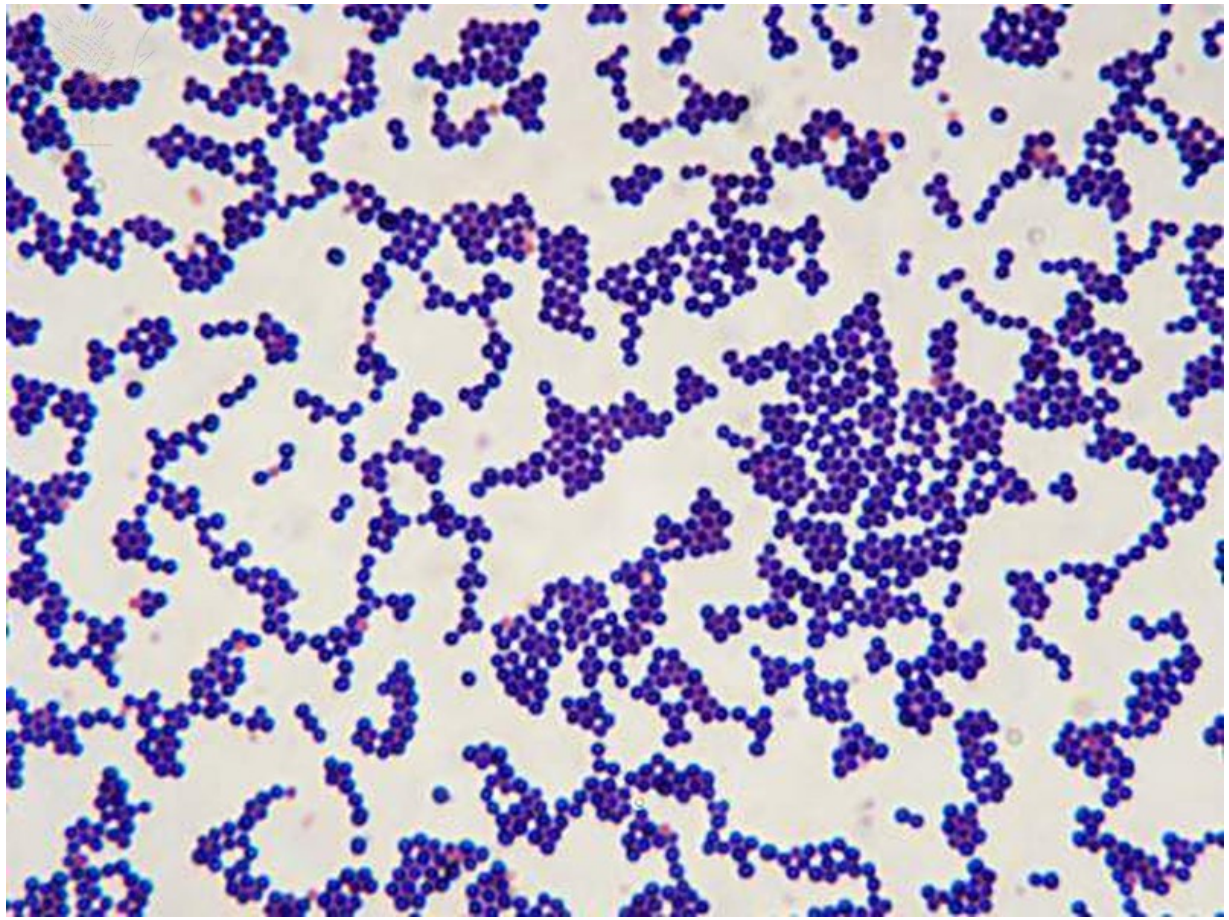
Microbiology Laboratory Aspects in the Diagnosis of Musculoskeletal and Skin Infections

Malik Sallam, M.D., Ph.D.
School of Medicine
The University of Jordan

MSS conditions caused by *Staphylococcus aureus*

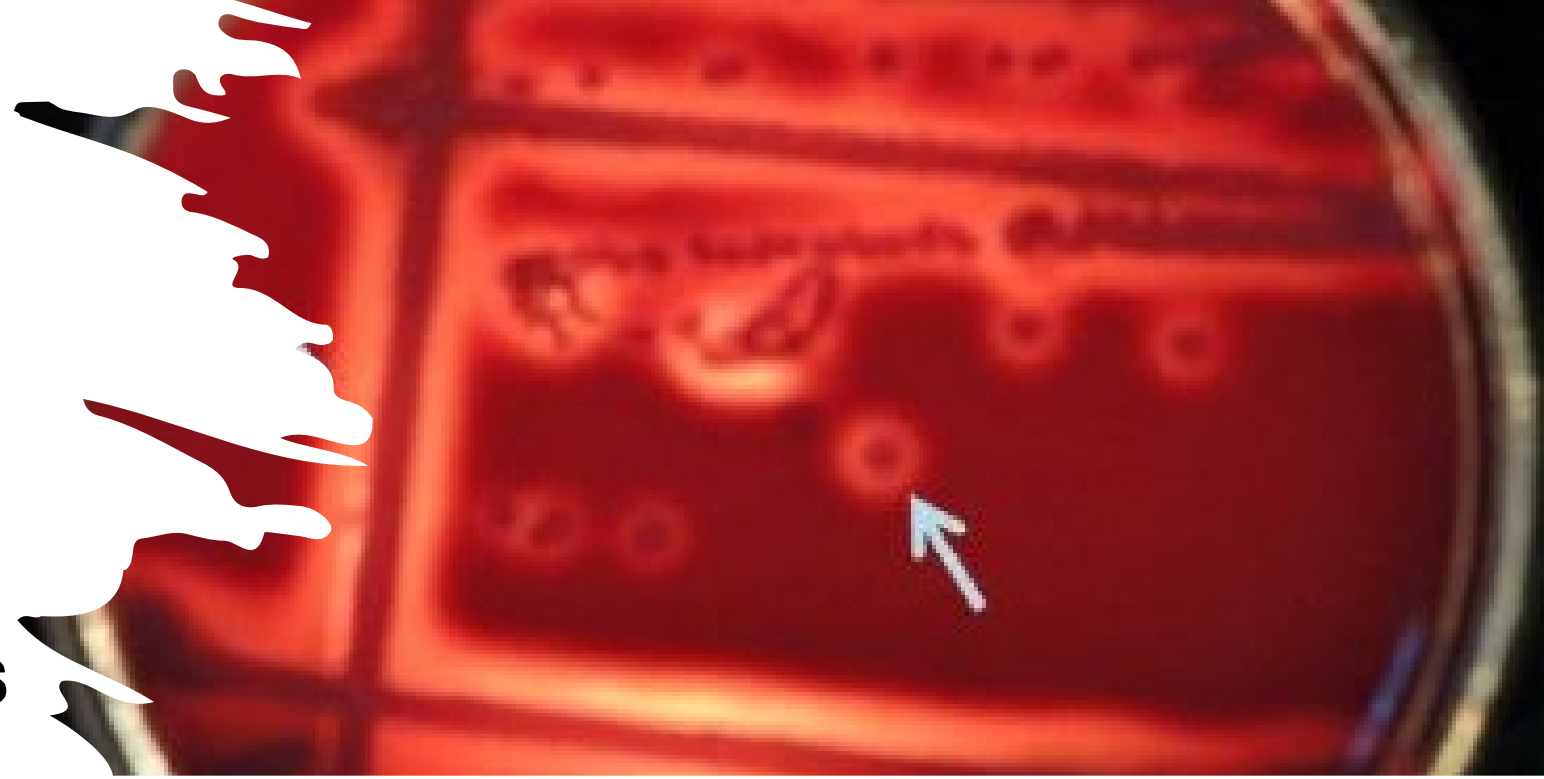
- Toxic shock syndrome
- Cellulitis
- Folliculitis, furuncles, and carbuncles
- Infectious endocarditis
- Impetigo
- Scalded skin syndrome
- Burn and wound infections including surgical site infections (SSIs)
- Infective endocarditis
- Osteomyelitis
- Septic arthritis



Laboratory identification of *Staphylococcus aureus*

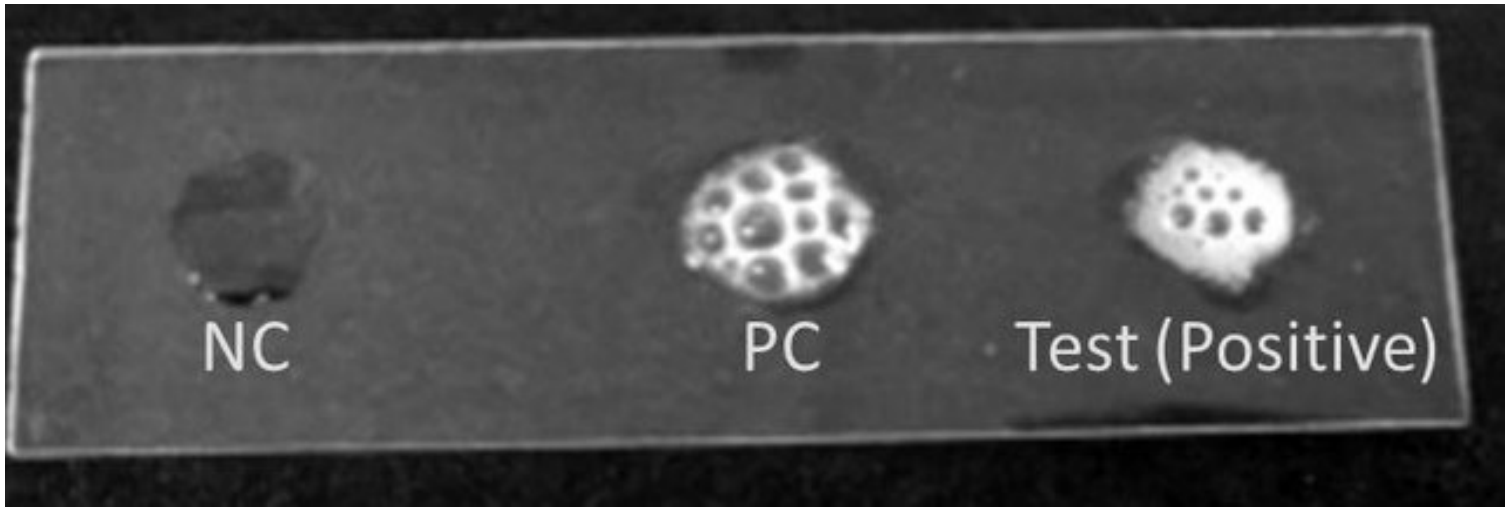
- *S. aureus* produces **beta hemolysis** on sheep blood agar plates and is usually **golden yellow** in color. Gram staining reveals Gram-positive cocci in clusters.
- The first test to differentiate staphylococci from other Gram-positive cocci is the **positive catalase test**
- To differentiate *S. aureus* from coagulase negative staphylococci (CoNS) the following tests are used:
  - **Positive tube coagulase test**
  - **Positive slide coagulase test**
  - **Fermentation of mannitol in 10% mannitol salt agar**

