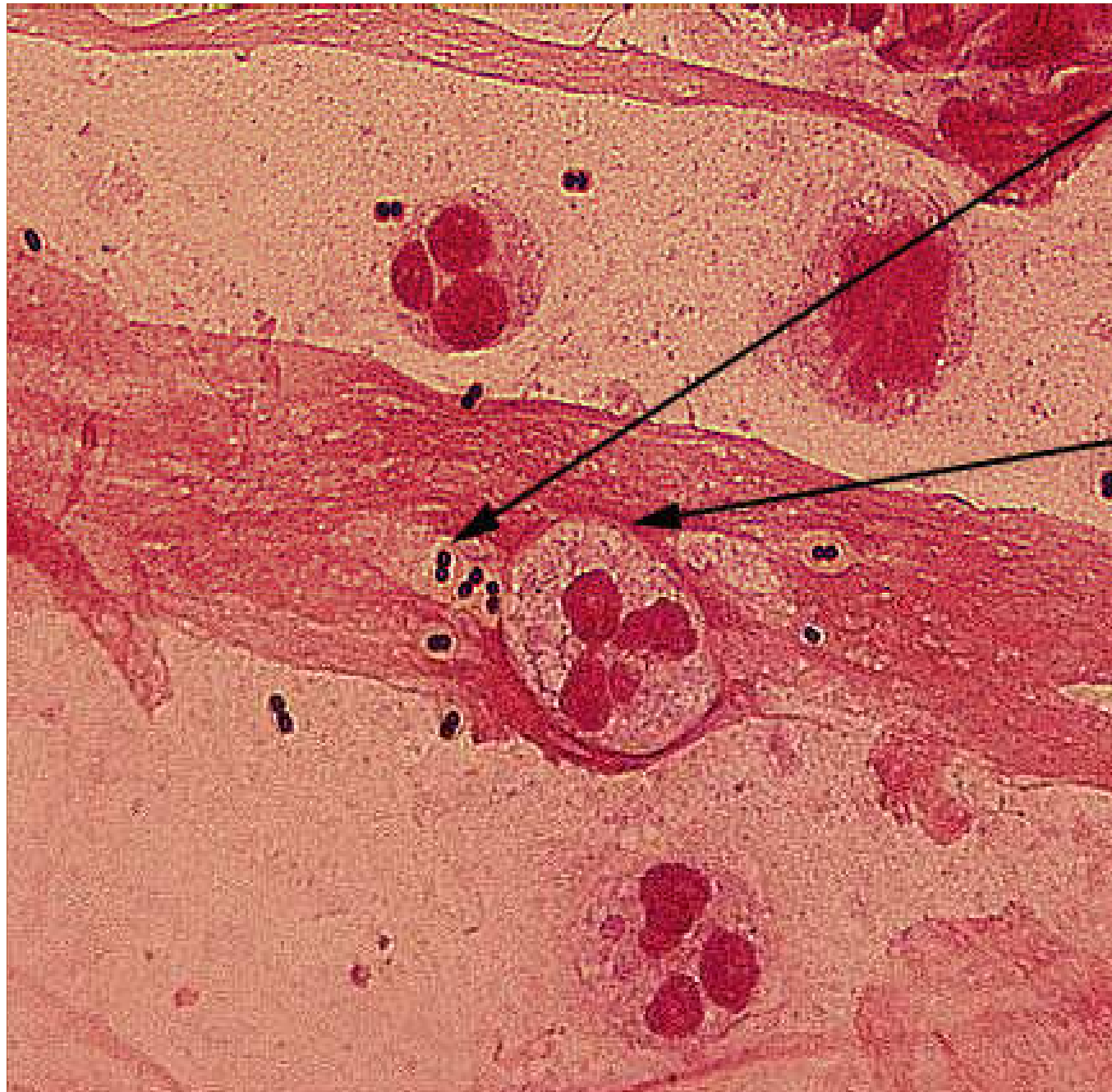


Pneumococcus

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



Gram-positive diplococci
surrounded by a capsule
(clear zone)

Polymorphonuclear leukocyte
(note the multi-lobed nucleus)

