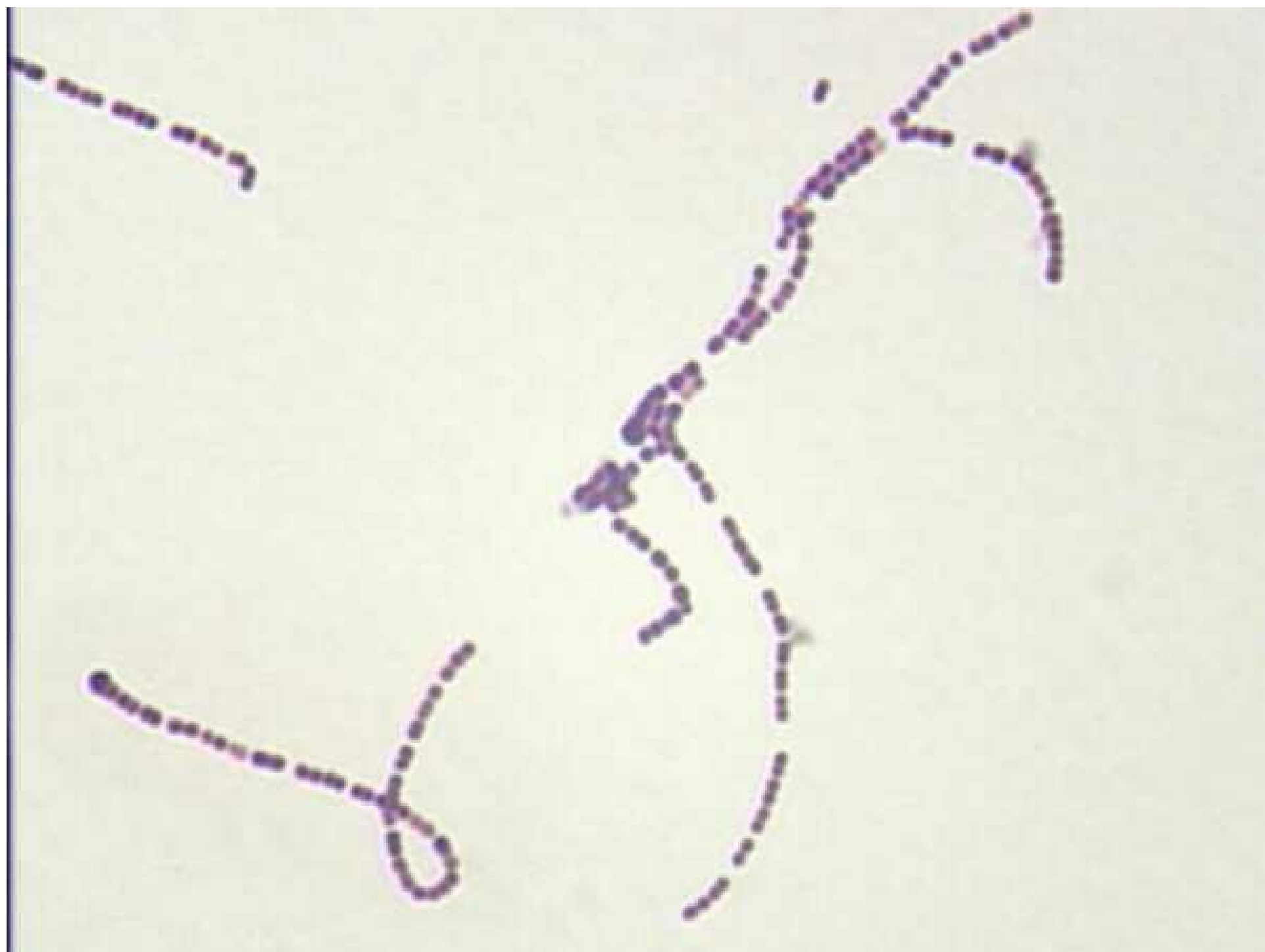


Streptococcus

- They are Gram positive cocci arranged in chains or pairs.
- Streptococcus species are mostly commensal residents of the mouth and throat, and a few particularly *S.pyogenes* are primary pathogens.
- Streptococci and related species are catalase negative helping them to distinguish from staphylococci.