Staphylococcus aureus **yellow colonies on 5% sheep blood agar showing beta hemolysis (complete lysis)**



Credit:
https://www.jfmed.uniba.sk/fileadmin/jlf/Pracoviska/ustav-mikrobiologie-a-imunologie/VLa/STAPHYLOCOCCI.pdf

Jahan et al.
http://dx.doi.org/10.5455/javar.2015.b47



Catalase test

Credit: Jahan et al. http://dx.doi.org/10.5455/javar.2015.b47

Slide Coagulase test

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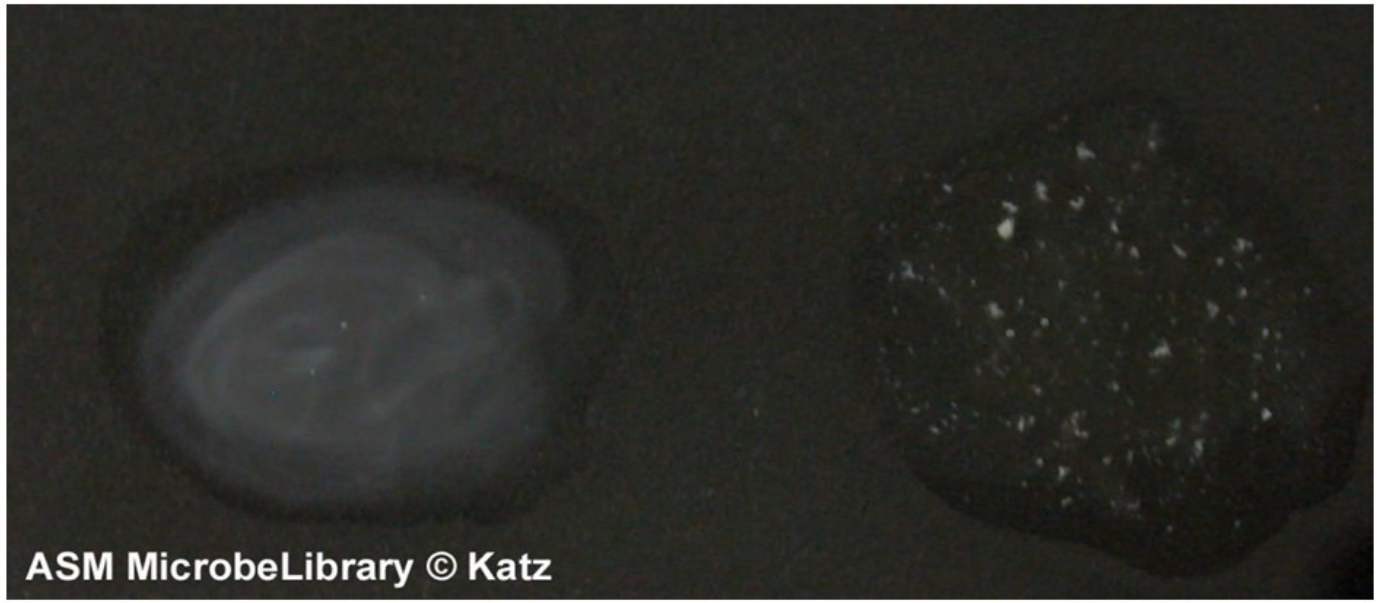
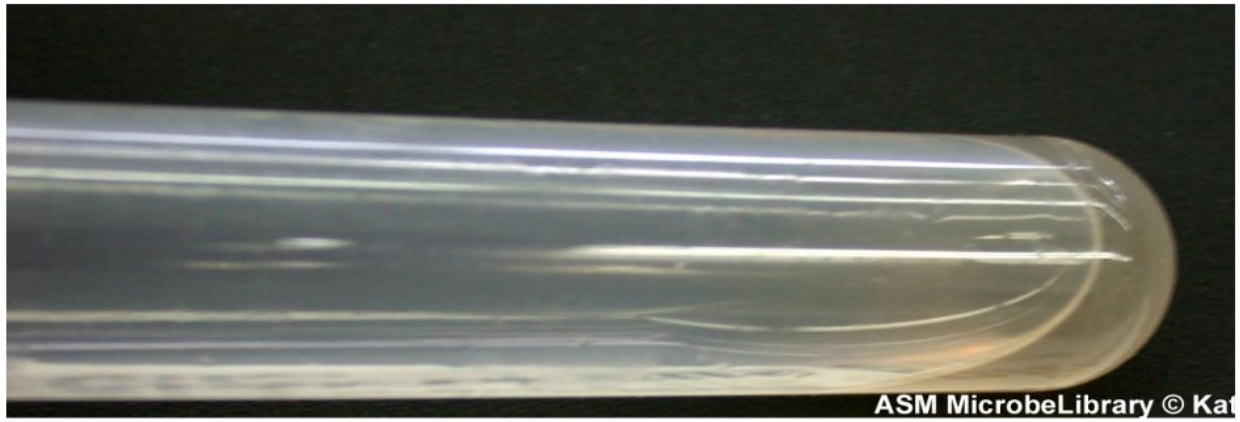


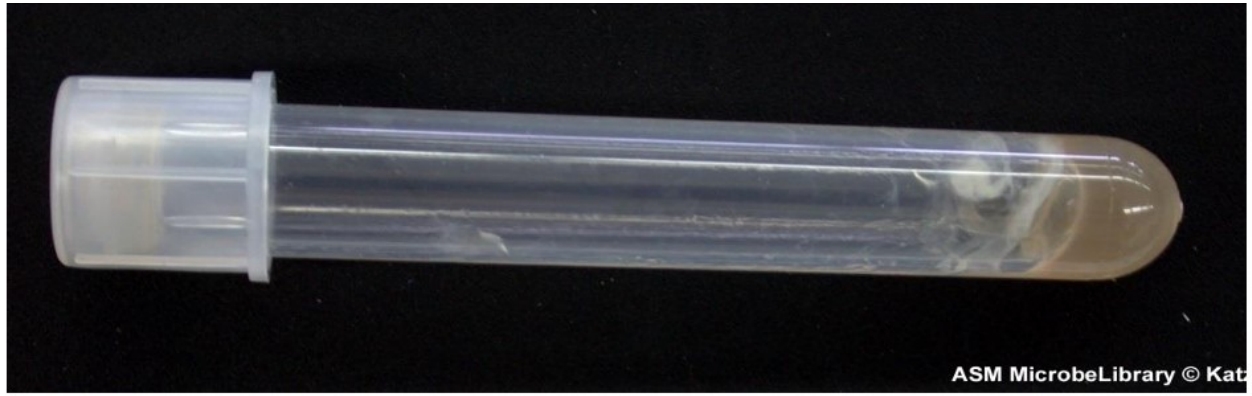
FIG. 1. Slide test. Coagulase-negative staphylococci are present on the left side of the slide, while coagulase-positive staphylococci are present on the right side of the slide.

Credit: https://asm.org/protocols/coagulase-test-protocol

Tube Coagulase test



A



B

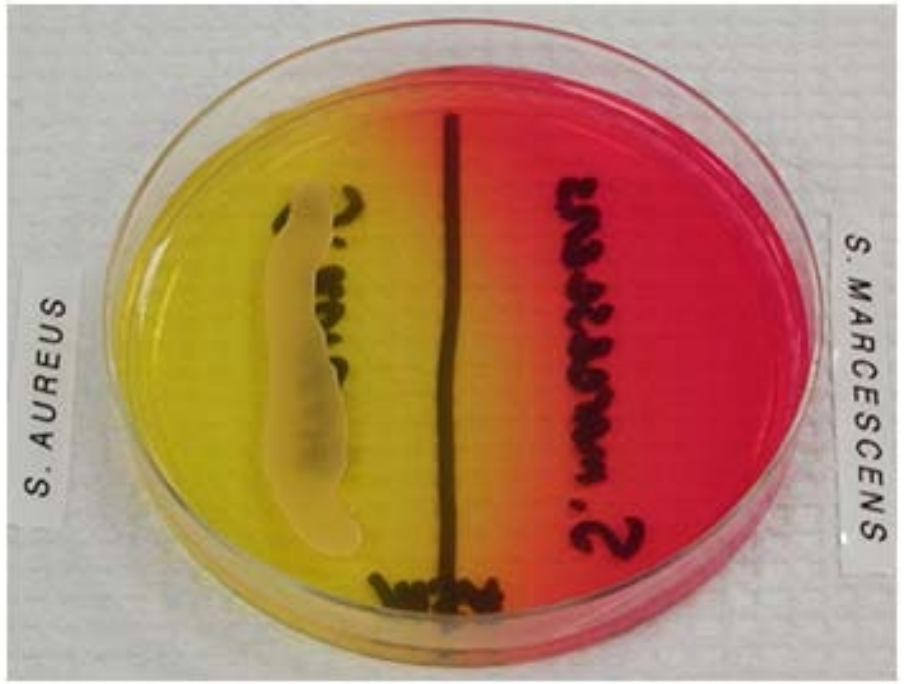
FIG. 3. (A) A negative tube coagulase test reaction indicating coagulase-negative cells. (B) A positive tube coagulase test reaction indicating coagulase-positive cells.