Pneumococci in CSF fluid

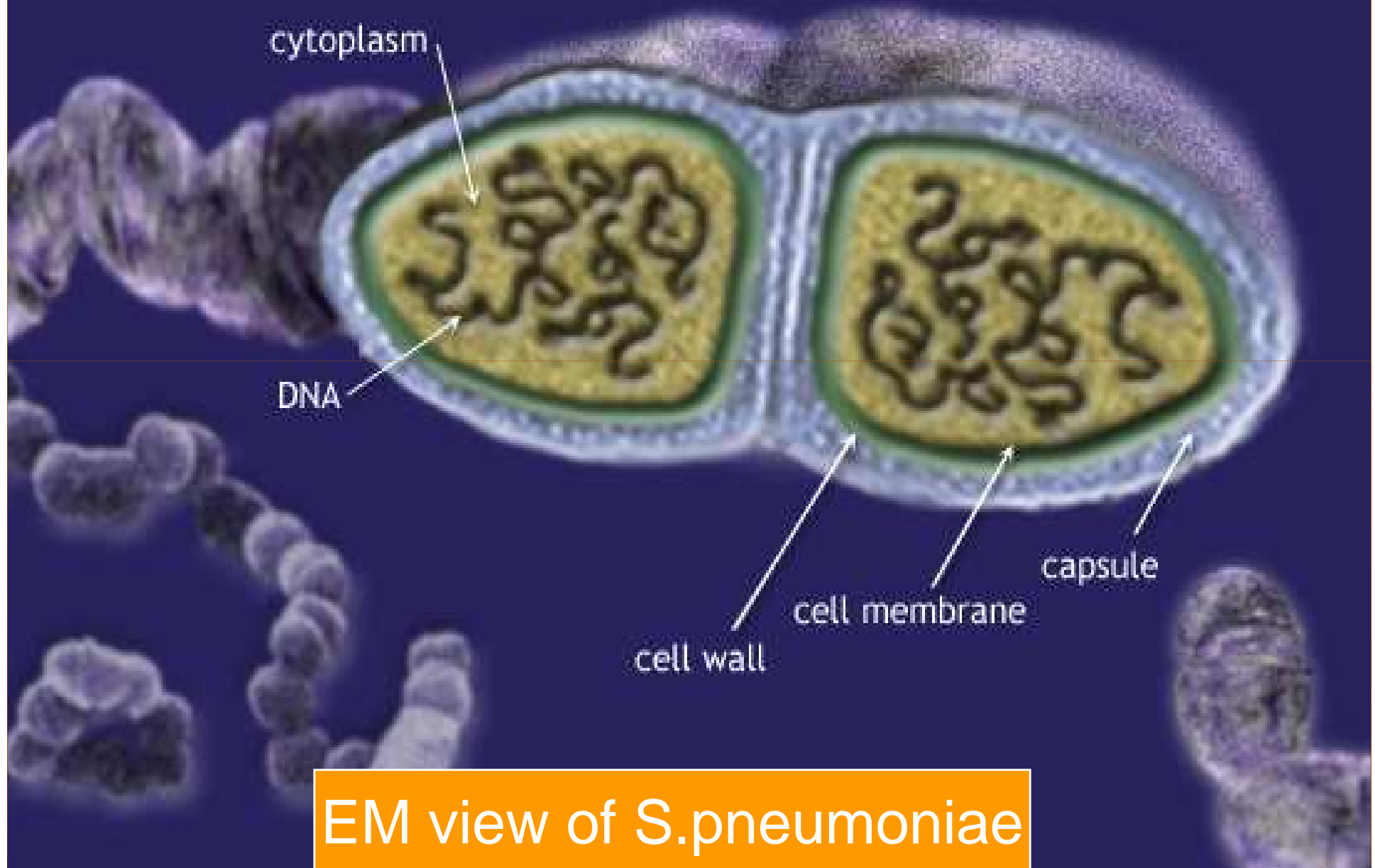
History

- Pasteur and Sternberg(1881) : first noticed pneumococci independently.
- Frankel and Weichselbaum(1886) : established the relationship between pneumococci and pneumonia independently.

Morphology

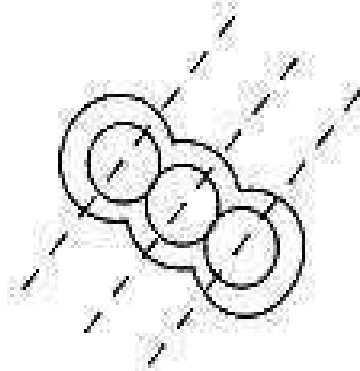
- Small(1 μm), slightly elongated cocci, with one end broad and the other end pointed, presenting a flame shape or lanceolate appearance.
- Occur in pair, with both ends in opposition, capsulated enclosing each pair.
- Nonmotile, nonsporing.
- Capsule stained by India ink preparation, Hiss capsular stain or Quellung reaction

