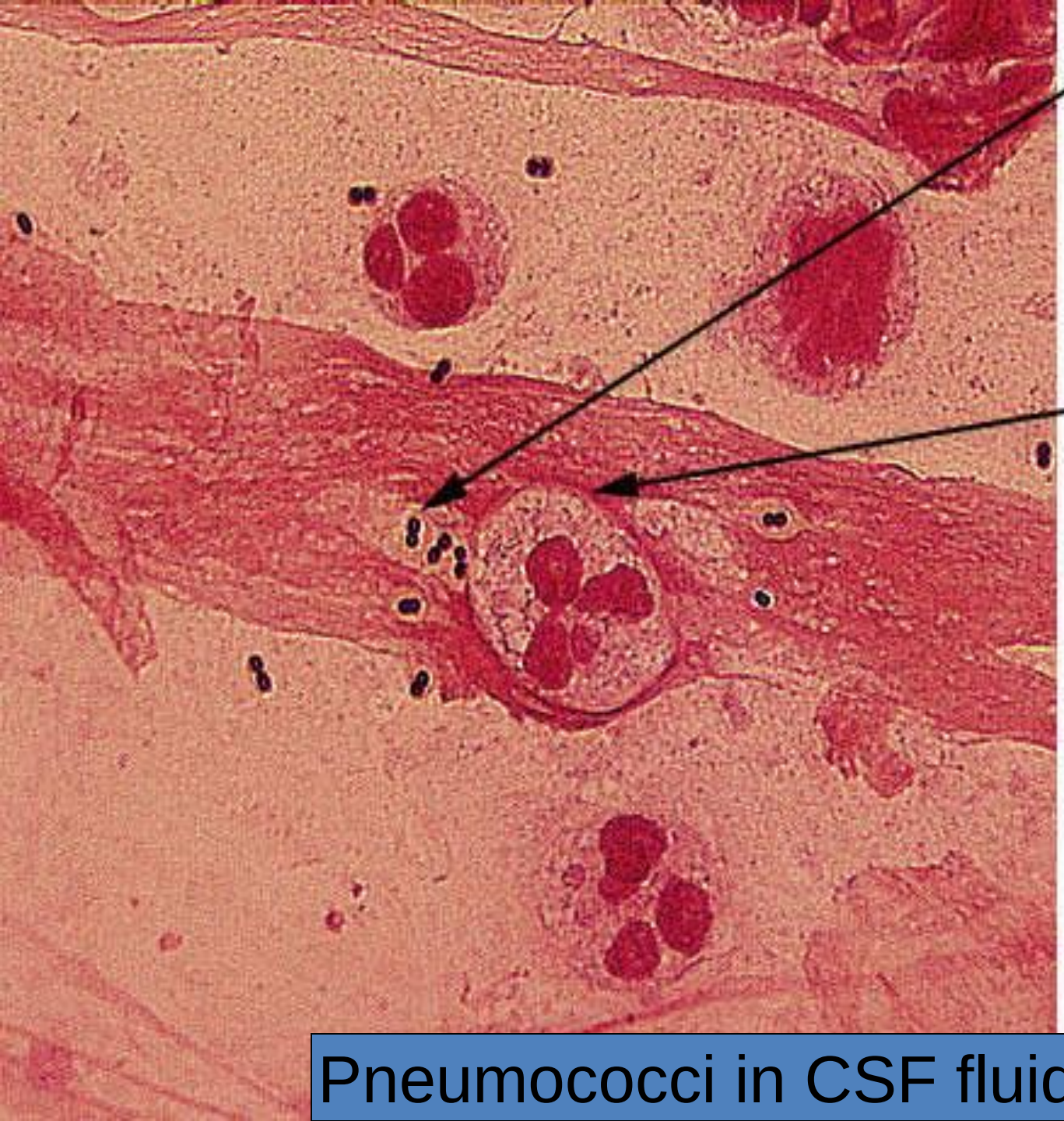
Streptococcus pneumoniae (pneumococcus)

Pneumococcus

- A gram positive lanceolate diplococcus.
- It differs from other streptococci with its morphology, bile solubility, optochin sensitivity and possession of a specific polysaccharide capsule.