Staphylococci

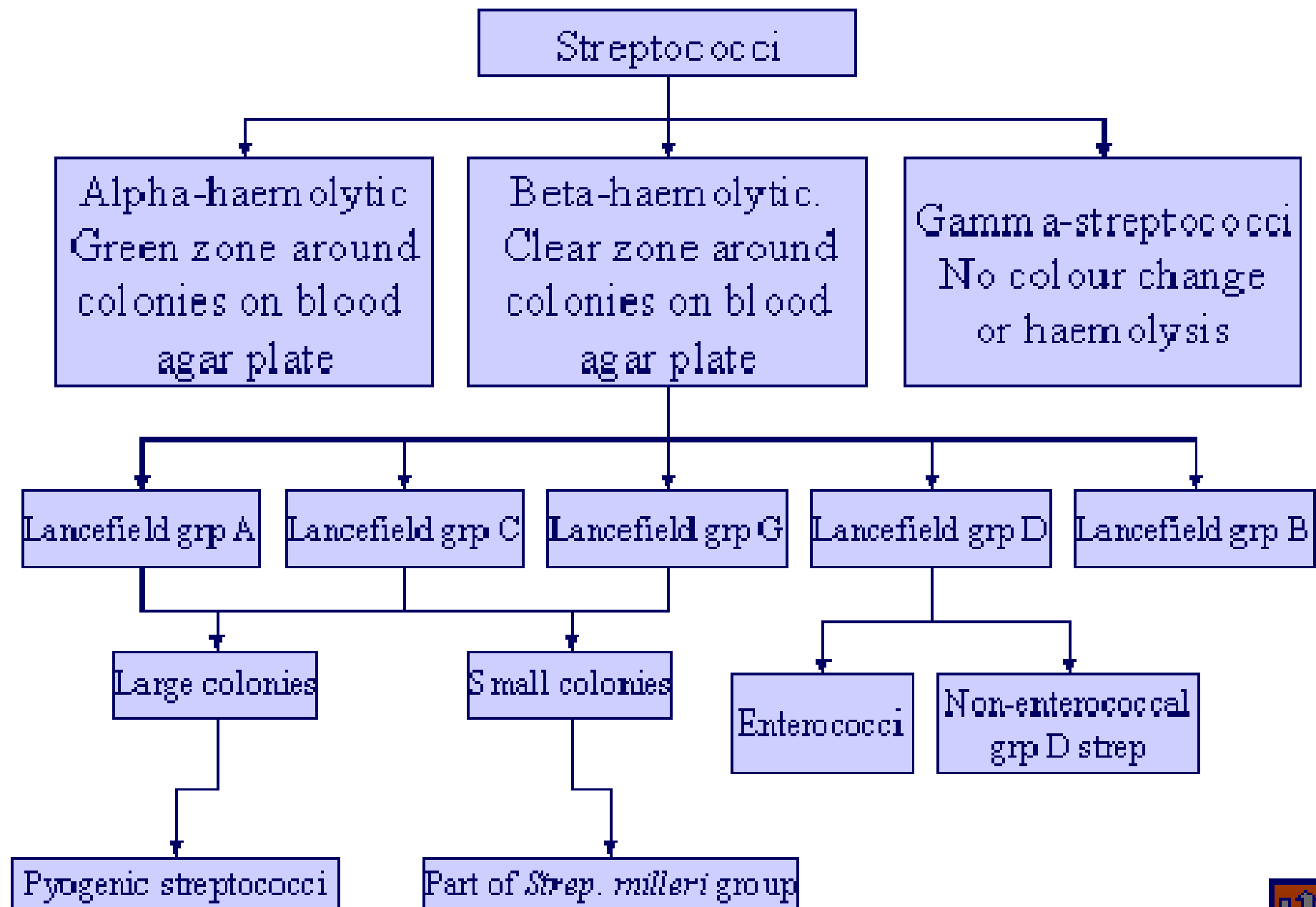
This is a composite of four microscopic images showing Staphylococci bacteria. The bacteria are small, dark, spherical (cocci) and are arranged in various clusters of different sizes, from small groups of two or three to large, dense, irregular masses. The background is a light pinkish-purple color.