Figure 4. Cross-section of *Streptococcus pneumoniae*

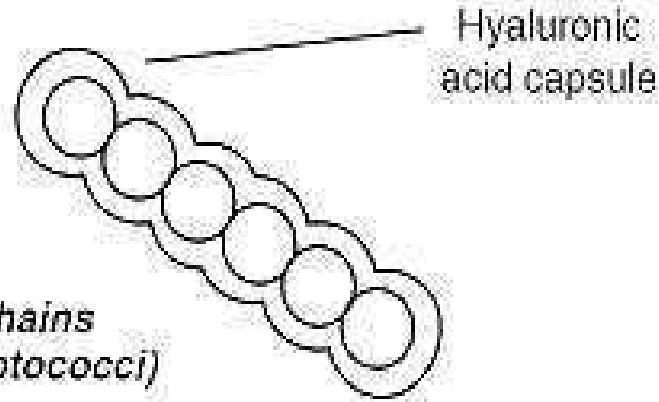


EM view of *S.pneumoniae*

Streptococcus pyogenes

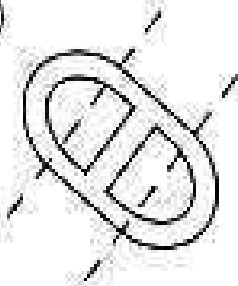


Chains (streptococci)

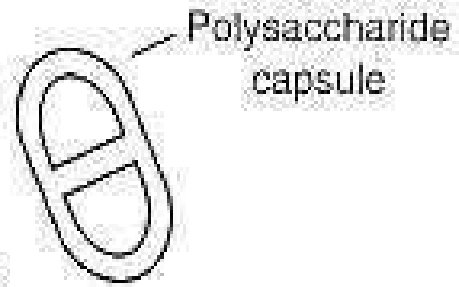


Plane of division
(perpendicular to
long axis of chain)

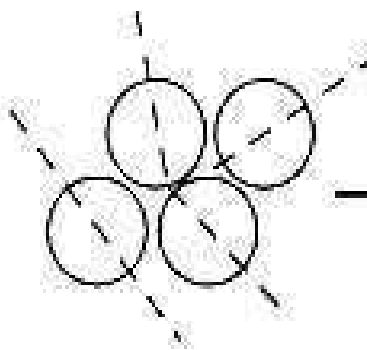
Streptococcus pneumoniae



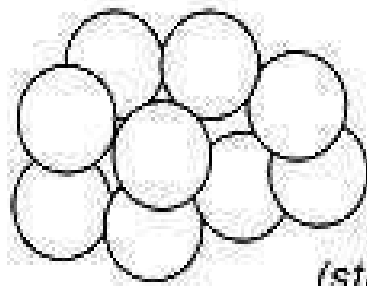
Pairs (diplococci)



Staphylococcus aureus



Clusters (staphylococci)



Cultural characteristics

- Aerobe and facultative anaerobe
- Optimum temp. 37°C(range25-42°C) and PH 7.8
- Grows better in the presence of 5-10% CO₂.
- On blood agar, after 18 hrs. of incubation, the colonies are small (0.5-1mm), dome shaped and glistening with an area of green discoloration(α hemolysis).