Pneumococci in CSF fluid

Virulence Factors and Pathogenesis

- **Capsular polysaccharide**
- **C carbohydrate antigen**(C-polysaccharide or C-substance) - Species specific
- **Pneumolysin**
- **Autolysin -** Autolysis of cells - enhanced by bile salts & other surface active agents →bile solubility and draughtsman colony
- **Pneumococcal surface protein A (PspA) –**
- **IgA protease** - cleaves IgA in respiratory mucosa, thus facilitates entry
- **Pneumococcal surface protein C (PspC) /**
- **Adhesins**

Clinical Manifestations

- Colonize human nasopharynx →spread either via bloodstream to distant sites (e.g. brain, joint, bones & peritoneal cavity) or spread locally to cause otitis media or pneumonia.
- **Lobar pneumonia**

- MC cause of lobar (alveolar) pneumonia
- Known to progress to bacteremia and invasive disease
- Empyema & parapneumonic effusion

CONTINEU....

- **Invasive pneumococcal disease**
- **Defined** as an infection confrimed by isolation of pneumococci from normally sterile site
- Blood stream infection
- Pyogenic meningitis – leading cause of meningitis in all ages (except in neonates)
- Others - cause osteomyelitis, septic arthritis, endocarditis, pericarditis, primary peritonitis, rarely, brain abscess & hemolytic-uremic syndrome.
- **Noninvasive manifestations -** otitis media & sinusitis (MC cause)

Epidemiology

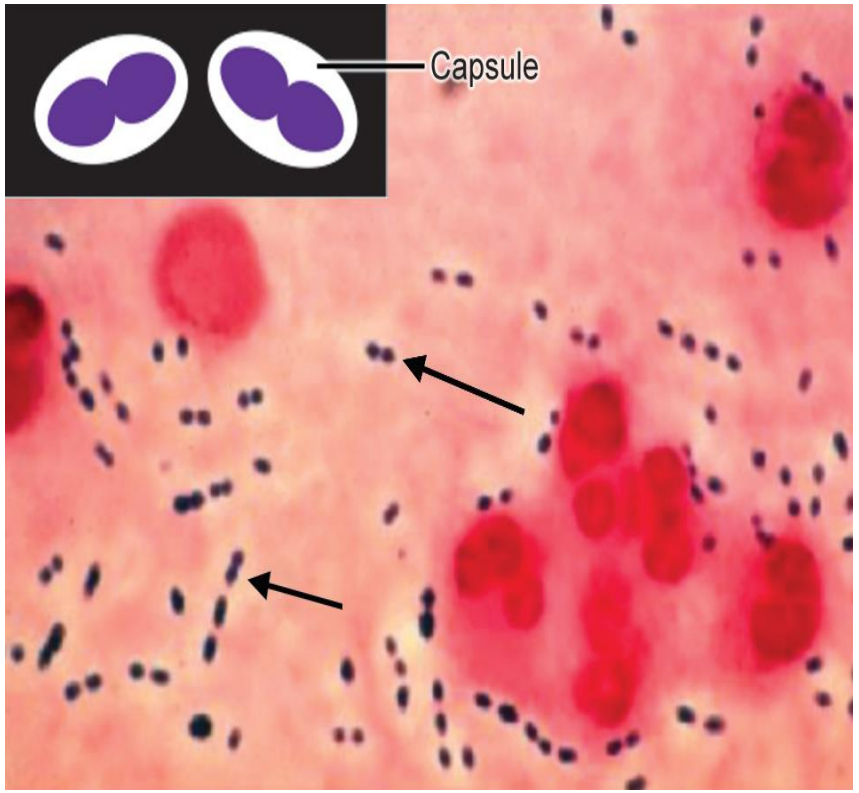
- **Source - upper respiratory tract of human** carriers (less often patients)
- **Carrier rate - >90% of children of 6 m to** 5 yrs – in nasopharynx
- **Mode of transmission – inhalation** droplet nuclei
- Infection usually leads to colonization and carrier state.
- Disease results only when the host resistance is lowered due to presence of associated risk factors.

Risk Factors

- **Children (<2 years)**
- **Splenectomy, sickle cell disease & other hemoglobinopathies**
- **Underlying comorbid diseases -** chronic lung, heart, kidney and liver disease, cochlear implants, diabetes mellitus &immunosuppression
- **Children** - Serotypes 4, 6B, 9V, 14, 18C, 19F, and 23F
- **Adults** - Serotypes 1–8
- **Virulent serotypes** - Serotype 3 followed by 7