Credit: https://asm.org/protocols/coagulase-test-protocol

Growth on MSA

Mannitol Salt Agar (MSA) for the isolation of *Staphylococcus aureus*

Yellow colonies of *Staphylococcus aureus*

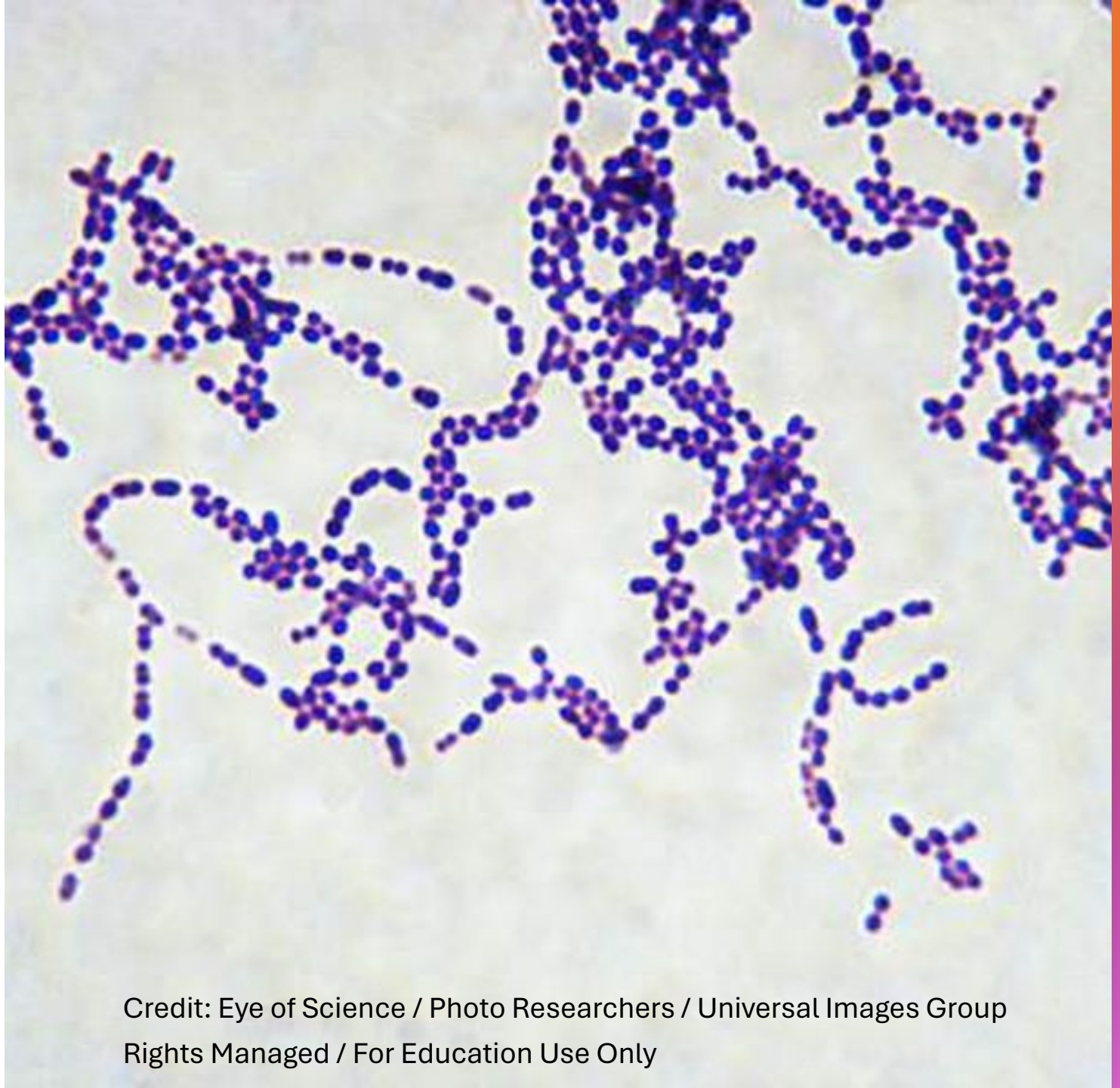


Staphylococcus aureus and *Serratia marcescens* on MSA

Credit: https://microbiologyinfo.com/mannitol-salt-agar-for-the-isolation-of-staphylococcus-aureus/

MSS conditions caused by *Streptococcus pyogenes*

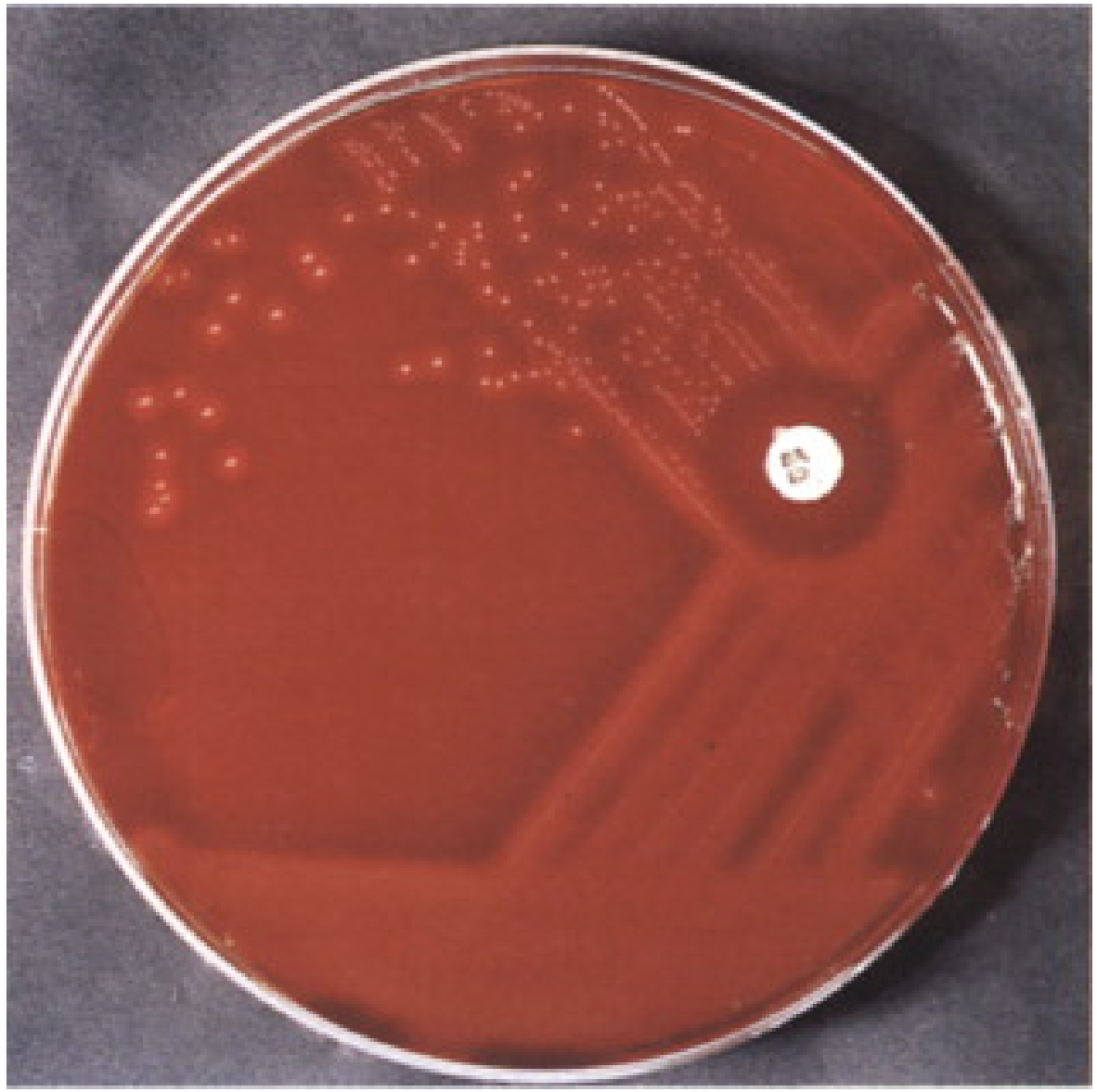
- Scarlet fever
- Toxic shock syndrome
- Cellulitis
- Erysipelas
- Subcutaneous necrotizing infections



Laboratory identification of *Streptococcus pyogenes*

- *S. pyogenes* produces **beta hemolysis** on sheep blood agar plates. Gram staining reveals **Gram-positive cocci** in chains.
- The first test to differentiate streptococci from other Gram-positive cocci is the **negative catalase test**
- To differentiate *S. pyogenes* from other beta hemolytic streptococci:
  - **Bacitracin sensitivity compared to bacitracin resistance for group B**
  - **Positive Lancefield group A antigen using latex agglutination test**