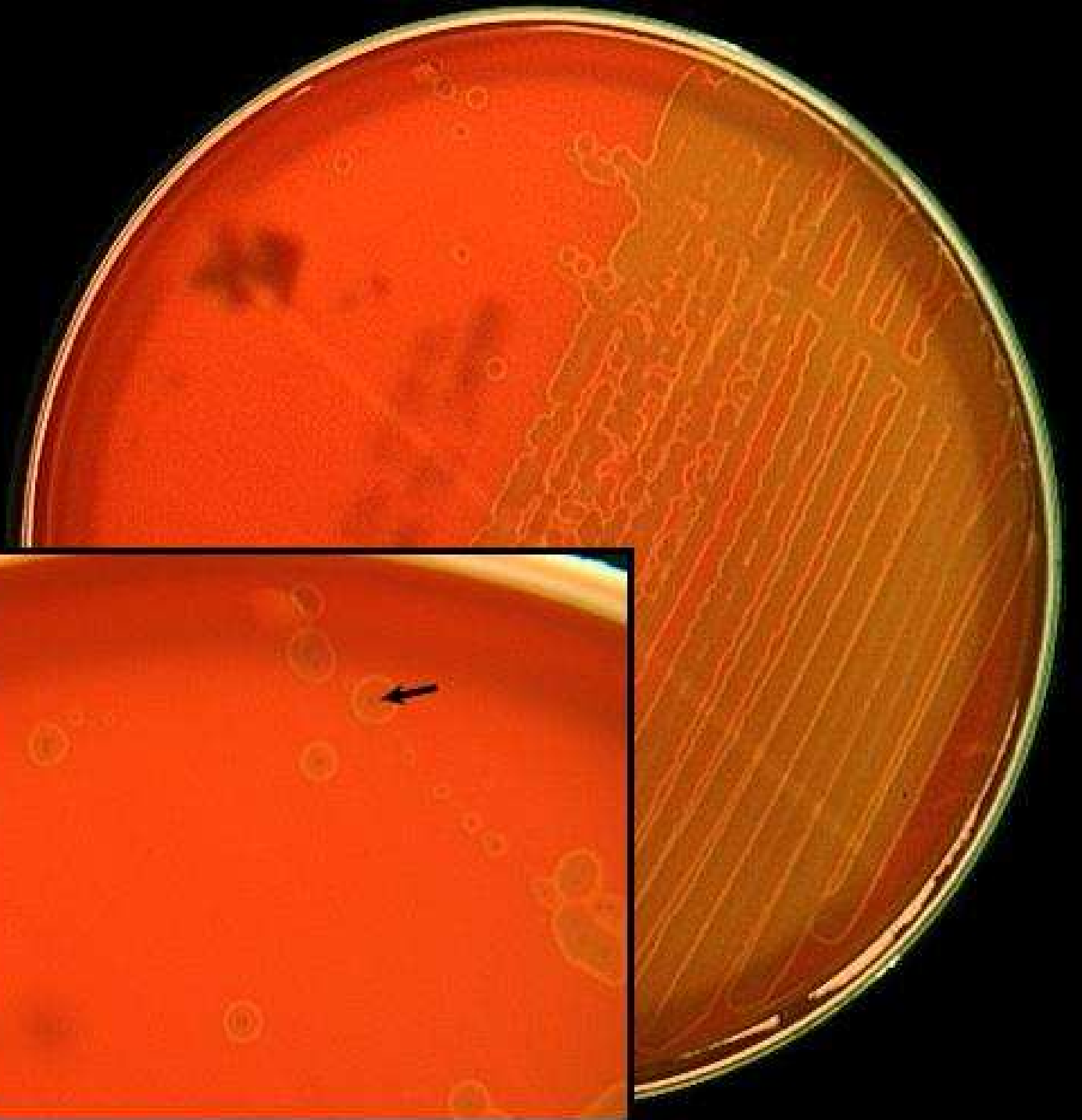
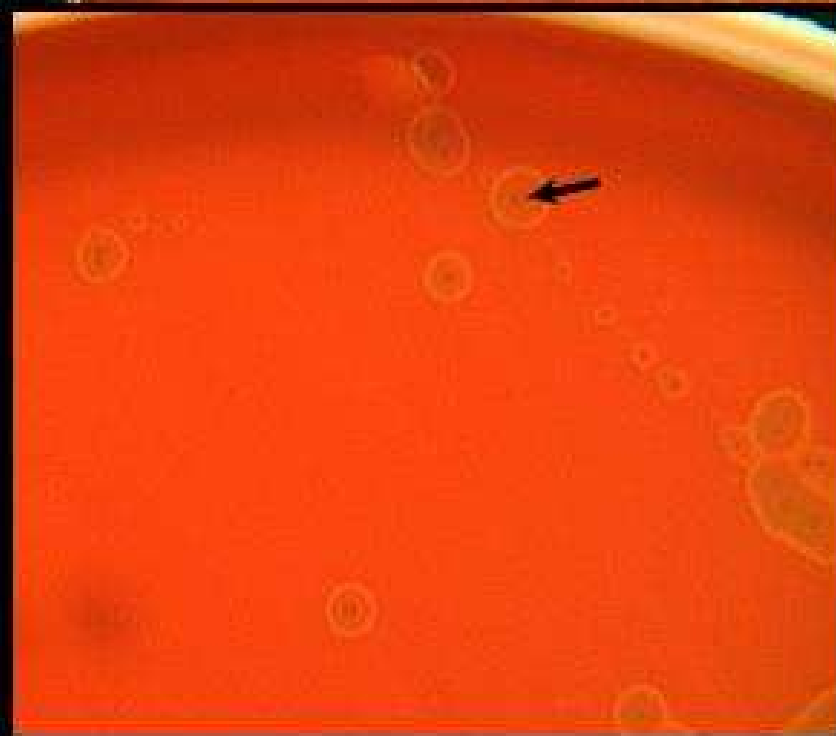


Alpha
Hemolysis
Of
pneumococci

Cultural characteristics Cont..

- On further incubation, the colonies become flat with raised edges and central depression resembling draughtsman or carrom coin appearance.
- In a liquid media, growth occurs as uniform turbidity.
- The cocci readily undergo autolysis due to heat labile intracellular enzymes.

