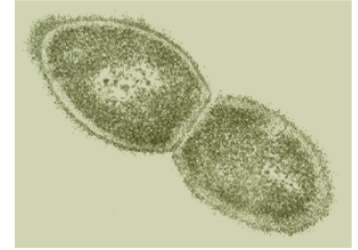


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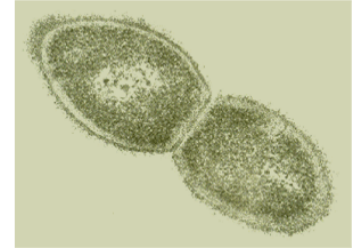
# *Streptococcus pneumoniae*

# Introduction



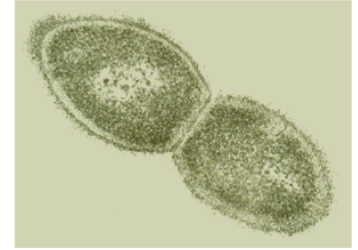
- Formerly classified as *Diplococcus pneumoniae*
- Differs from other streptococci in-
  - Morphology
  - Bile solubility
  - Optochin sensitivity
  - Possession of specific polysaccharide capsule

# Characteristics



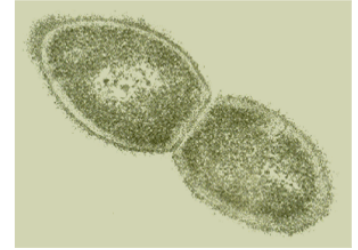
- Gram positive cocci occurring in pairs or short chains
- 1µm, ovoid or lanceolate in shape
- Non-motile & non-sporing
- Freshly isolated strains are capsulated.

# Characteristics



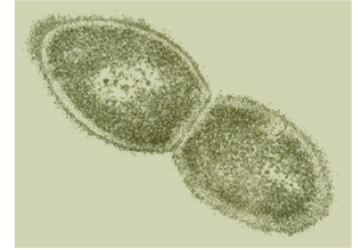
- Aerobic and facultatively anaerobic
- Grows best in atmosphere containing 5-10%  $CO_2$ .
- Grows better on media with 5-10% serum, blood or heated blood, which supplies nutrients, pH buffers and catalase.

# Characteristics



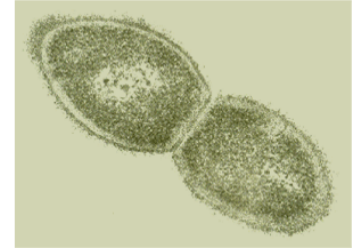
- On prolonged incubation
  - Colonies become flat with central umbonation
  - Draughtsman or carrom coin appearance
- Zone of beta hemolysis under anaerobic conditions

# Characteristics



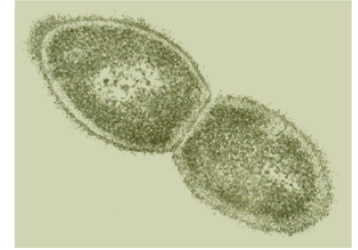
- Autolysis -
  - Due to activity of intracellular enzymes
  - Enhanced by bile salts and other surface active agents
- On repeated subculture S forms change to R forms

# Biochemical...



- Catalase negative, Oxidase negative
- Form acid but not gas from glucose, lactose and sucrose
- Inulin fermented
- Fermentation tested on Hiss's serum slopes.
- Bile soluble

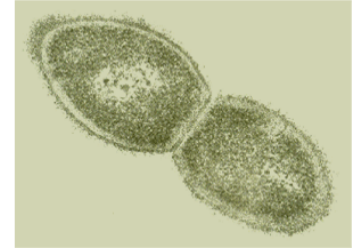
# Characteristics



- Killed by moist heat at 55°C in 10min.
- Highly sensitive to Optochin(.001%)