Bacitracin sensitivity and beta hemolysis of *Streptococcus pyogenes*



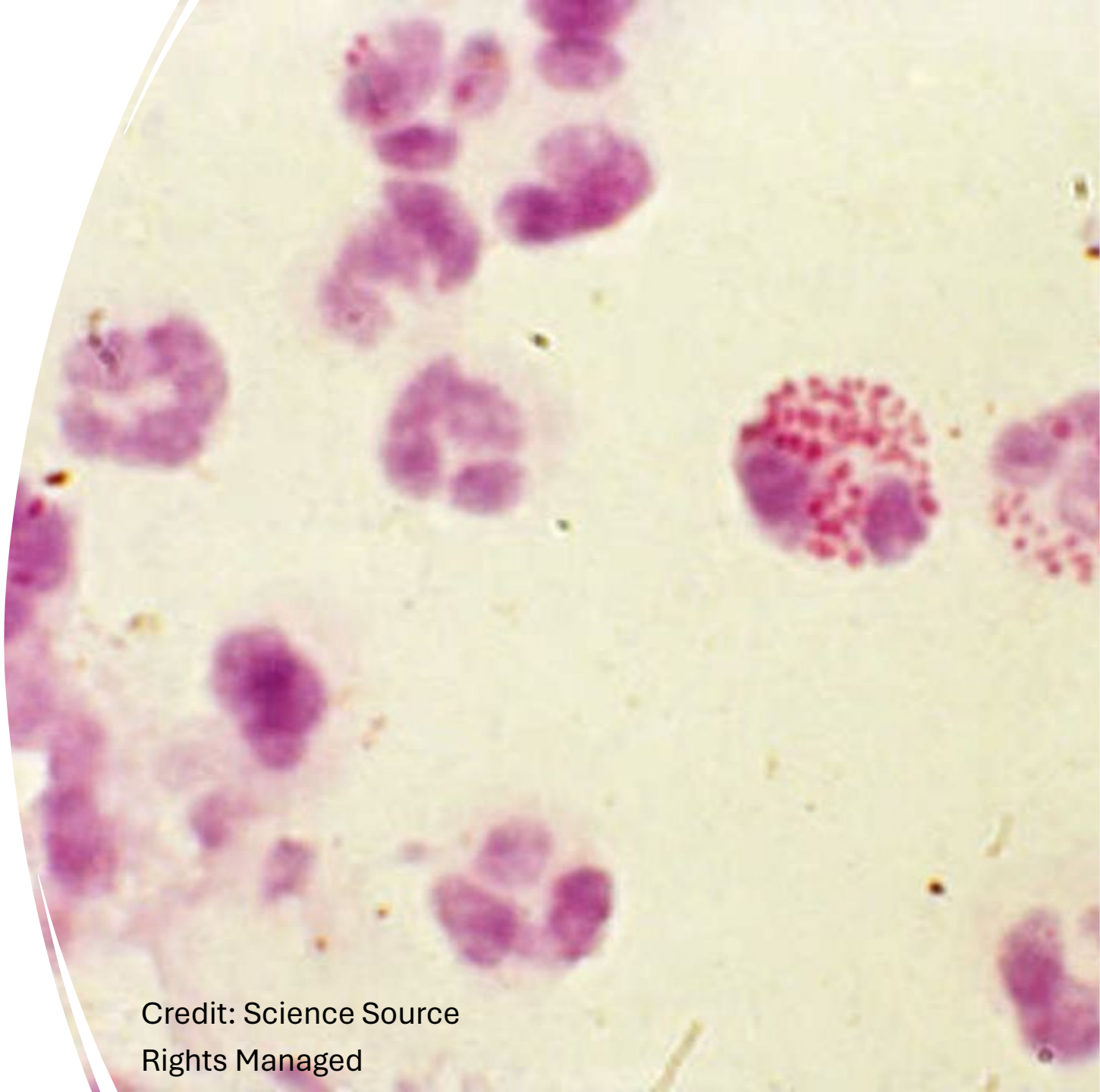
Credit: https://doi.org/10.1016/B978-0-7506-0187-0.50007-9/

Agglutination tests for identification of β-hemolytic streptococci

Credit: https://www.bio-rad.com/en-jo/product/pastorex-strep?ID=OT2MTO7OP/

MSS conditions caused by *Neisseria gonorrhea*

- Gonococcal septic arthritis
- Gonococcemia



Credit: Science Source
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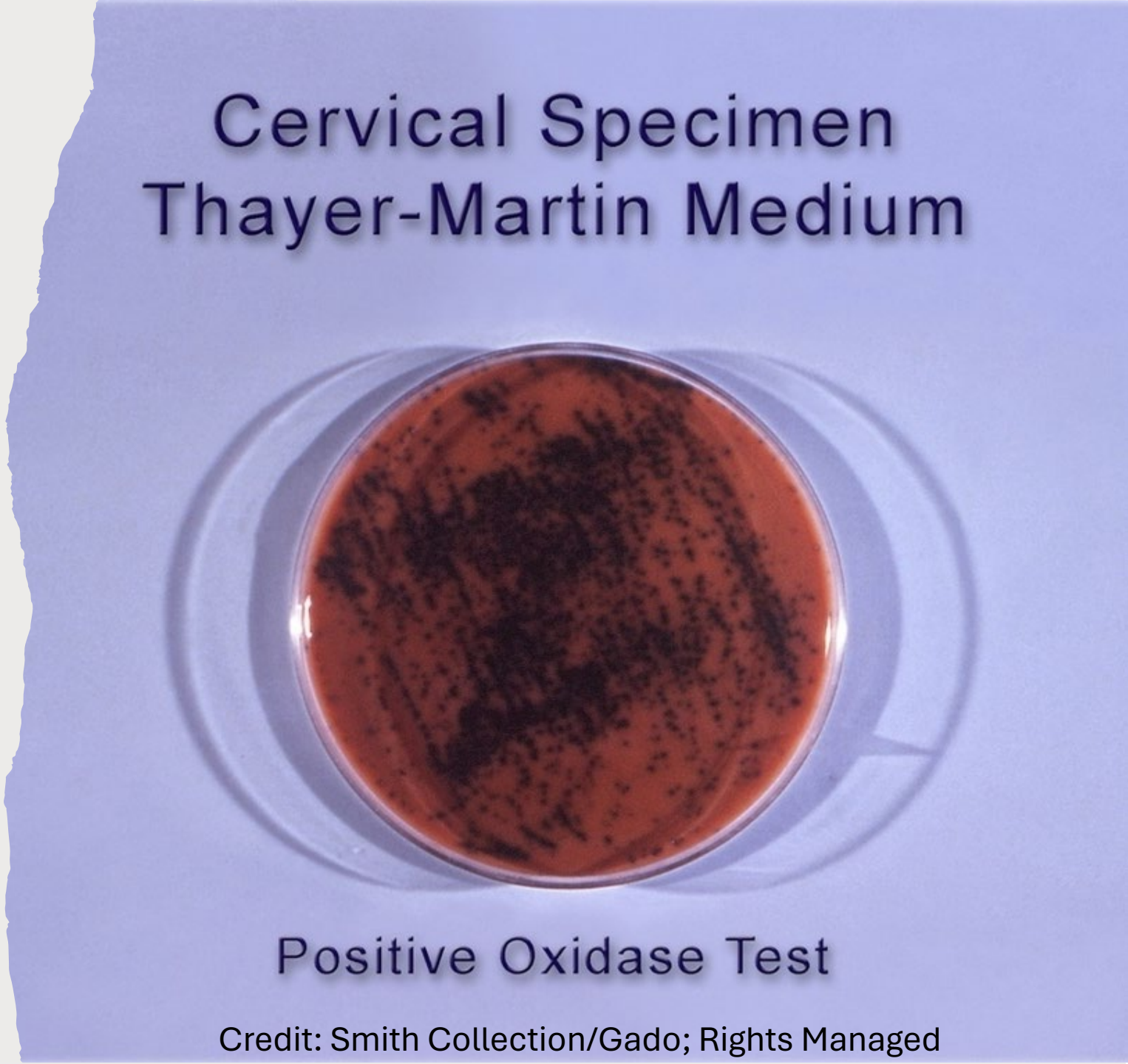
Laboratory identification of *Neisseria gonorrhea*

- Identification of *N. gonorrhoeae* depends on the isolation of an oxidase-positive, **Gram-negative** diplococci grown on non-selective chocolate agar and on selective media such as Thayer Martin agar.
- The inoculated plates should be incubated at 35°C to 37°C in a moist atmosphere enriched with CO_2.