Carrom
Coin
appearance

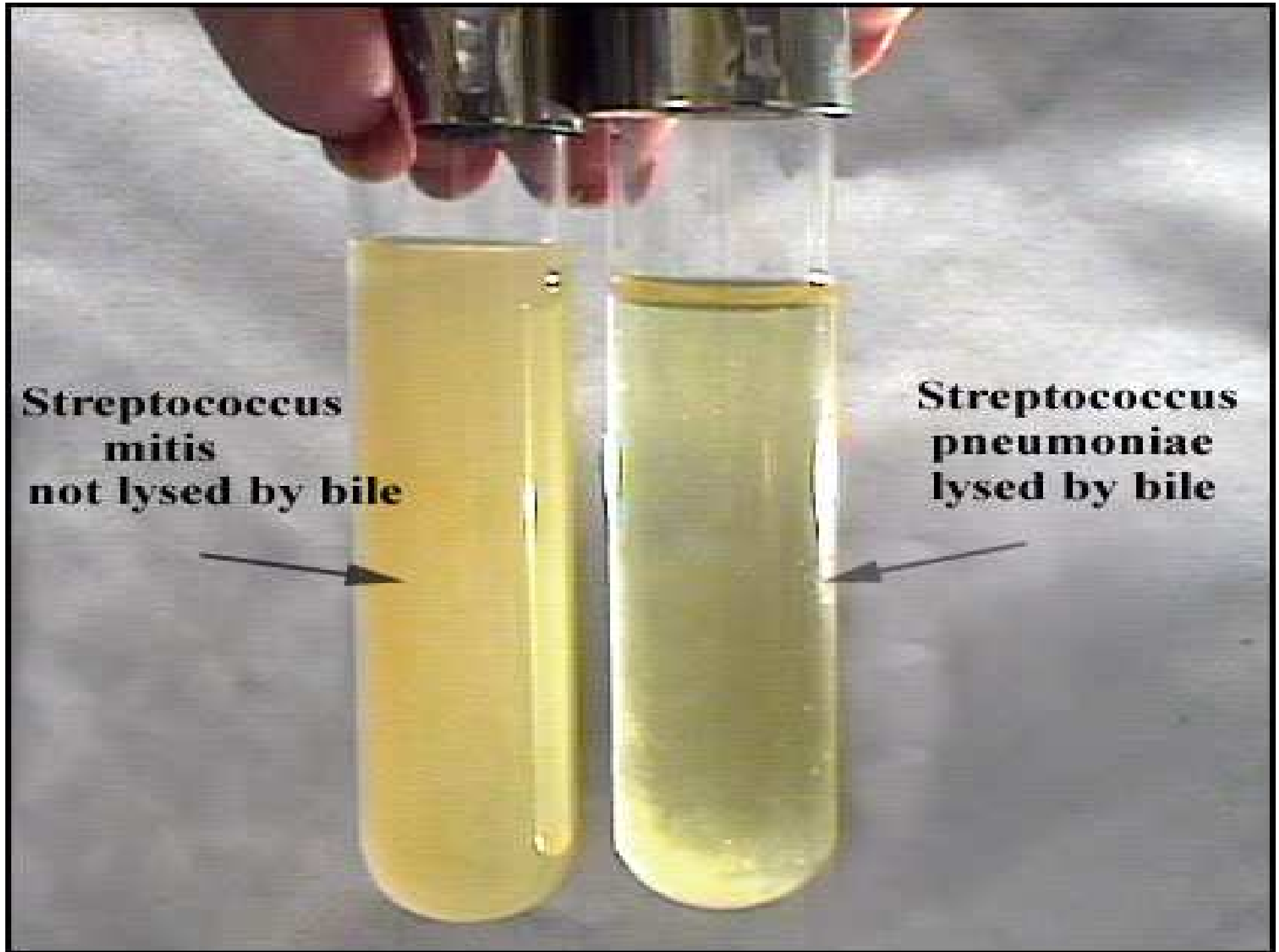
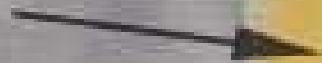


Biochemical reactions

- Ferment several sugars in Hiss's serum water including inulin fermentation that differentiate them from streptococci.
- Bile soluble due to presence of autolytic enzyme Amidase.
- Catalase and oxidase negative.