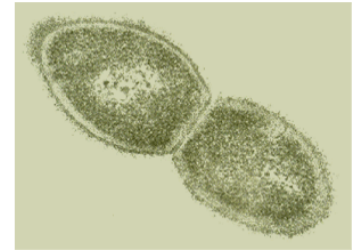


# Antigenic characters



- Type specific capsular polysaccharide
  - 'specific soluble substance'
  - Type of pneumococcus determined by reactions with its types specific antisera, tested first in pools and then singly
  - Immunity based on development of opsonizing antibody to the capsular antigen

# Typing...

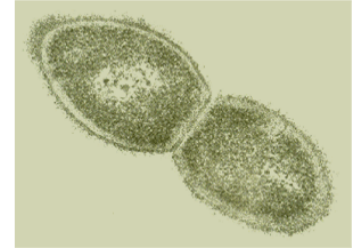


- Agglutination of cocci with type specific antiserum
- Precipitation with type specific antiserum
- Neufeld's capsular swelling reaction

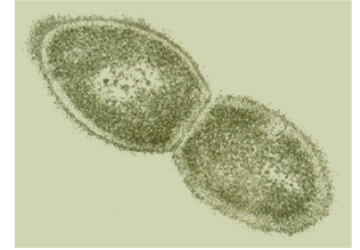


Quellung Reaction

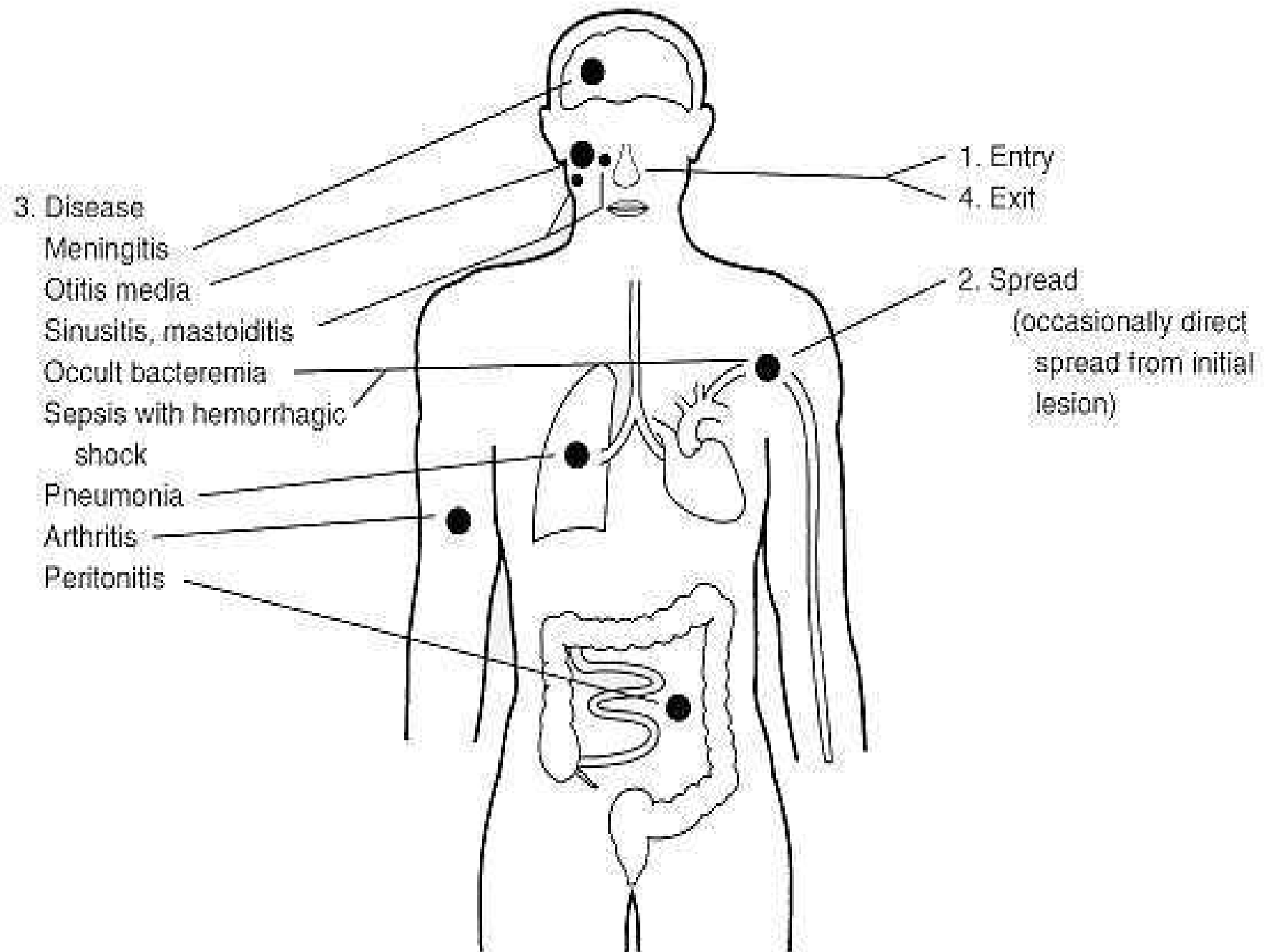
# Virulence factors

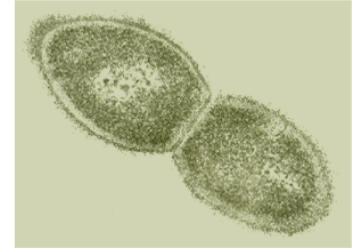


- Capsule
- Pneumolysin
  - Stored intracellular and is released upon lysis of pneumococci by autolysin
  - Stimulates production of inflammatory cytokines, inhibits beating of the epithelial cell cilia, inhibits lymphocyte proliferation, decreases the bactericidal activity of neutrophils, and activates complement