MSS conditions caused by *Pseudomonas aeruginosa*

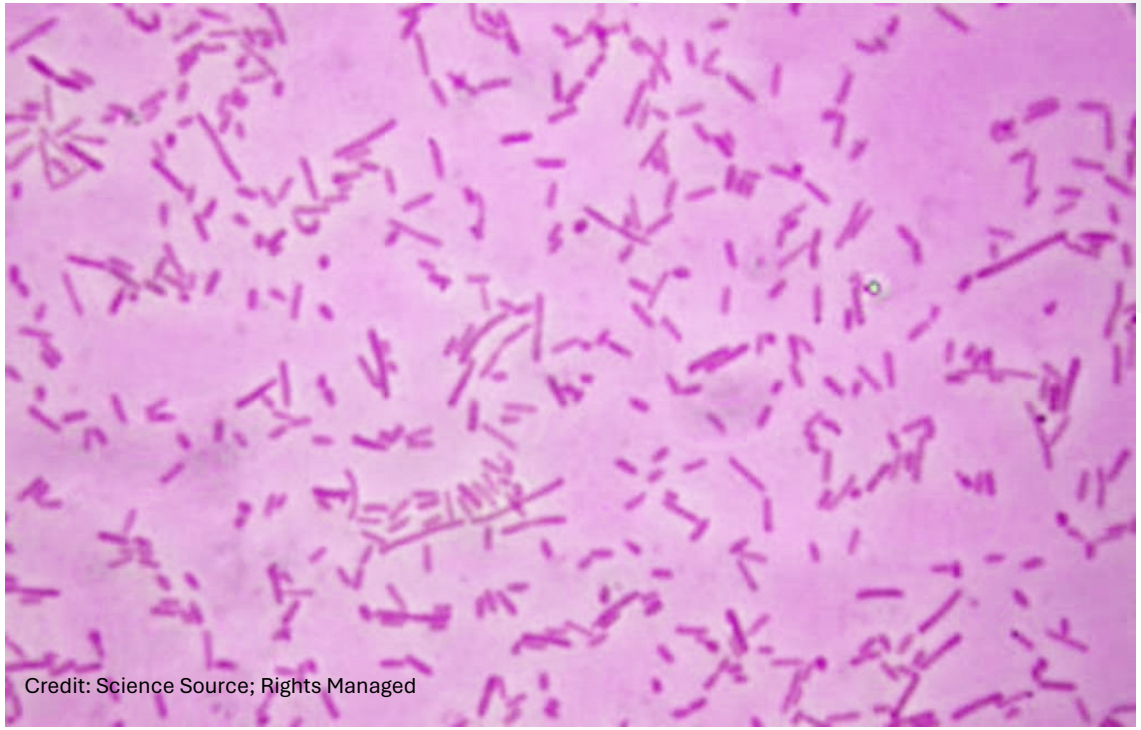
Cellulitis

Hot-tub folliculitis

Burn and wound infections

Ecthyma gangrenosum

Infectious endocarditis



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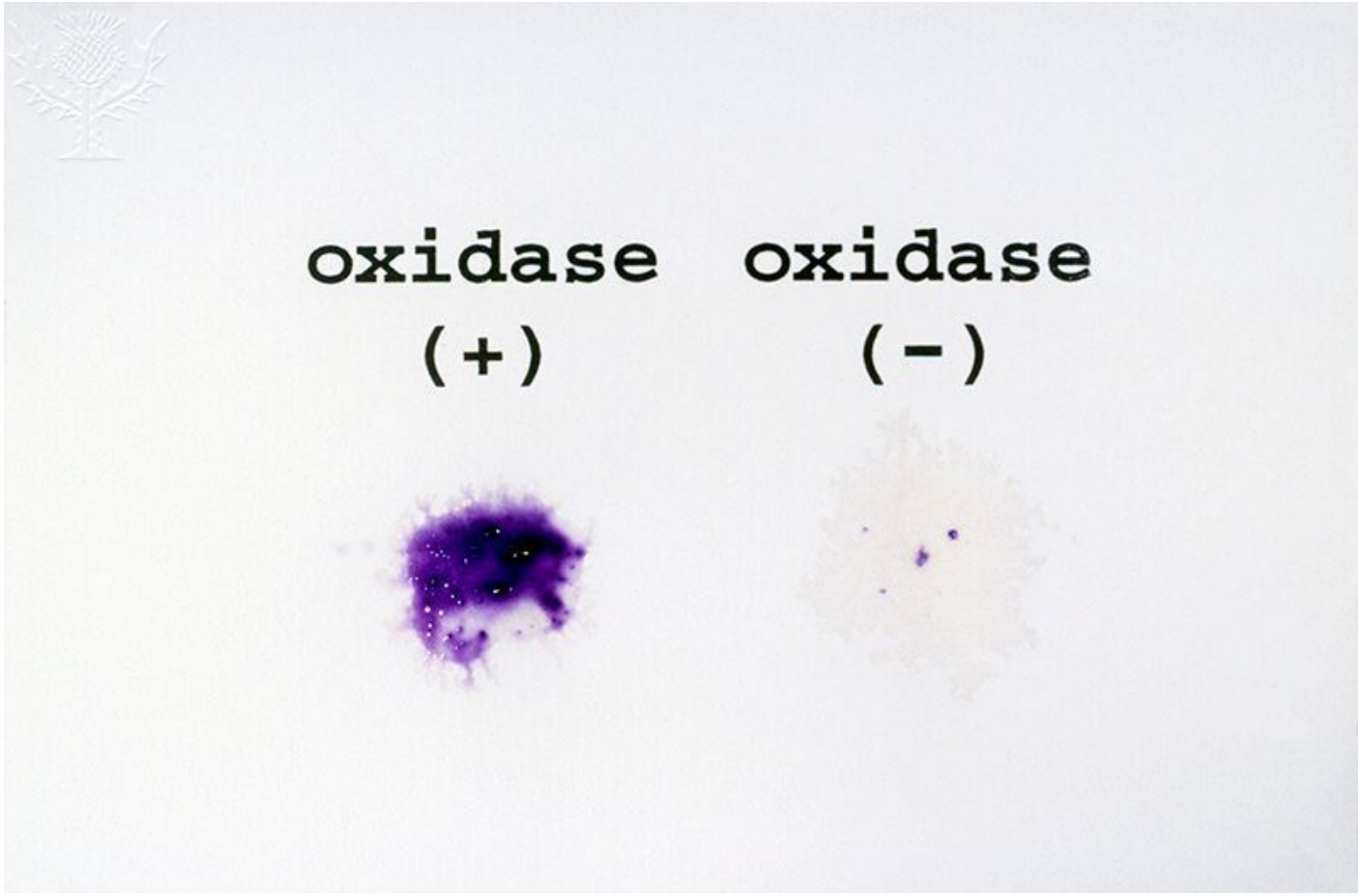
Laboratory identification of *P. aeruginosa*

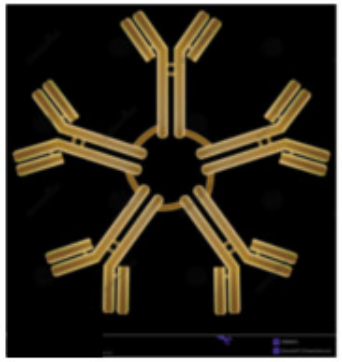
- *P. aeruginosa* grows well on most laboratory media and commonly is isolated on blood agar plates or MacConkey agar or CLED agar.
- *P. aeruginosa* is identified based on its **Gram-negative** rod morphology, inability to ferment lactose or glucose, a positive oxidase reaction, its fruity odor, and the ability to produce green or blue or yellow pigments.

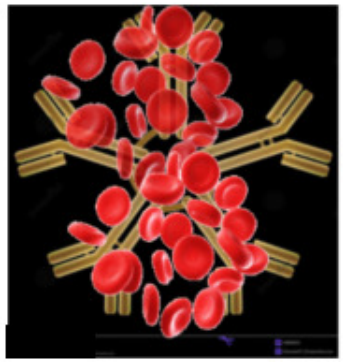


Credit: Fundamental Photographs, Inc.

Laboratory diagnosis of Infectious Mononucleosis
Monospot test

IgM + Sheep RBCs = Agglutination





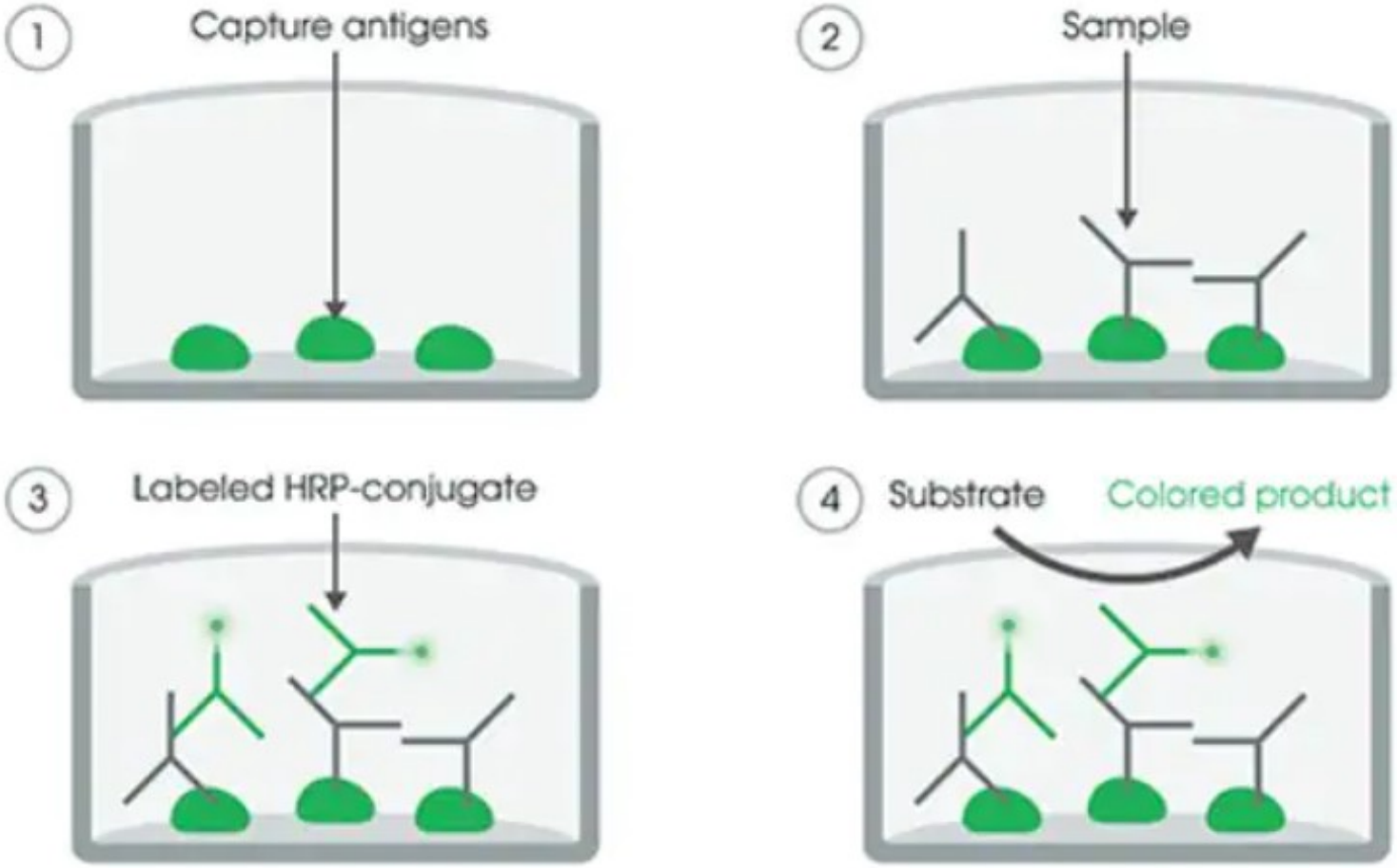
Test is no longer recommended today

Sensitivity is only 75% in the first week but increases to 90% afterwards

Both false positives (cancer, early HIV, autoimmune disorders) and false negatives (young age) are common