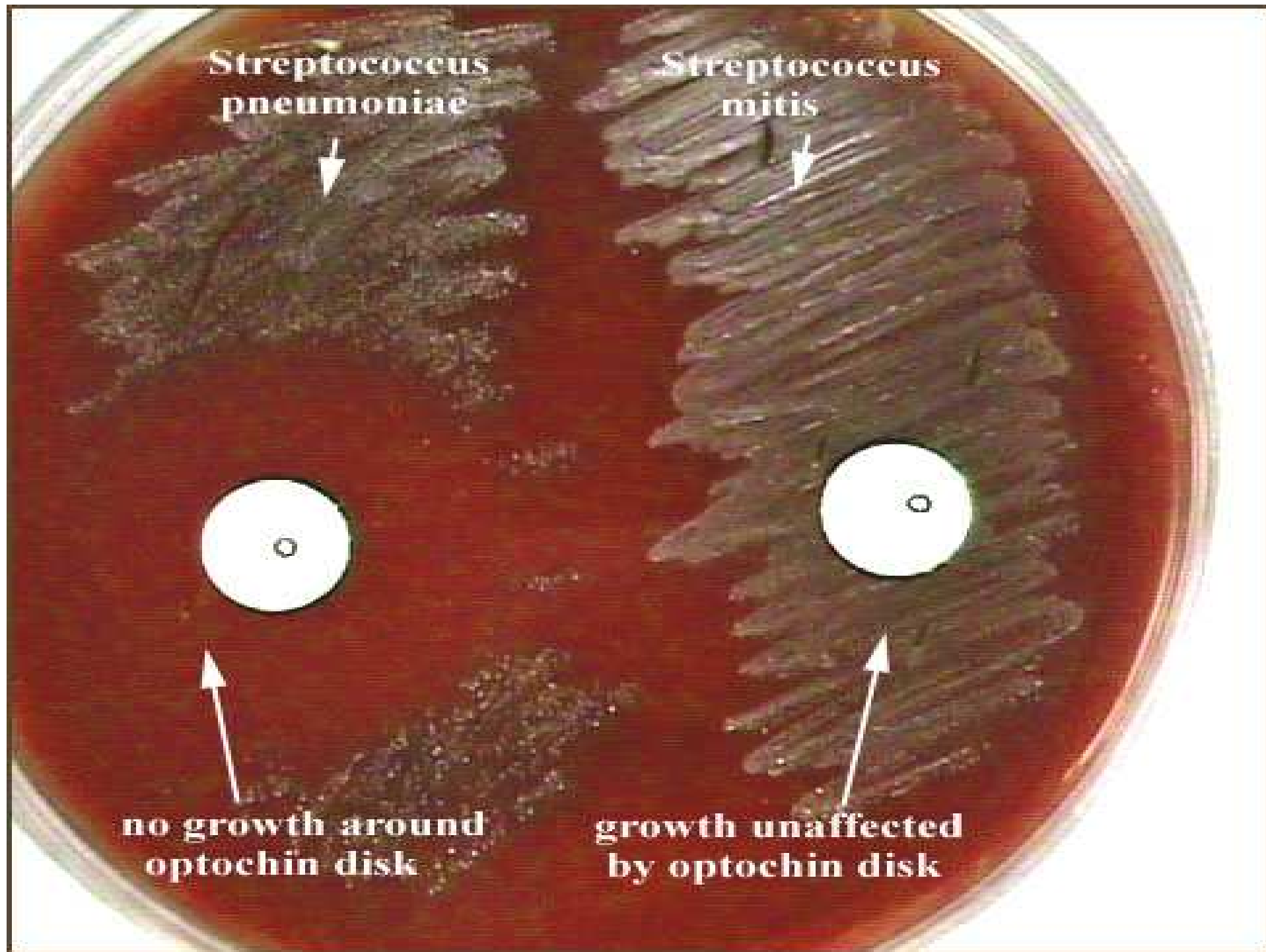
**Streptococcus
mitis
not lysed by bile**

**Streptococcus
pneumoniae
lysed by bile**



Resistance

- Delicate organisms, destroyed by heat (52°C for 15 min) and most antiseptics.
- Develop resistance to penicillin due to mutation or gene transfer in penicillin binding proteins
- Sensitive to optochin

