolysis:** Produces beta hemolysis (complete lysis) on sheep blood agar, usually appearing golden yellow.
 - **Catalase Test:** Positive (this differentiates it from other Gram-positive cocci like Streptococcus).
 - **Coagulase Test:** Positive in both slide and tube tests (this differentiates *S. aureus* from Coagulase-Negative Staphylococci or CONS).
 - **Mannitol Salt Agar (MSA):** Ferments mannitol in 10% MSA, producing yellow colonies.

Streptococcus pyogenes (Group A Strep)

- **Conditions it causes:** Scarlet fever, toxic shock syndrome, cellulitis, erysipelas, and subcutaneous necrotizing infections.
- **Microscopic Appearance:** Gram-positive cocci arranged in chains.
- **Key Laboratory Tests:**
 - **Hemolysis:** Produces beta hemolysis on sheep blood agar.
 - **Catalase Test:** Negative.
 - **Bacitracin Test:** Sensitive to bacitracin (differentiates it from bacitracin-resistant Group B Streptococcus).
 - **Antigen Test:** Positive for Lancefield group A antigen using a latex agglutination test.

GRAM-NEGATIVE BACTERIA OVERVIEW: NEISSERIA GONORRHOEAE & PSEUDOMONAS AERUGINOSA

Neisseria gonorrhoeae



CULTURE



INCUBATION



TEMP: 35°C to 37°C

ATMOSPHERE: MOIST,
CO₂-ENRICHED

OXIDASE TEST



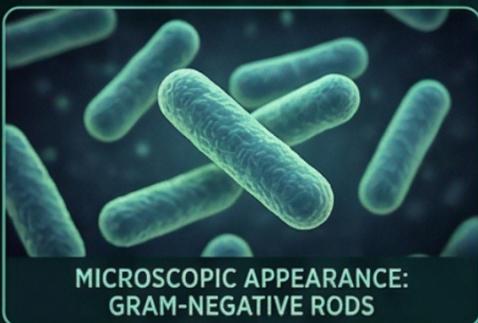
POSITIVE

CONDITIONS CAUSED



GONOCOCCEMIA

Pseudomonas aeruginosa



CULTURE

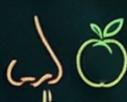


CHARACTERISTICS



NON-LACTOSE
FERMENTER
(MACCONKEY AGAR)
or
(non-pink colonies)

NON-GLUCOSE FERMENTER (e.g.)



FRUITY ODOR
(LIKE GRAPES OR CORN TACOS)