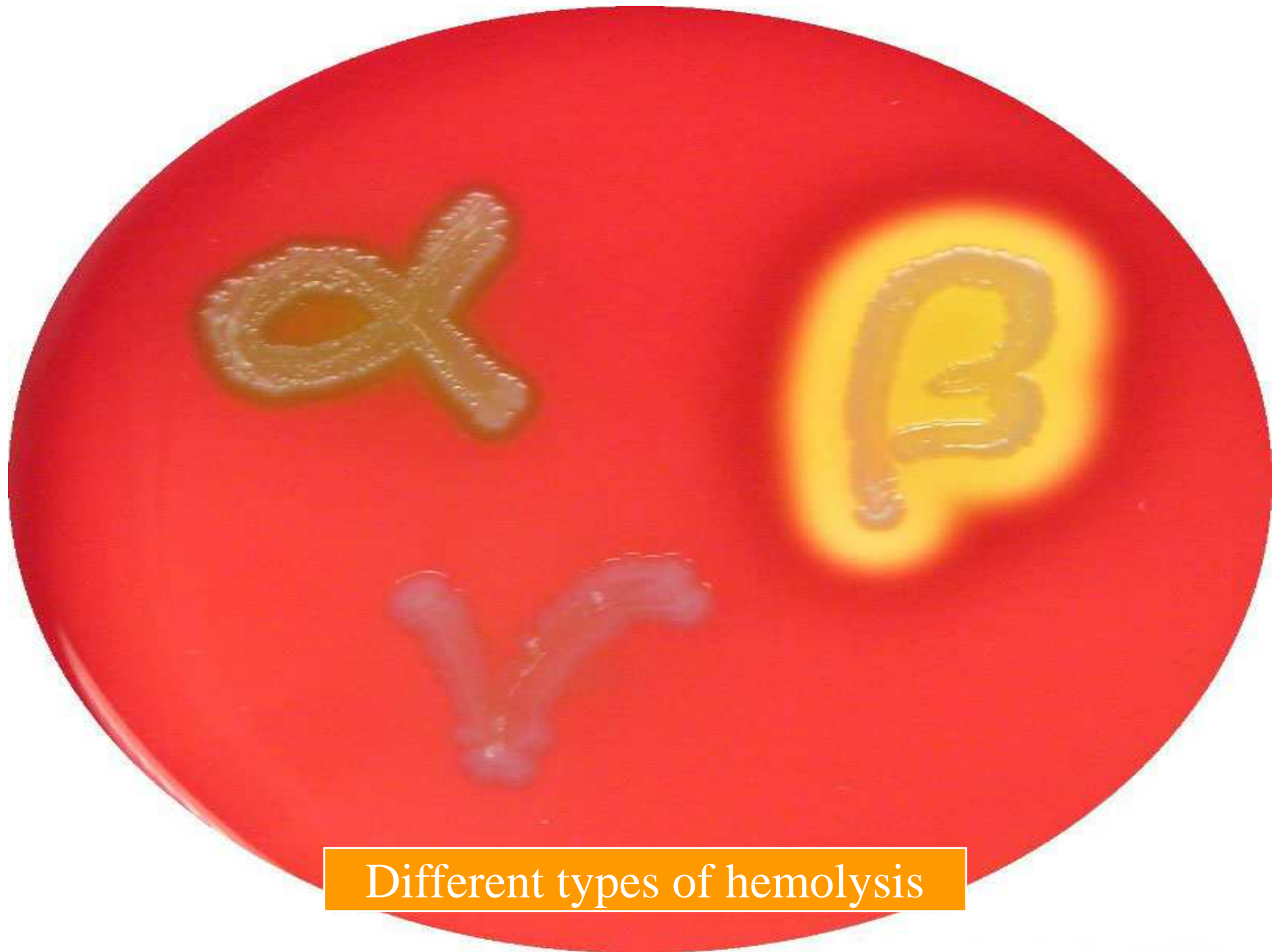
Streptococci

This is a composite of four microscopic images showing Streptococci bacteria. The bacteria are small, dark, spherical (cocci) and are arranged in chains of varying lengths. Some chains are short and curved, while others are long and more linear. The background is a light pinkish-purple color.

History

- Billroth(1874) : First to observe cocci in chain in wound infection who called them streptococci (streptos, meaning twisted or coiled).
- Ogston(1881) : isolated them from acute abscesses and distinguish them from staphylococci.
- Rosenbach(1884) : isolate from human infections and gave them the name *Streptococcus pyogenes*.





Different types of hemolysis

Streptococcus pyogenes

Morphology

- Size : 0.5-1.0 micrometer in diameter
- Shape : spherical or oval
- Arrangement : in chains, the length of which varies within wide limits, being longer in the liquid medium. Chain formation is due to the cocci dividing in one plane only.
- Non motile and non sporing
- Group A and C have capsules composed of hyaluronic acid while group B and D have polysaccharide capsules.

Cultural characteristics

- Facultative anaerobe
- Optimum temp. for growth is 37°C (range 22-42°C).
- Exacting in nutritive requirements, grows only in presence of glucose or serum.
- On blood agar, after incubation for 24hrs, the colonies are small (0.5 to 1.0mm), circular, semitransparent, low convex discs with an area of clear hemolysis around them.



Cultural characteristics cont.