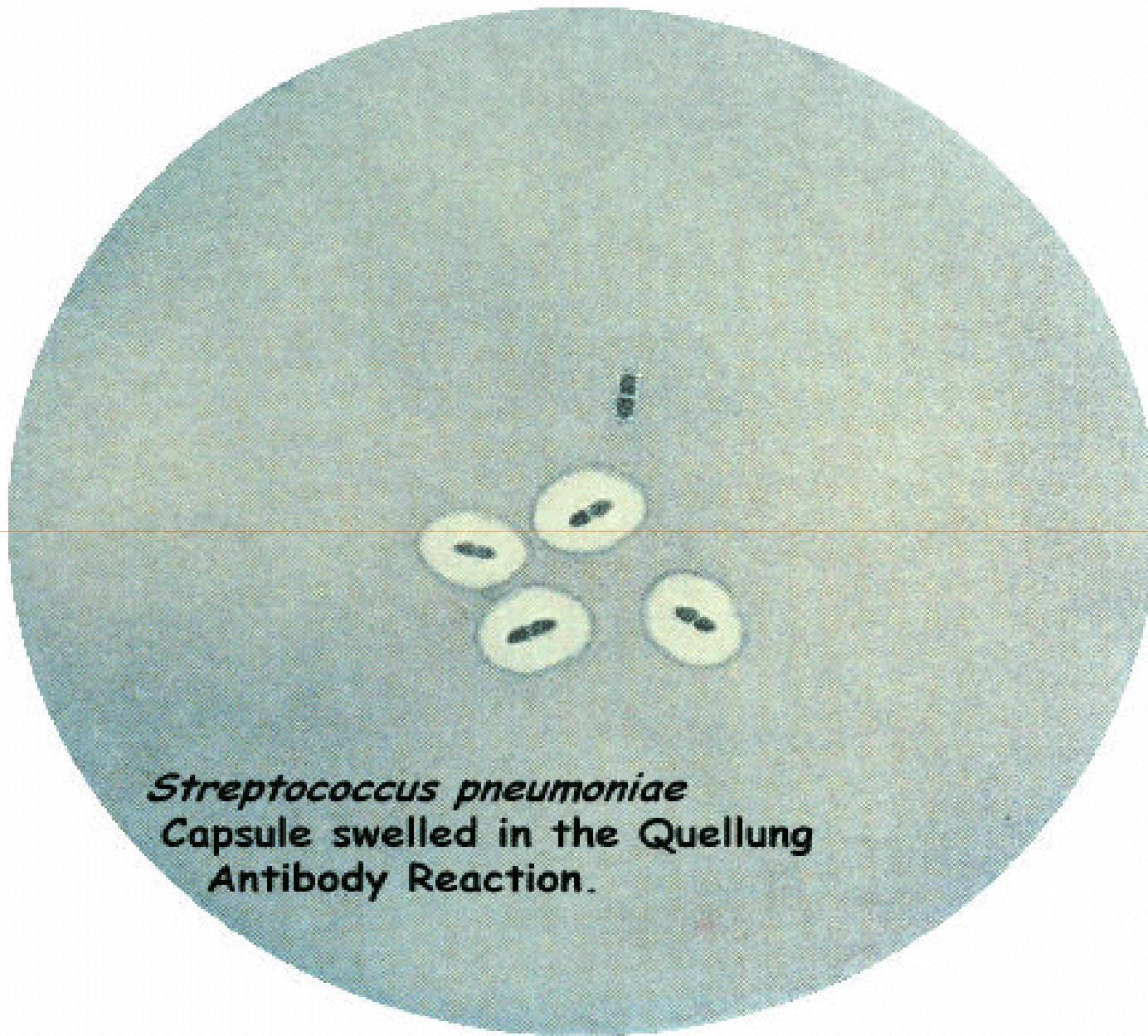


Antigenic properties

- Type specific capsular polysaccharide
- A nucleoprotein
- Somatic C carbohydrate

Capsular polysaccharide

- Polysaccharide in nature, readily diffuses in to the medium, called specific soluble substance.
- Pneumococci typed based on capsule, 90 different serotypes recognized.
- Typing carried out by :
 - 1) agglutination
 - 2) precipitation
 - 3) Quellung reaction



Streptococcus pneumoniae
Capsule swelled in the Quellung
Antibody Reaction.