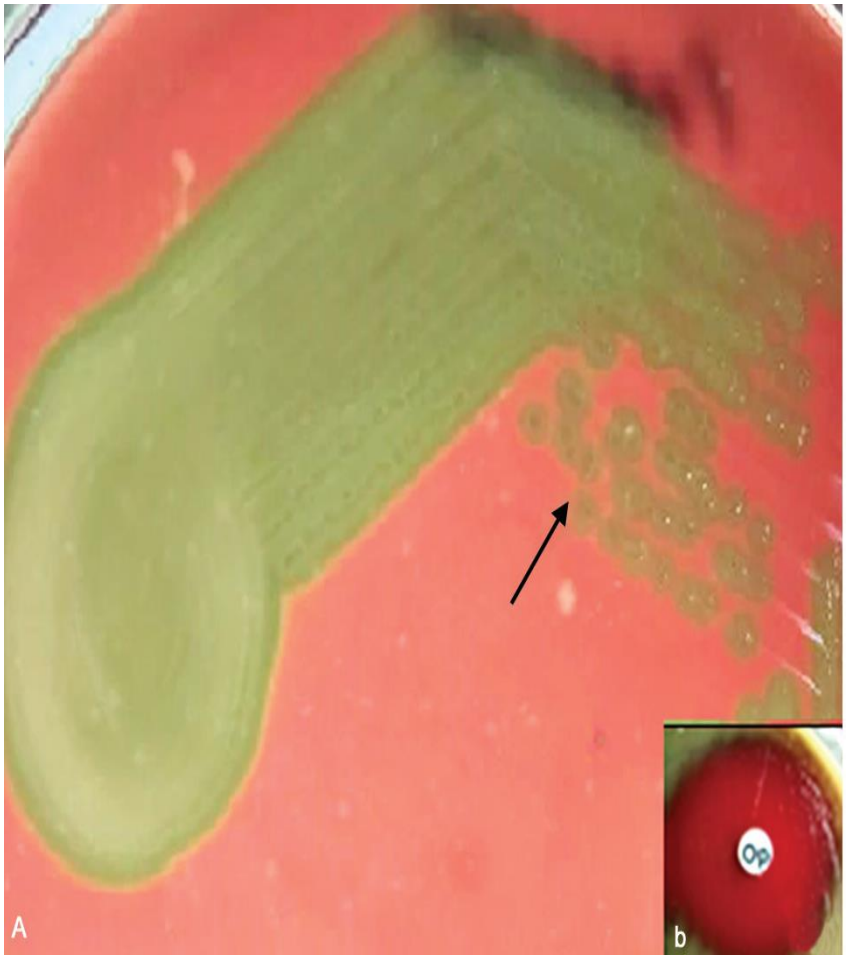
LAB. DIAGNOSIS

- **Specimen Collection**
- Sputum, cerebrospinal fluid (CSF), pleural fluid and other sterile body fluids, Blood culture
- **Microscopy**
- Lanceolate-shaped **Gram positive cocci** in pairs
- **India ink** - capsule