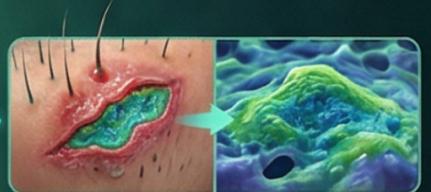
PIGMENT PRODUCTION



CONDITIONS CAUSED

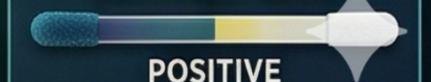


HOT-TUB FOLLICULITIS



INFECTIOUS
ENDOCARDITIS

OXIDASE TEST



2. Gram-Negative Bacteria

Neisseria gonorrhoeae

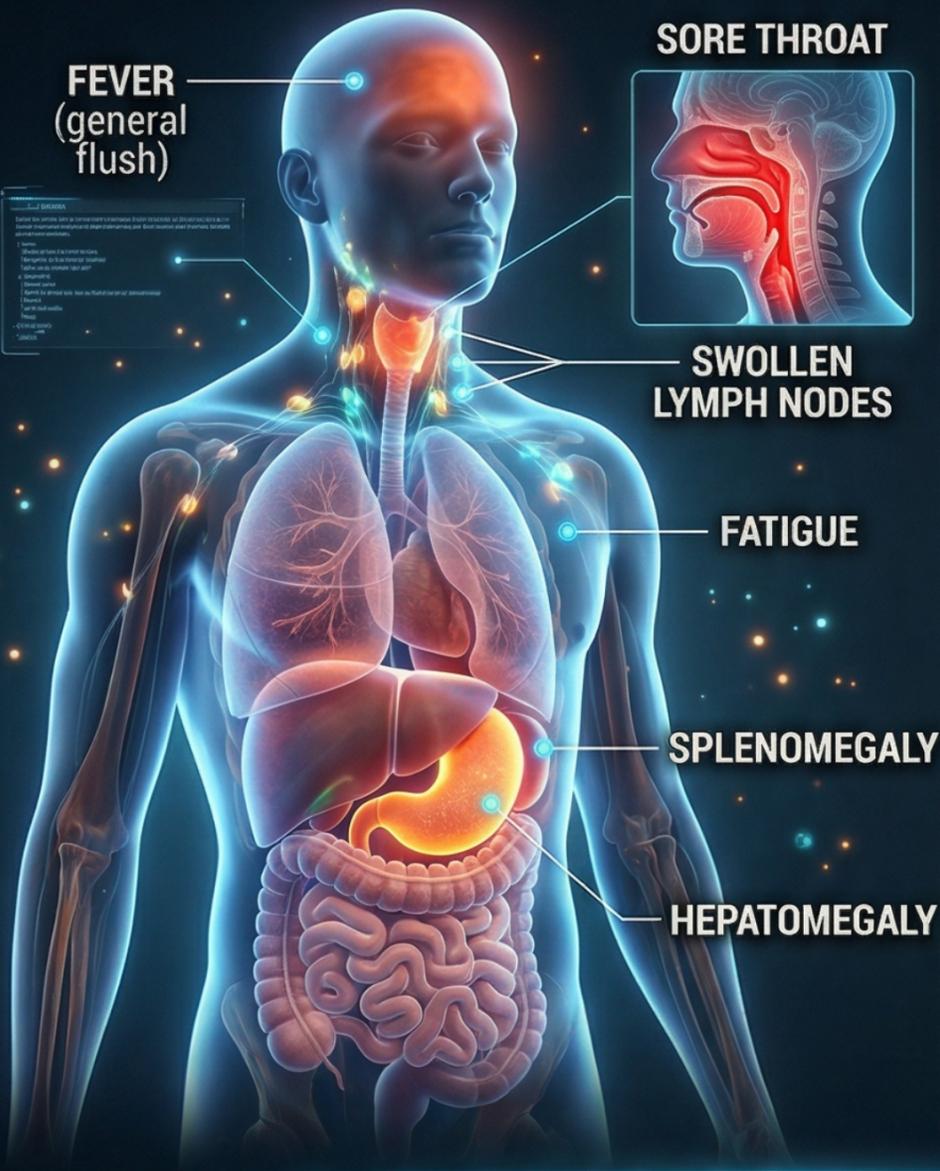
- **Conditions it causes:** Gonococcal septic arthritis and gonococcemia.
- **Microscopic Appearance:** Gram-negative diplococci.
- **Key Laboratory Tests:**
 - **Culture:** It is grown on non-selective chocolate agar and selective media like Thayer-Martin agar.
 - **Incubation:** Requires 35°C to 37°C in a moist, CO_2 -enriched atmosphere.
 - **Oxidase Test:** Positive.

Pseudomonas aeruginosa

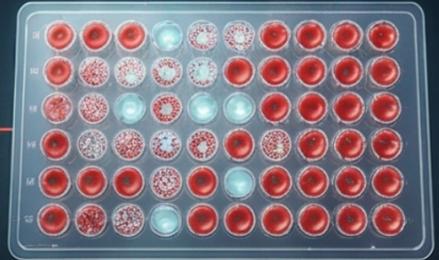
- **Conditions it causes:** Cellulitis, hot-tub folliculitis, burn and wound infections, ecthyma gangrenosum, and infectious endocarditis.
- **Microscopic Appearance:** Gram-negative rods.
- **Key Laboratory Tests:**
 - **Culture:** Grows well on most media, including blood agar, MacConkey agar, or CLED agar.
 - **Characteristics:** Inability to ferment lactose or glucose, produces a fruity odor, and creates green, blue, or yellow pigments.
 - **Oxidase Test:** Positive.