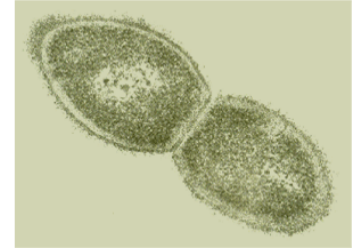
Clinical conditions caused





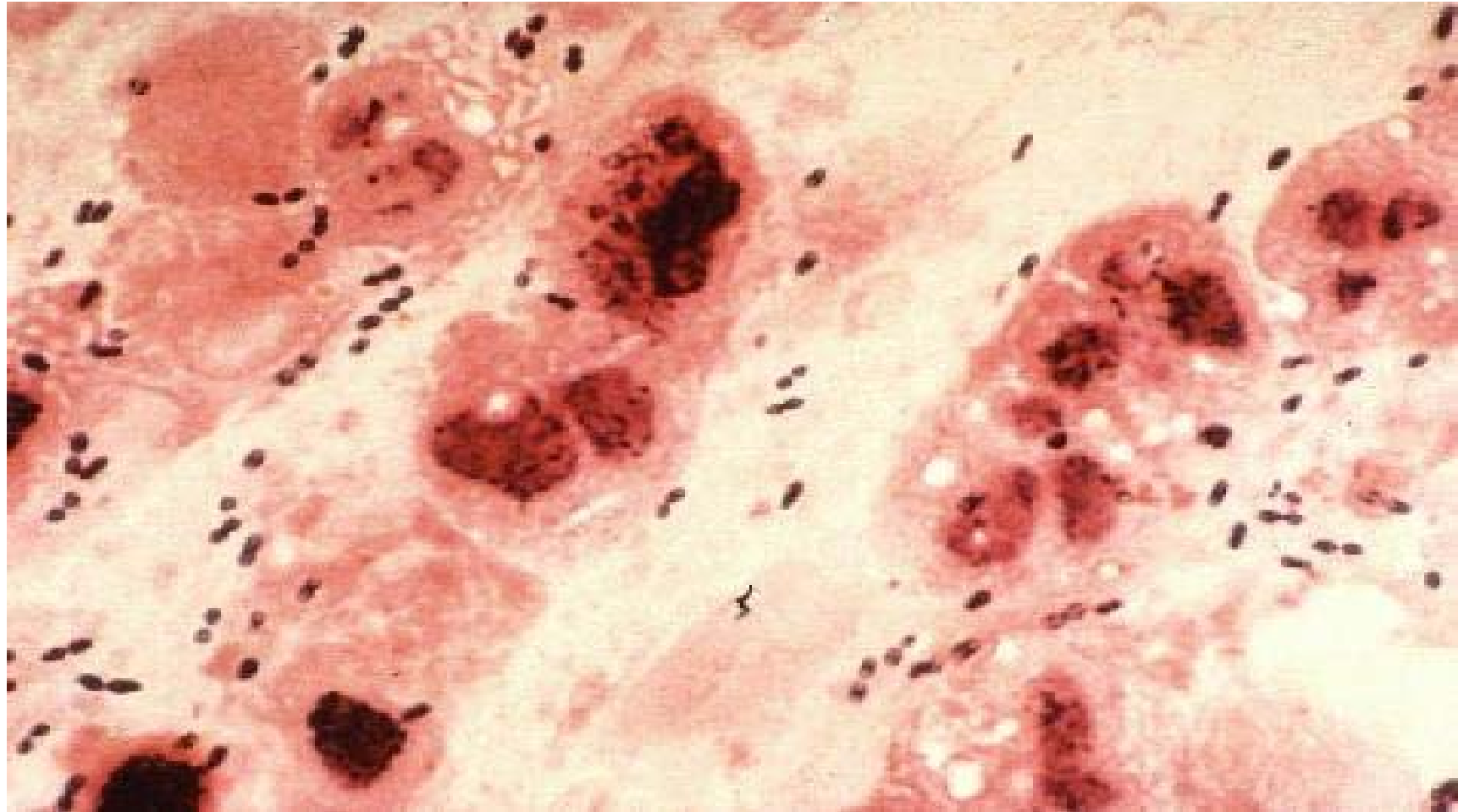
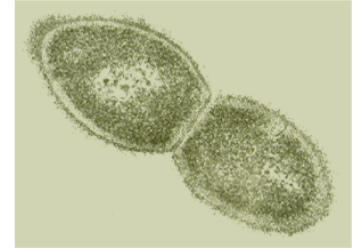
# Laboratory diagnosis

# Specimens



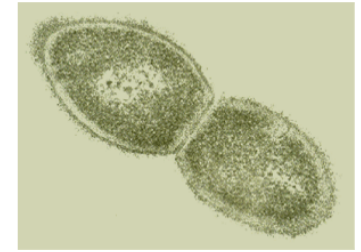
- CSF
- Sputum, lung aspirate, pleural fluid
- Blood
- Peritoneal fluid
- Exudate from joint, ear etc.