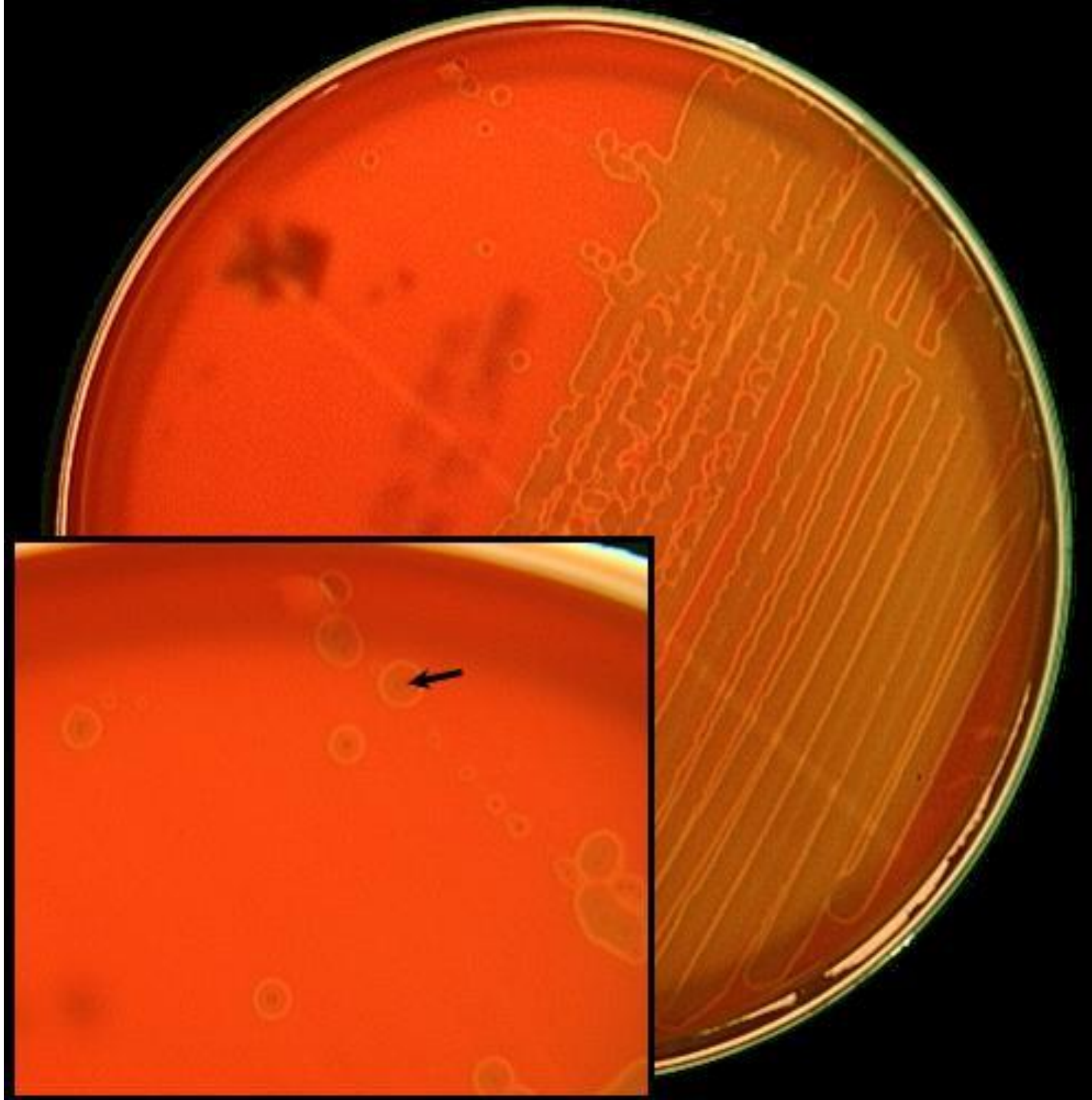


CULTURE

- Enriched media,5–10% CO2
- **Blood agar** – Alpha hemolytic draughtsman-shaped or carom coin-shaped colony
- **Chocolate agar** – bleeching effect
- **BHI broth** – Uniform turbidity → clearing