STATPEARLS

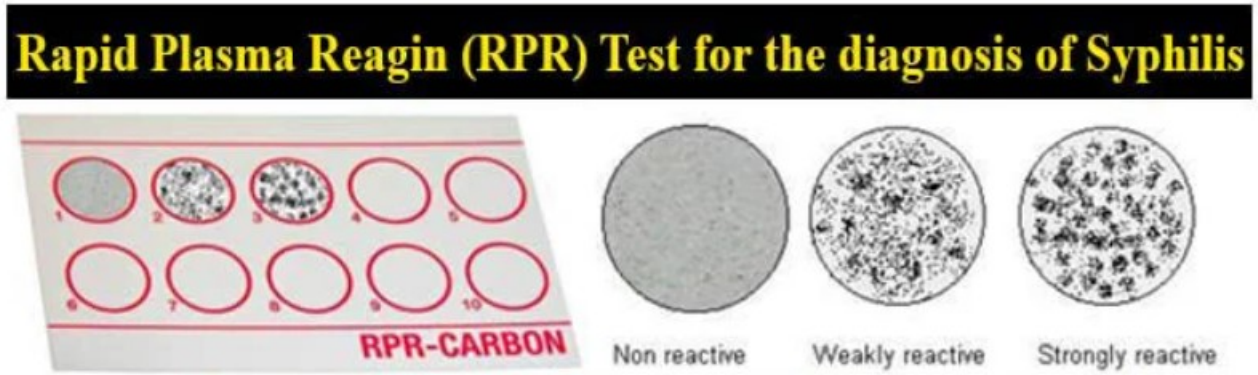
Laboratory diagnosis of Infectious Mononucleosis
ELISA for VCA antibody



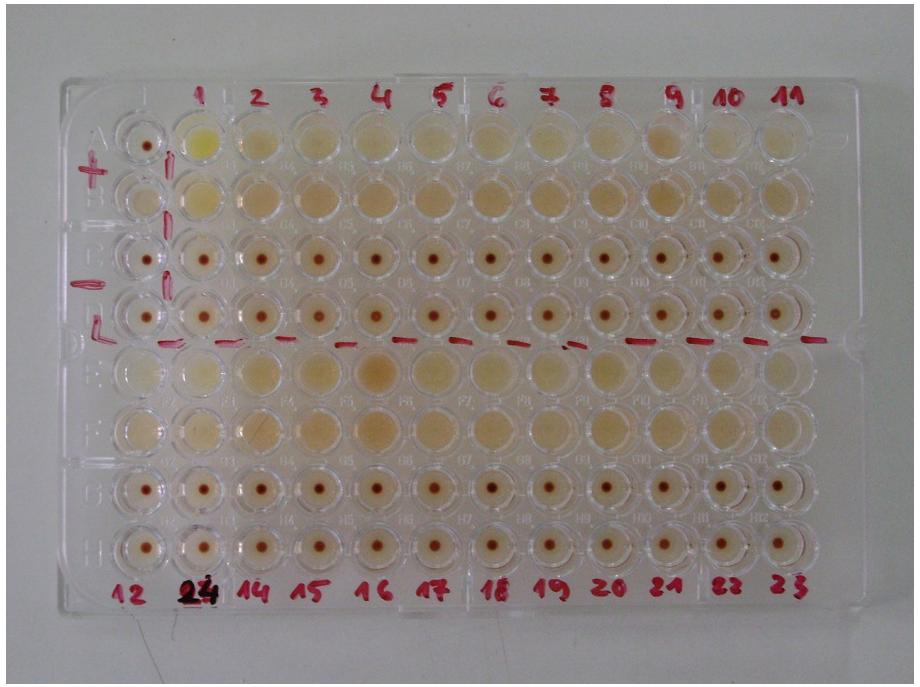
Credit: https://www.abcam.com/products/elisa/human-epstein-barr-virus-igg-elisa-kit-ebv-vca-ab108730.html#lb

Secondary Syphilis Diagnosis

- Screening by non-treponemal serologic tests including the venereal diseases research laboratory (VDRL) and rapid plasma reagin (RPR) tests.
- Confirmatory or treponemal tests include the fluorescent treponemal antibody absorption (FTA-ABS), and microhemagglutination assay for *T. pallidum* (MHA-TP).



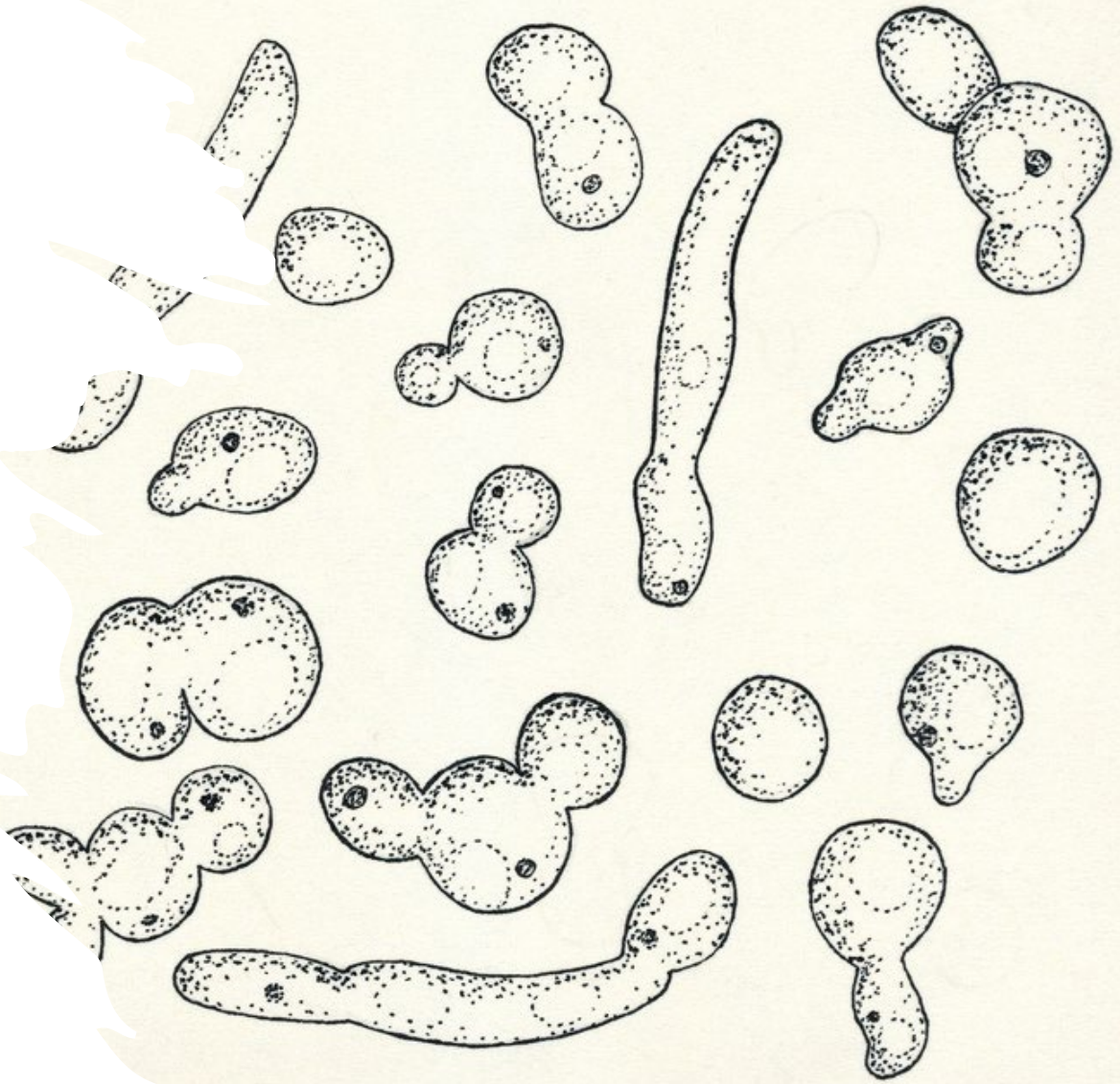
Credit: https://microbiologyinfo.com/rapid-plasma-reagin-rpr-test-for-the-diagnosis-of-syphilis/