# Microscopy

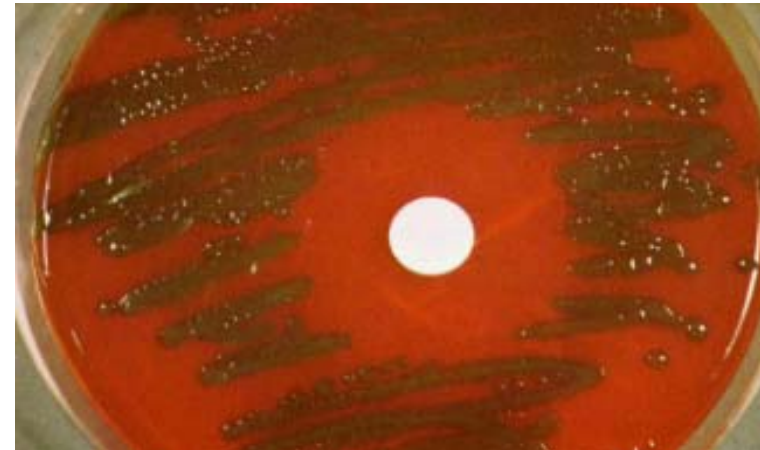




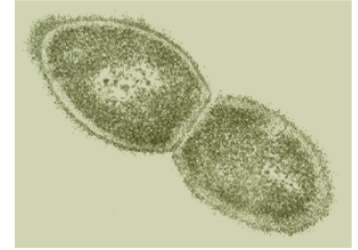
# Culture



- Blood agar, chocolate agar
- Optochin 5ug disc to be used
- 5-10%  $CO_2$
- Bile solubility test