3. VIRAL & SPIROCHETE INFECTIONS: COMPREHENSIVE MEDICAL OVERVIEW

INFECTIOUS MONONUCLEOSIS (EPSTEIN-BARR VIRUS)

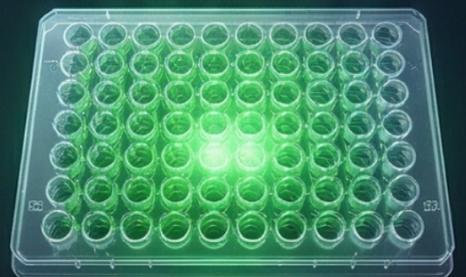


OLD TESTING METHOD: MONOSPOT TEST (NOT RECOMMENDED)



- **LOW SENSITIVITY** FIRST WEEK (75%, INCREASING TO 90% LATER)
- **HIGH FALSE POSITIVES** (CANCER, EARLY HIV, AUTOIMMUNE DISORDERS)
- **HIGH FALSE NEGATIVES** (YOUNG AGE)

ALTERNATIVE TESTING (Current): ELISA for VCA ANTIBODIES



SECONDARY SYPHILIS (TREPONEMA PALLIDUM)



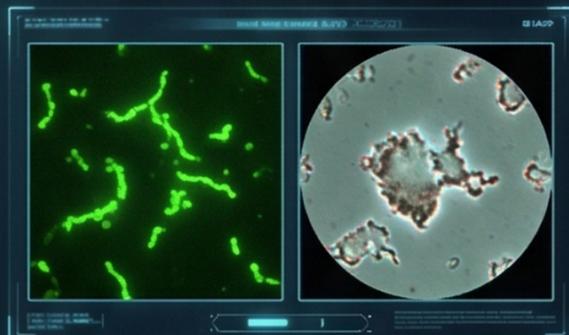
SCREENING TESTS (NON-TREPONEMAL):

VDRL (VENEREAL DISEASES RESEARCH LABORATORY),
RPR (RAPID PLASMA REGAIN)



CONFIRMATORY TESTS (TREPONEMAL):

FTA-ABS (FLUORESCENT TREPONEMAL ANTIBODY ABSORPTION),



MHA-TP (MICROHEMAGGLUTINATION ASSAY FOR *T. PALLIDUM*)

3. Viral & Spirochete Infections

Infectious Mononucleosis (Epstein-Barr Virus)

- **Old Testing Method:** The Monospot test involves mixing IgM with sheep RBCs to cause agglutination. However, this test is **no longer recommended** today. It has low sensitivity in the first week (75%, increasing to 90% later) and high rates of false positives (due to cancer, early HIV, autoimmune disorders) and false negatives (in young age).
- **Alternative Testing:** ELISA for VCA antibodies.

Secondary Syphilis (*Treponema pallidum*)

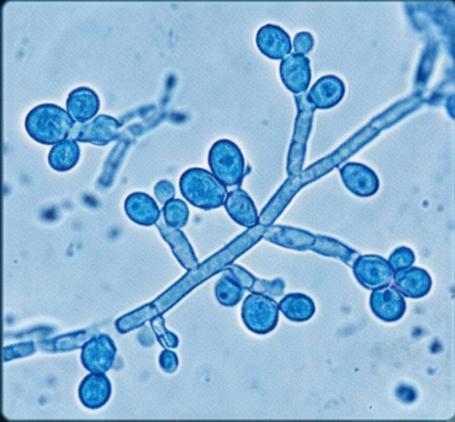
- **Screening Tests (Non-treponemal):** VDRL (Venereal Diseases Research Laboratory) and RPR (Rapid Plasma Reagin) tests.
- **Confirmatory Tests (Treponemal):** FTA-ABS (Fluorescent treponemal antibody absorption) and MHA-TP (Microhemagglutination assay for *T. pallidum*).