Credit: dr. David Csaba Levente

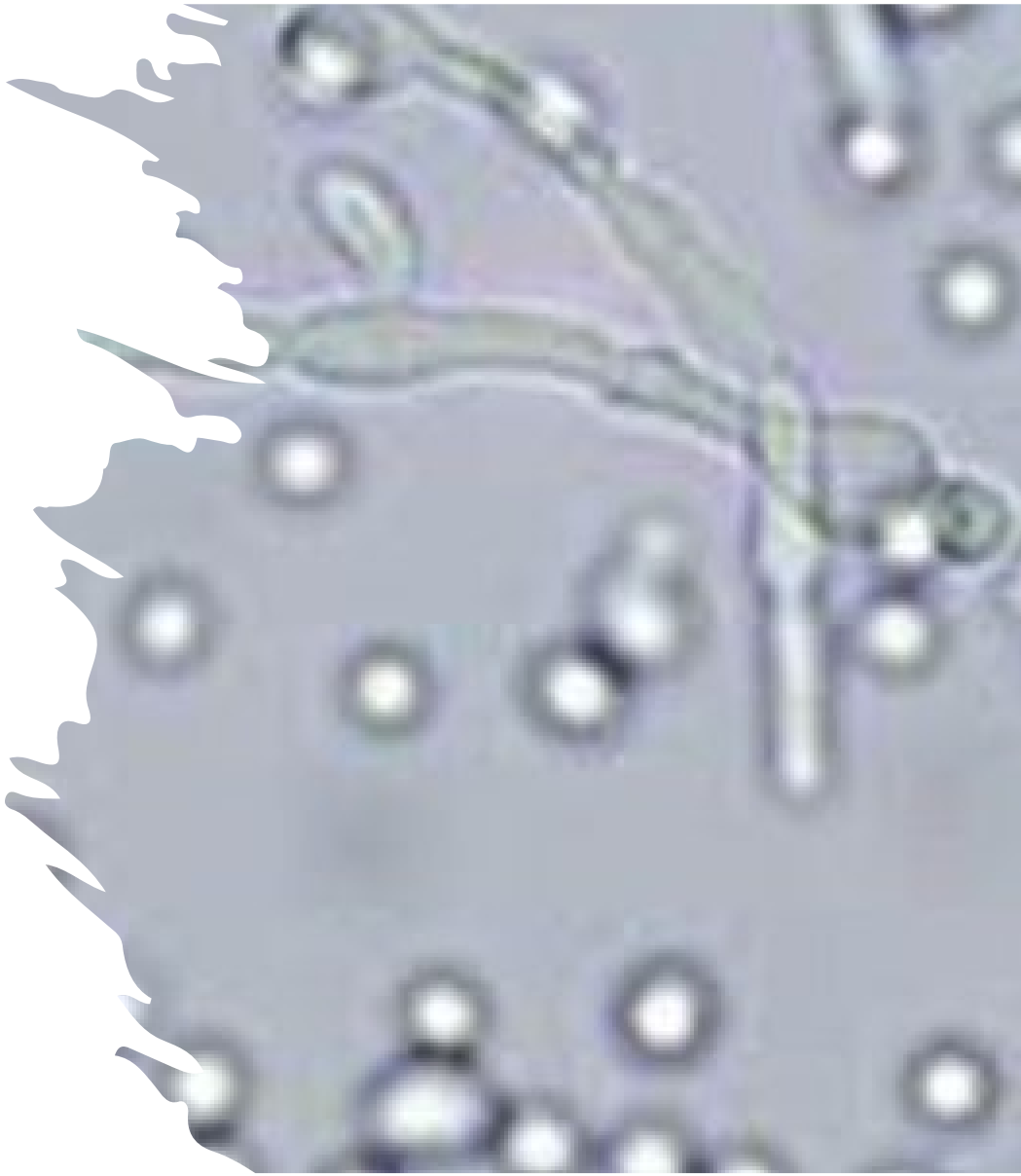
Cutaneous candidiasis

- *Candida* species grow readily in cultures and results are usually available in 48–72 hours usually producing white creamy colonies.
- Wet preparation reveal budding yeast.



Cutaneous candidiasis

- The 10% KOH (potassium hydroxide) procedure is a method used to examine specimens for yeast.
- KOH serves as an enzymatic agent that breaks down debris in a specimen, such as epithelial cells and WBCs, to view yeast or pseudohyphae.



Credit: This job aid is a component of the free, on-demand CDC training course "Routine Microscopy Procedures." Find the course at https://www.cdc.gov/labtraining.

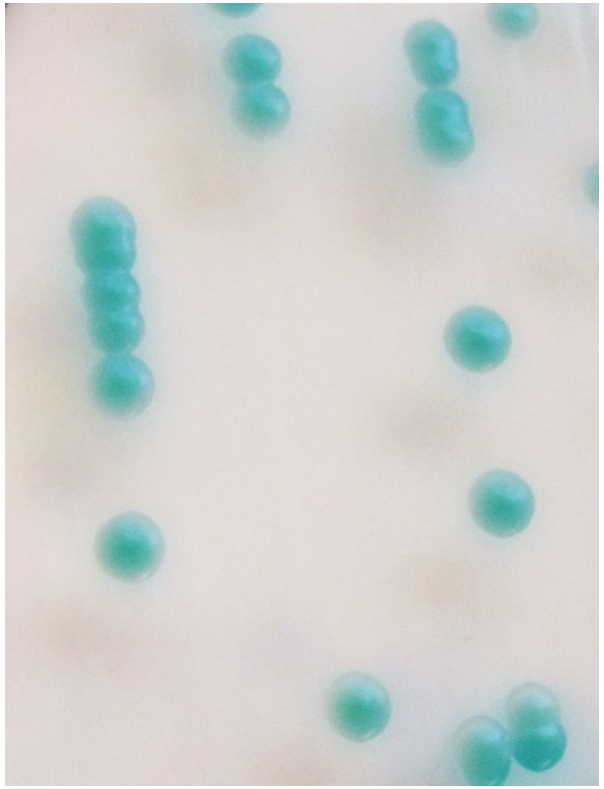
Species identification of *Candida*

- Species identification of *Candida* is required for all infections because of the variable susceptibility to antifungal drugs that is species specific.
- CHROMagar, a culture media utilized to rapidly identify many common Candida species, employs a colorimetric reaction on special agar that allows distinction among *C. albicans*, *C. glabrata, C. krusei, C. tropicalis*, and several other non-albicans Candida species.