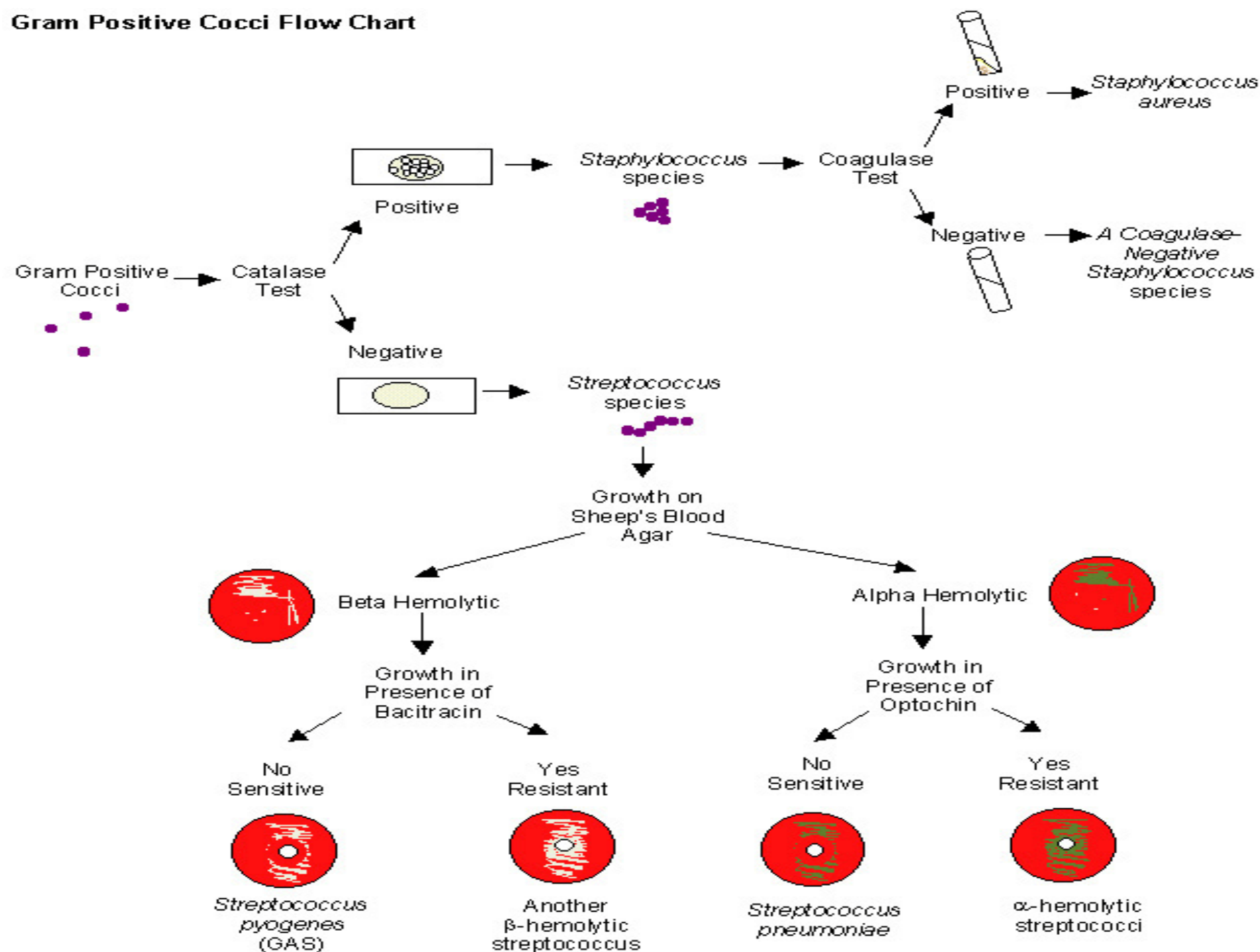


# Bile solubility test



- Touch a suspected colony with a loopful of 2% Sodium deoxycholate solution
- Incubate plate for 30min at 37°C.
- Colonies of pneumococci disappear leaving a zone of alpha hemolysis
- *Animal inoculation*

# Gram Positive Cocci Flow Chart



## GRAM POSITIVE COCCI

Note: *Strep. viridans*  
are alpha hemolytic and  
negative for all the tests  
below

Catalase



*Staphylococcus* (Clusters)