FUNGAL INFECTIONS

COMPREHENSIVE OVERVIEW

CUTANEOUS CANDIDIASIS (Candida species)

1 MICROSCOPIC APPEARANCE



Wet preparations reveal budding yeast.

A 10% KOH (potassium hydroxide) prep is used because it breaks down cellular debris (like epithelial cells and WBCs) so you can clearly see the yeast or pseudohyphae.

2 CULTURE

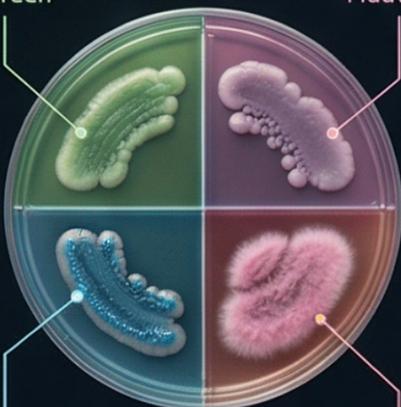


Grows readily within 48-72 hours, producing white creamy colonies.

3 SPECIES IDENTIFICATION

Knowing the exact species is required to determine the correct antifungal drug. CHROMagar is a special media that uses color reactions to identify species rapidly.

Candida albicans: Green
Candida glabrata: Mauve



Candida tropicalis: Metallic blue
Candida krusei: Pink and fuzzy

DERMATOPHYTOSES (Tinea / Ringworm)

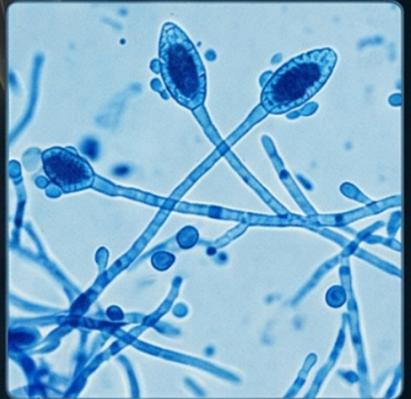
1 CULTURE



Specimens must be cultured on Sabouraud dextrose agar (SDA) supplemented with gentamicin.

They need to be incubated for at least 2 weeks before ruling out the infection.

2 STAINING



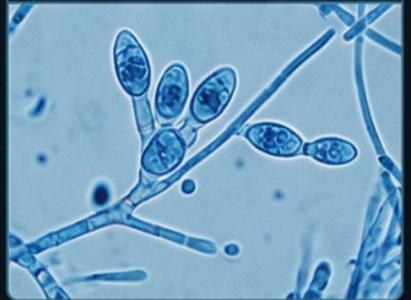
Lactophenol blue stain is used to prepare slides for microscopic examination.

3 EXAMPLES MENTIONED

1. *Epidermophyton floccosum*



2. *Microsporum gypseum*



4. Fungal Infections

Cutaneous Candidiasis (*Candida* species)

- **Microscopic Appearance:** Wet preparations reveal budding yeast. A 10% KOH (potassium hydroxide) prep is used because it breaks down cellular debris (like epithelial cells and WBCs) so you can clearly see the yeast or pseudohyphae.
- **Culture:** Grows readily within 48-72 hours, producing white creamy colonies.
- **Species Identification:** Knowing the exact species is required to determine the correct antifungal drug. **CHROMagar** is a special media that uses color reactions to identify species rapidly:
 - *Candida albicans*: Green.
 - *Candida glabrata*: Mauve.
 - *Candida tropicalis*: Metallic blue.
 - *Candida krusei*: Pink and fuzzy.

Dermatophytoses (Tinea / Ringworm)

- **Culture:** Specimens must be cultured on Sabouraud dextrose agar (SDA) supplemented with gentamicin. They need to be incubated for **at least 2 weeks** before ruling out the infection.
- **Staining:** Lactophenol blue stain is used to prepare slides for microscopic examination.
- **Examples mentioned:** *Epidermophyton floccosum* and *Microsporum gypseum*.