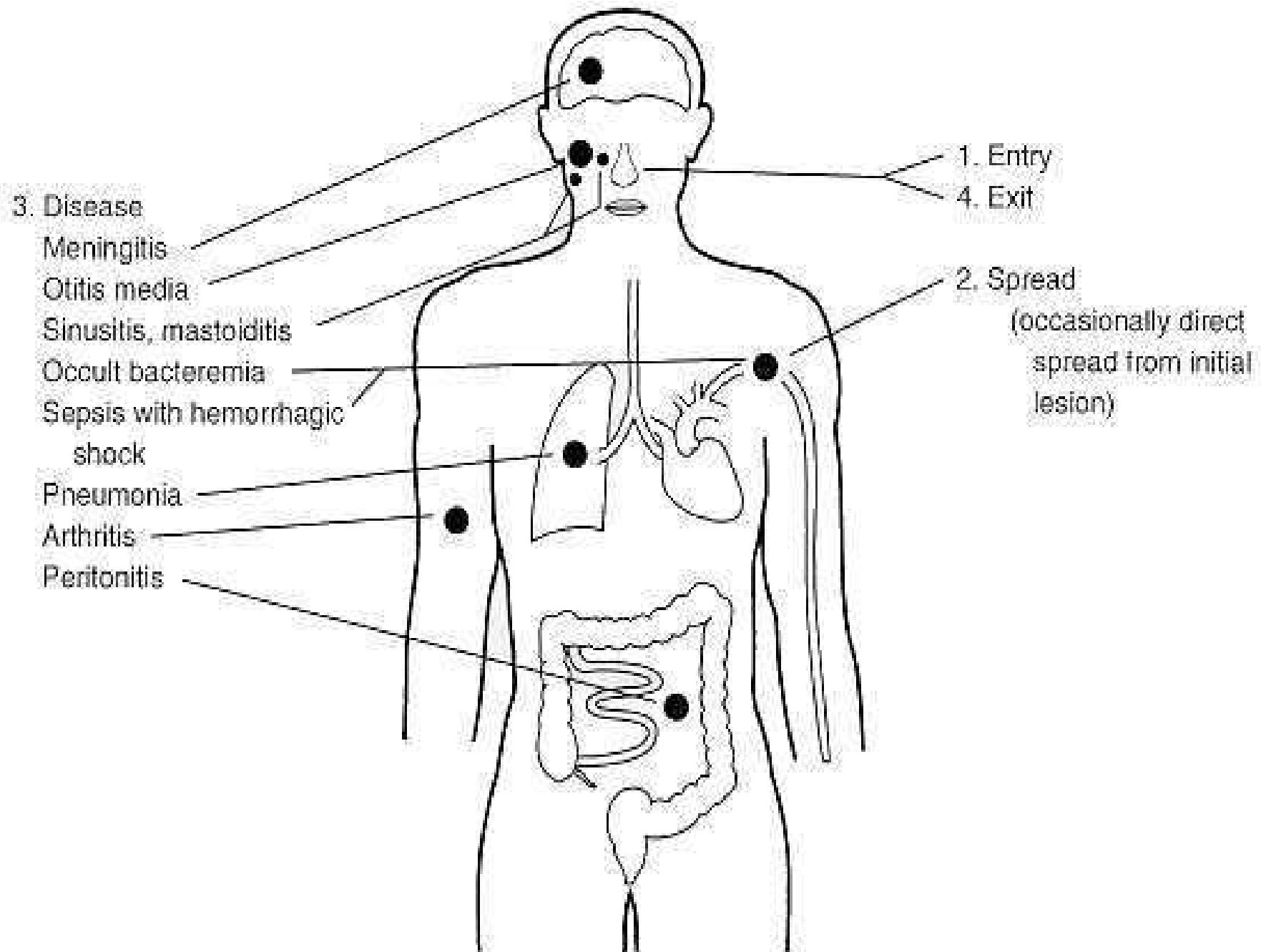
Image Courtesy CDC Public Health Image Library

Toxins and other virulence factors

- An oxygen labile hemolysin
- Leucocidin
- Pneumolysin has cytotoxic and complement activating properties.

Pathogenicity

- Commonly endogenous infection
- Otitis media and sinusitis
- Pneumonia
- Acute tracheobronchitis and empyema
- Meningitis
- Other suppurative lesions-less common



Laboratory diagnosis

- The specimens to be collected depend on the type of the lesion.

- Direct microscopy

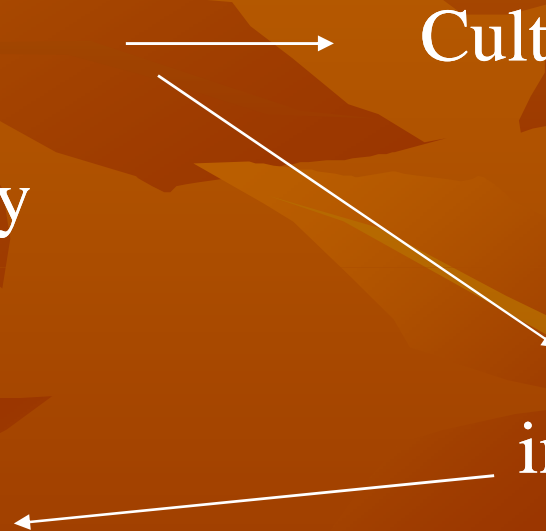
Culture on blood agar

Antibiotic sensitivity

Animal inoculation (mice)

Biochemical test

- Serology (agglutination, precipitation of capsule)



Prophylaxis

- Type specific immunity to capsular polysaccharide.
- A polyvalent vaccine representing the capsular antigens of 23 prevalent antigens give 80-90% protection.