*Streptococcus* (pairs & chains)

Coagulase


Hemolysis



*S. aureus*  
β hemolytic  
mannitol  
yellow





*S. epidermidis*  
nonhemolytic (usually)  
mannitol  
white

(1) BETA: Bacitracin  → *S. pyogenes* (group A)

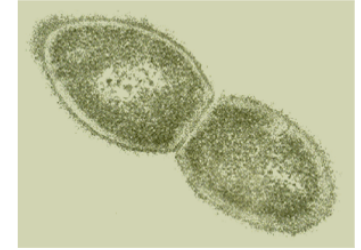
CAMP/Hippurate  → *S. agalactiae* (group B)

(2) ALPHA: Optochin/Bile Solubility  → *S. pneumoniae*

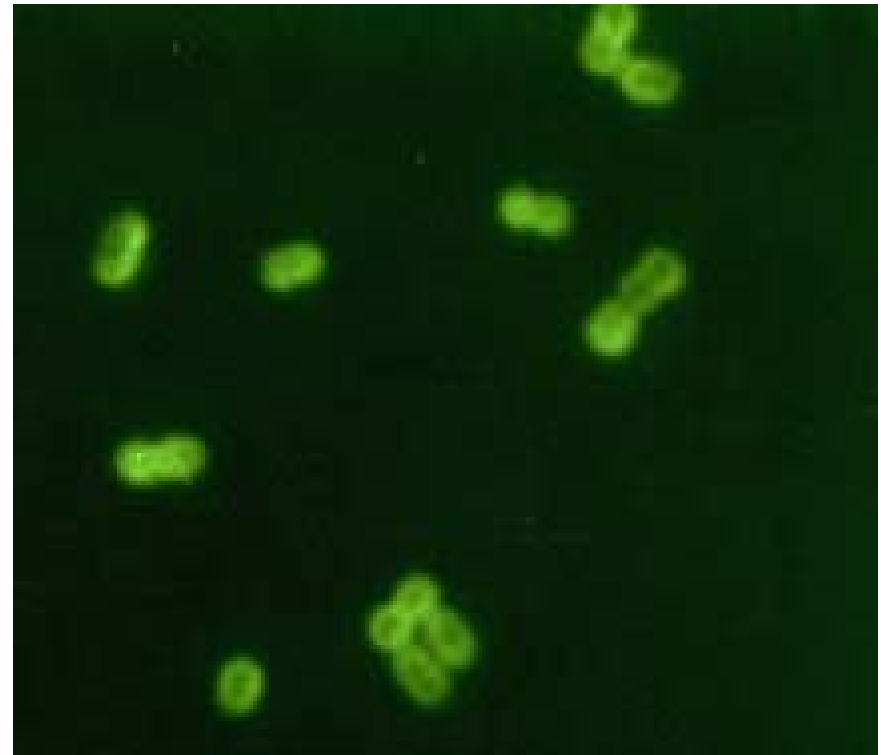
(3) GAMMA: Bile Esculin  6.5% NaCl  → Group D<sup>+</sup>  
*Enterococcus*