Credit: https://www.chromagar.com/en/product/chromagar-candida/

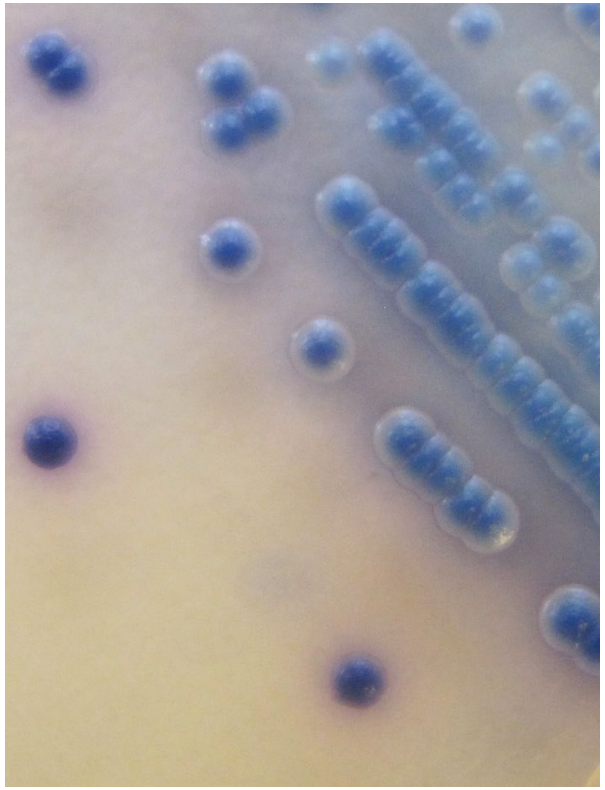
Species identification of *Candida*

Candida albicans
green

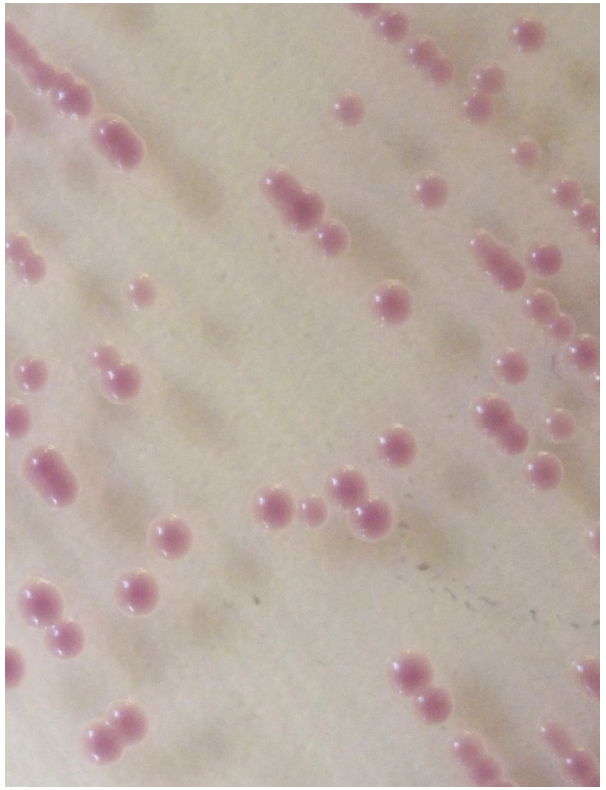


Candida krusei
pink, fuzzy

Candida tropicalis
metallic blue



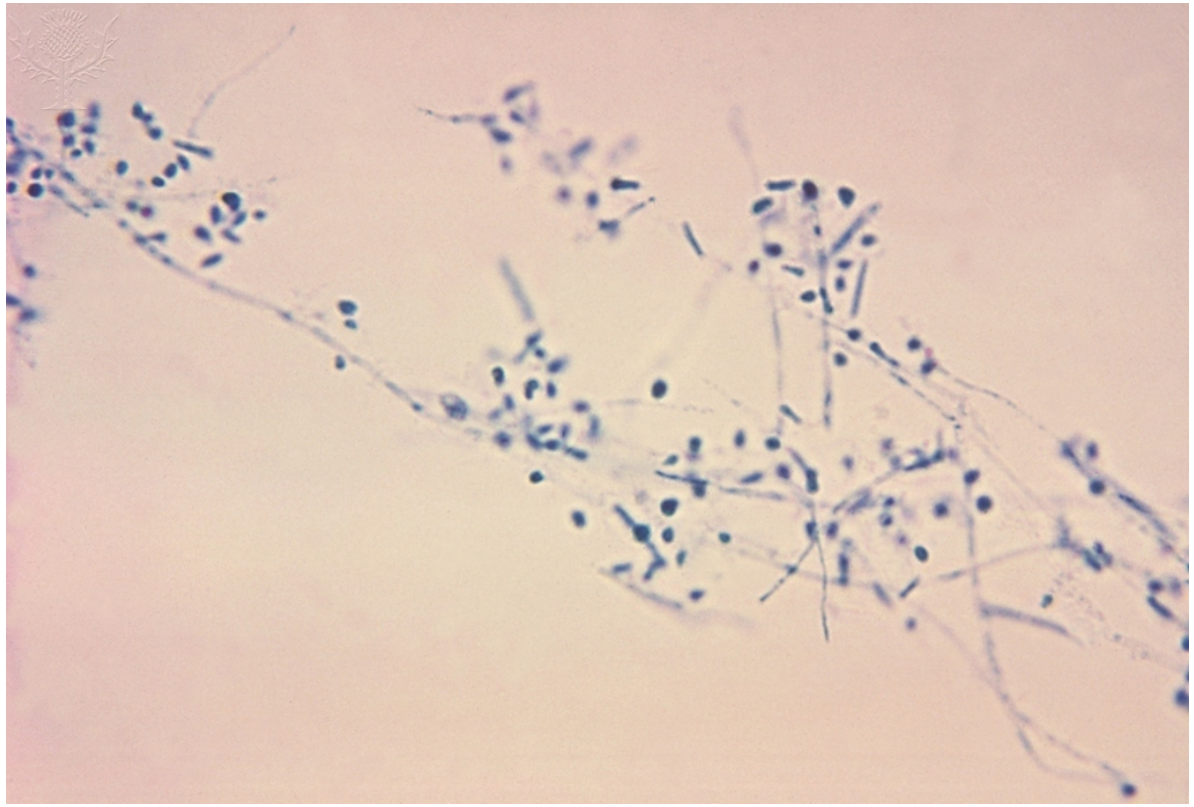
Candida glabrata
mauve



Credit: https://www.chromagar.com/en/product/chromagar-candida/

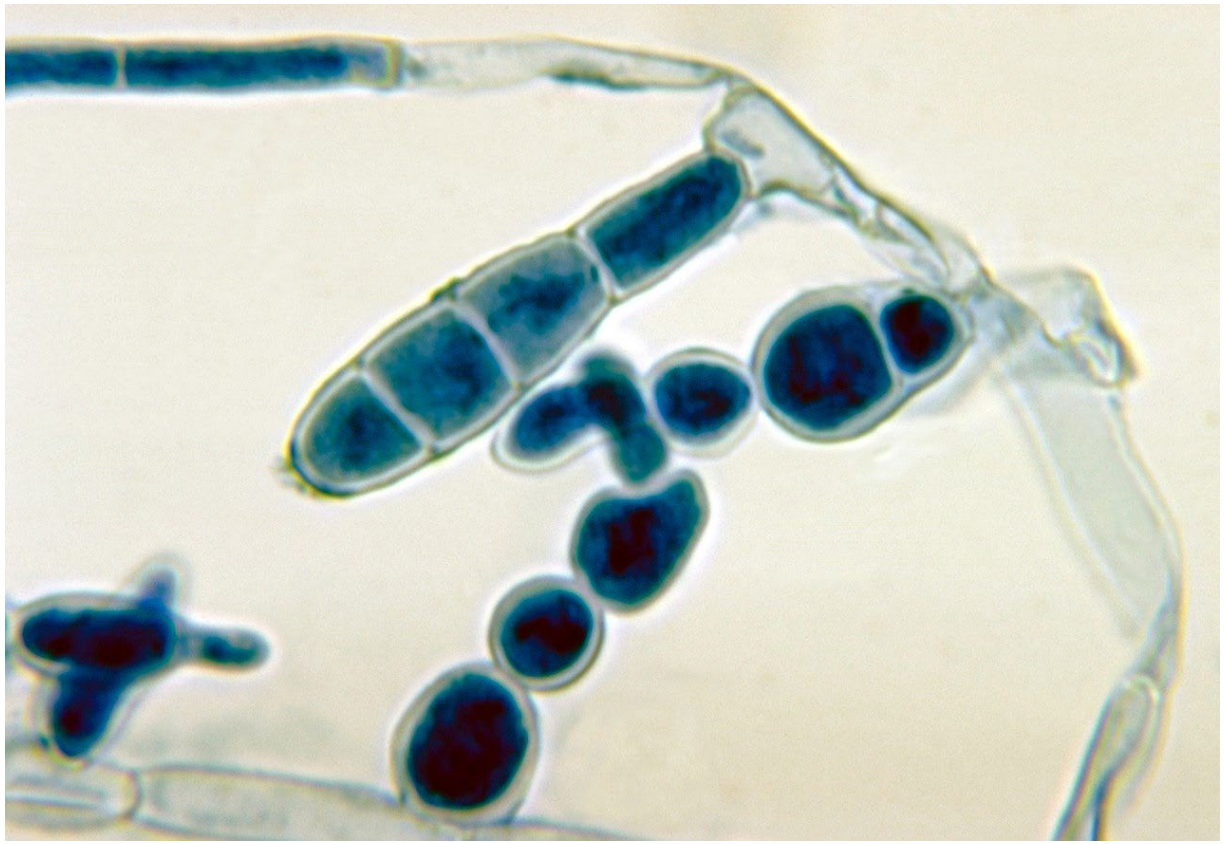
Tinea (Dermatophytoses)

- To isolate the causative agents of dermatophytoses, all specimens should be cultured on Sabouraud dextrose agar (SDA) supplemented with gentamicin and incubated for at least 2 weeks before ruling out dermatophytoses.
- Lactophenol blue stain is a mounting medium and staining agent used in the preparation of slides for microscopic examination of fungi.



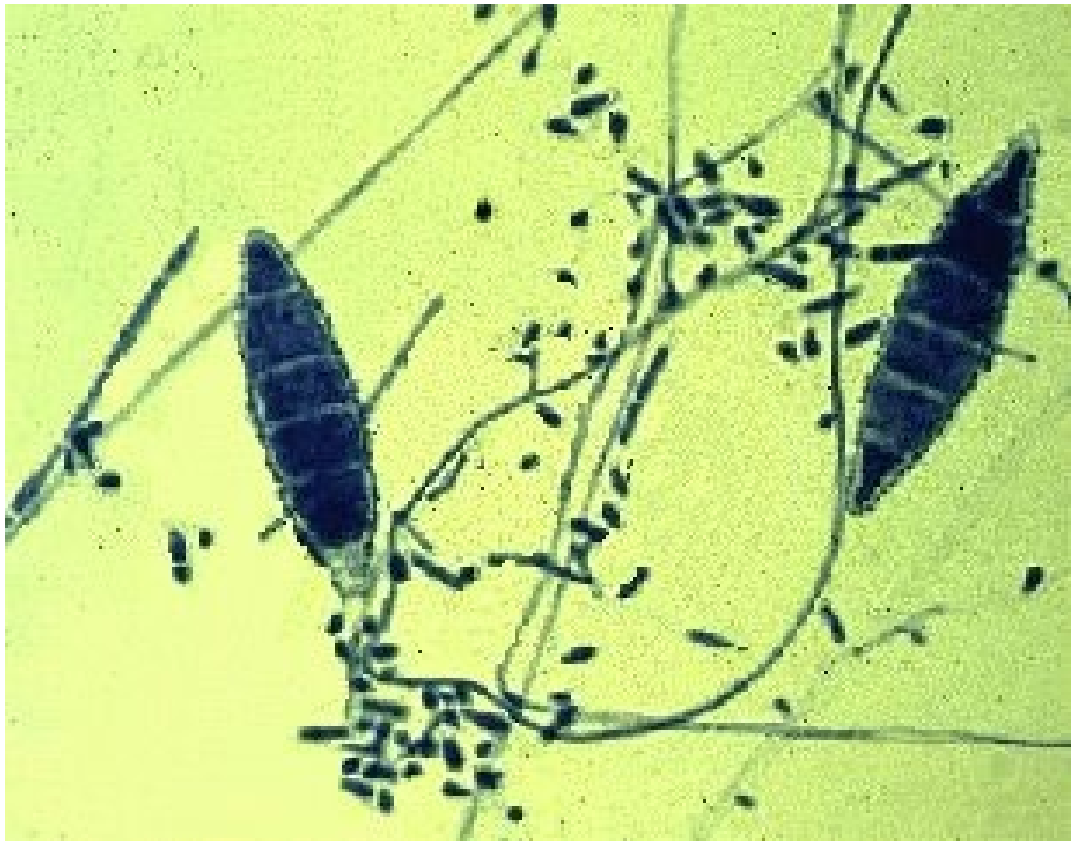
Epidermophyton floccosum

Credit: Science Photo Library; Rights Managed



Credit: Macroconidia of the dermatophytic fungus en:Epidermophyton floccosum. Obtained from the CDC Public Health Image Library. Image credit: CDC/Dr. Libero Ajello (PHIL #4207), 1972.

Microsporum gypseum



Credit: Dr. Michael R. McGinnis, Medical Mycology Research Center, The University of Texas Medical Branch at Galveston, Texas, USA (http://fungusweb.utmb.edu).

Thanks for listening!