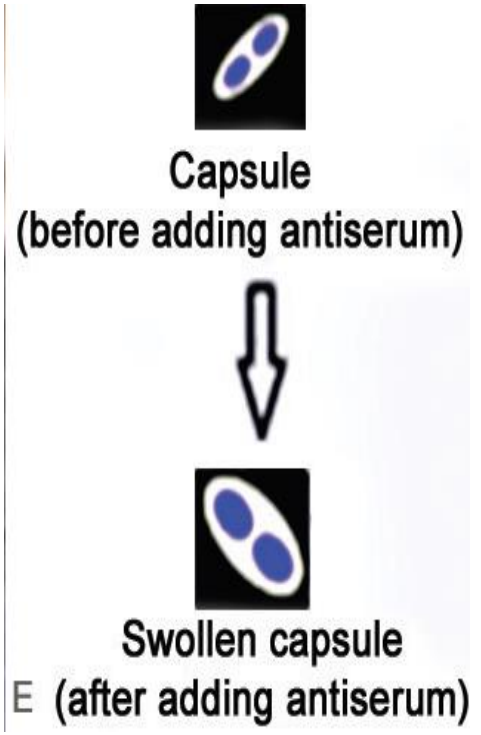


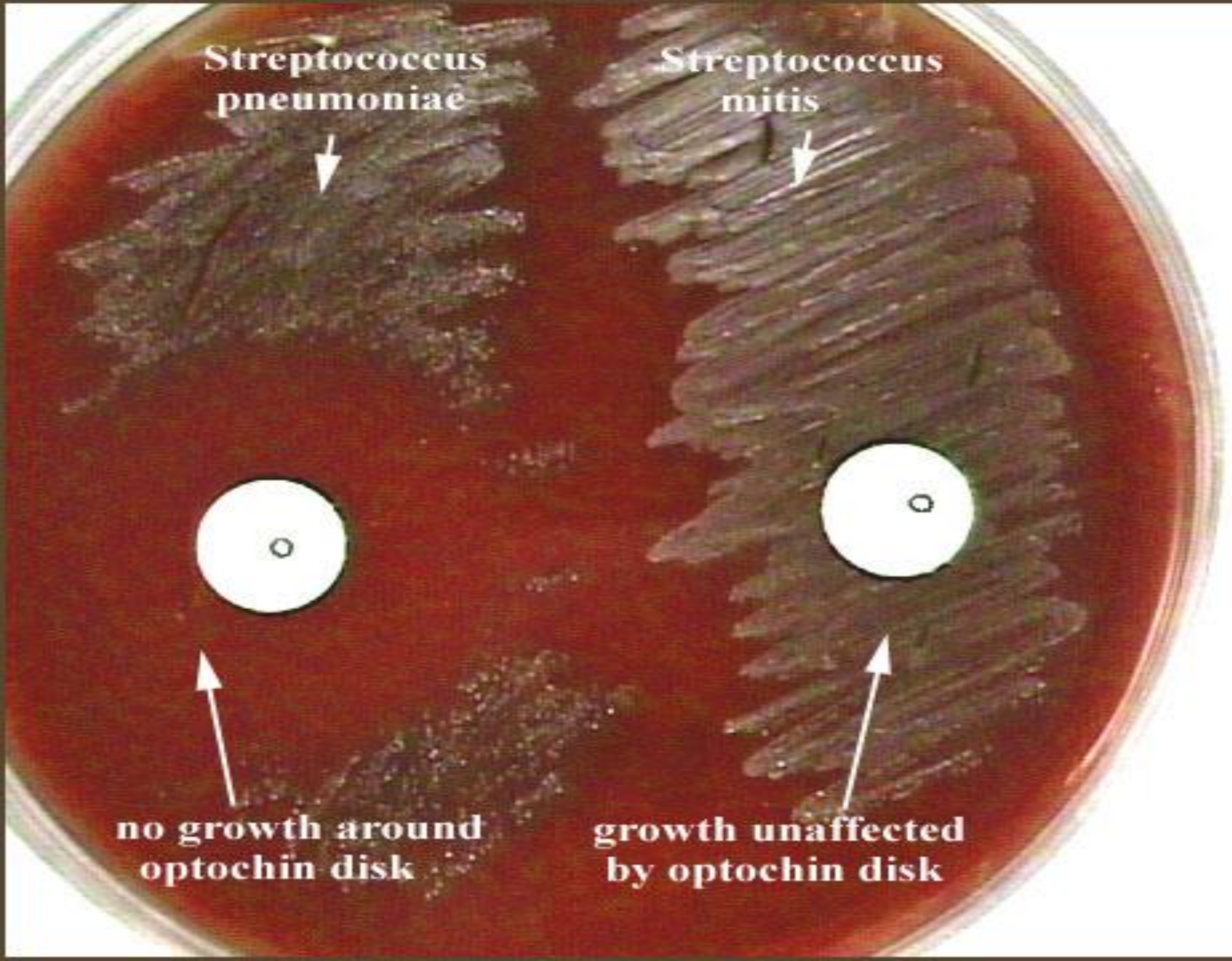
Carrom Coin appearance



BIOCHEMICAL TESTS

- **Catalase negative**
- **Bile sensitivity**
- Plate and Tube method
- **Optochin sensitive**
- **Inulin fermented**
- **Quellung reaction**




Streptococcus pneumoniae
Streptococcus mitis
no growth around optochin disk
growth unaffected by optochin disk

ANTIMICROBIAL SENSITIVITY TESTING

- **Oxacillin** - disk diffusion test
- Sensitive → sensitive to Penicillin, ceftriaxone and other β lactams
- Resistant → MIC testing for individual β lactams should be done

- **Treatment**
- Penicillin – DOC
- Alternatives
- Cephalosporins
- Vancomycin
- Quinolones

RESISTANCE

- **Penicillin Resistance**

Alteration of PBP to PBP2a

- **MDR Pneumococcus**

Resistant to

- Penicillins
- Erythromycin
- Tetracycline
- Clindamycine
- Sulfonamides

Differences between Viridans Streptococci & Pneumococcus

Feature	S.pneumoniae	Viridans streptococci
Morphology	Lanceolate or flame shaped	Round / oval
Arrangement	Gram positive cocci in pairs	Gram positive cocci in long chains
Capsule	Present	Absent
Colony on blood agar	Draughtsman or carom coin	Convex shaped colony
Liquid medium	Uniform turbidity	Granular turbidity
Bile solubility	Soluble in bile	Insoluble in bile