Bile Esculin  6.5% NaCl  → Group D<sup>+</sup>  
*Non-Enterococcus*

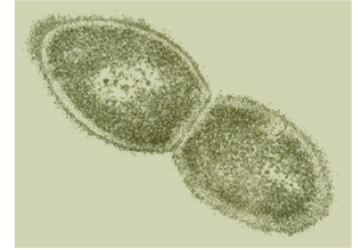
# Immunodiagnosis



- Indirect fluorescent antibody test
- Indirect hemagglutination test
- Radioimmunoassay
- Latex agglutination tests

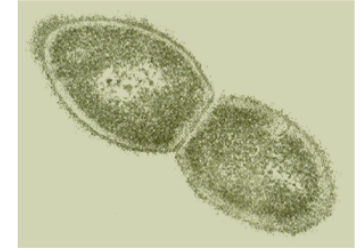


# Treatment

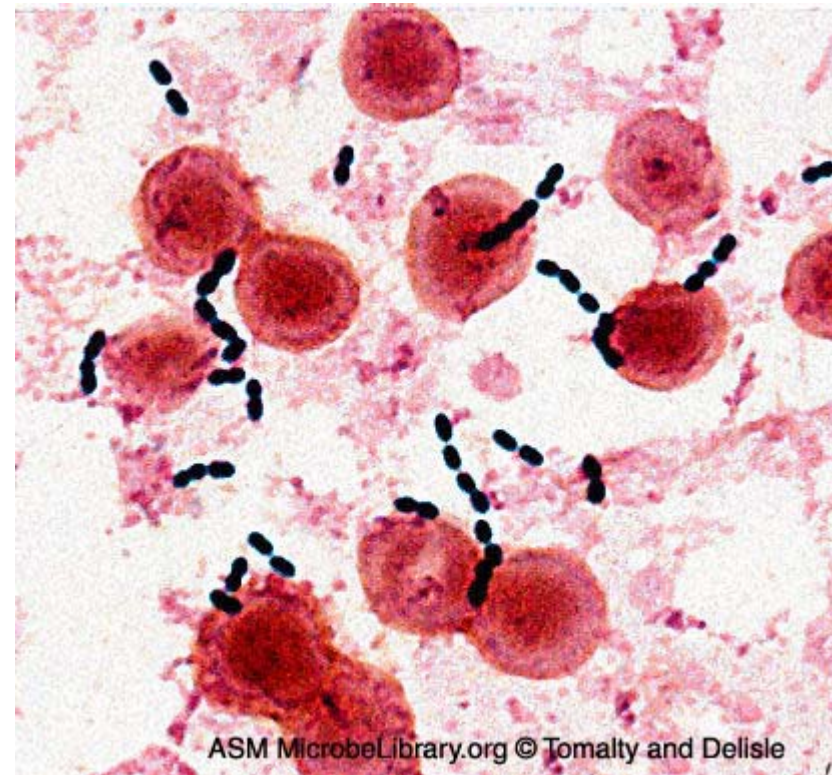


- Penicillin
- Erythromycin
- Tetracycline
- Cephalosporins
- Vancomycin

# *Enterococcus sp.*

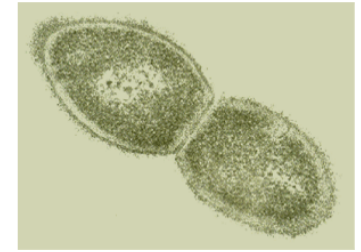


- Formerly classified as fecal streptococci
- GPC pairs and short chains
- Possess group D antigen
- May cause urinary and biliary tract infections, wound infections etc.





# Features



- Grows on MacConkey agar
- 6.5%NaCl agar
- Survives heating at 60°C for 30 min.
- Ferments mannitol
- Ferments aesculin in 4%bile
- VP positive
- PYRase positive