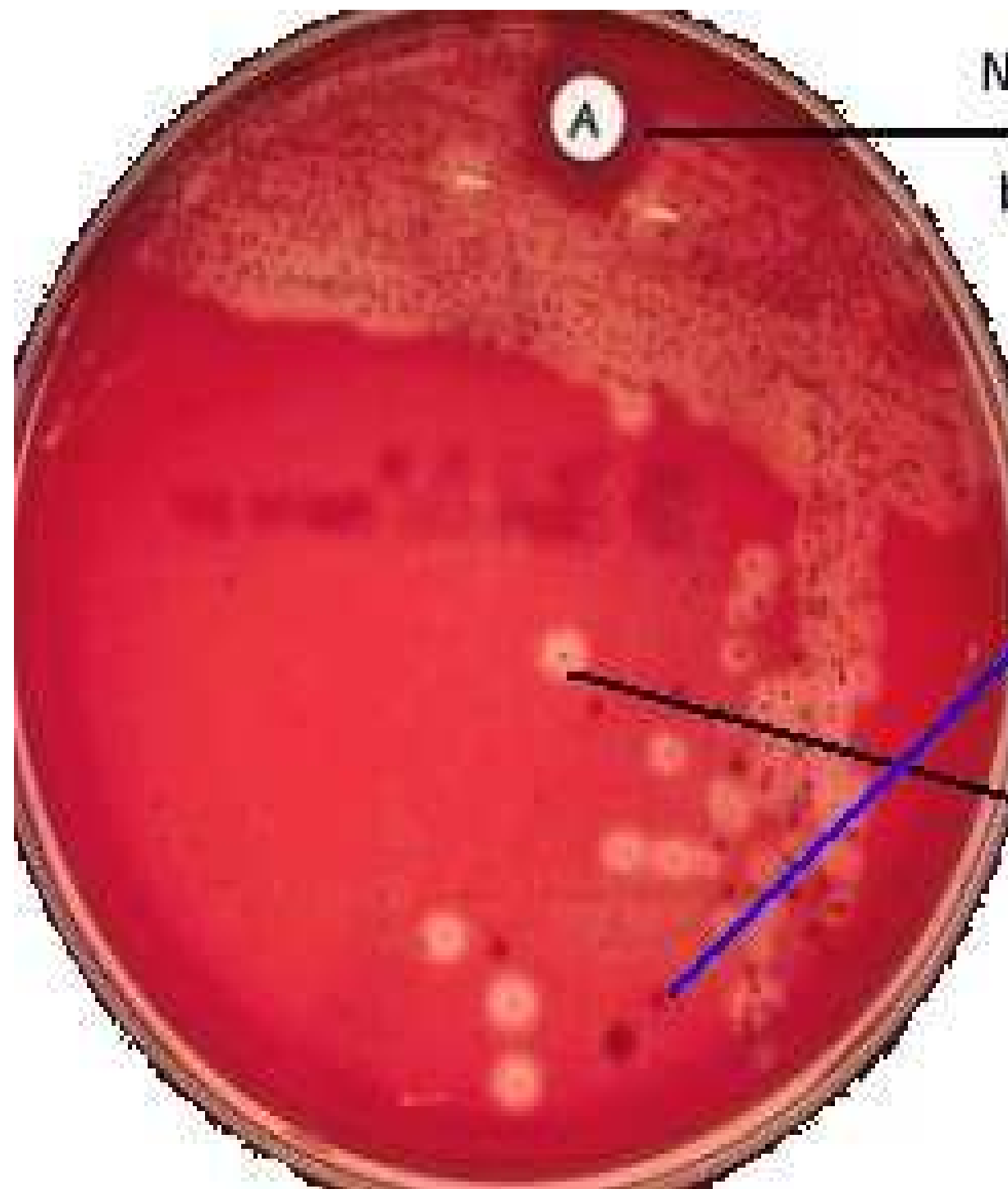
- Growth and hemolysis are promoted by 10% CO₂.
- In liquid media, growth occurs as a granular turbidity with powdery deposit.
- Colony types :
 - 1) **Matt type** : fresh isolate of virulent strain (finely granular)
 - 2) **Glossy type**: a virulent strains
 - 3) **Mucoid type**: capsular strain

Biochemical reactions

- Catalase negative and insoluble in bile like other streptococci
- Ferments variety of sugars in sugar serum peptone waters.
- *S.pyogenes* is positive in PYRase test, which distinguishes it from non-group A hemolytic streptococci.

Resistance

- Delicate organism, easily destroyed by heat (54° C for 30 minutes).
- Crystal violet (1mg/L), nalidixic acid (15mg/L) and colistin sulphate (10mg/L) added to blood agar provide a good selective medium.
- Sensitive to most antibiotics
- Sensitive to Bacitracin unlike other streptococci.



Notice the zone of growth inhibition around the bacitracin (Taxo A disc).

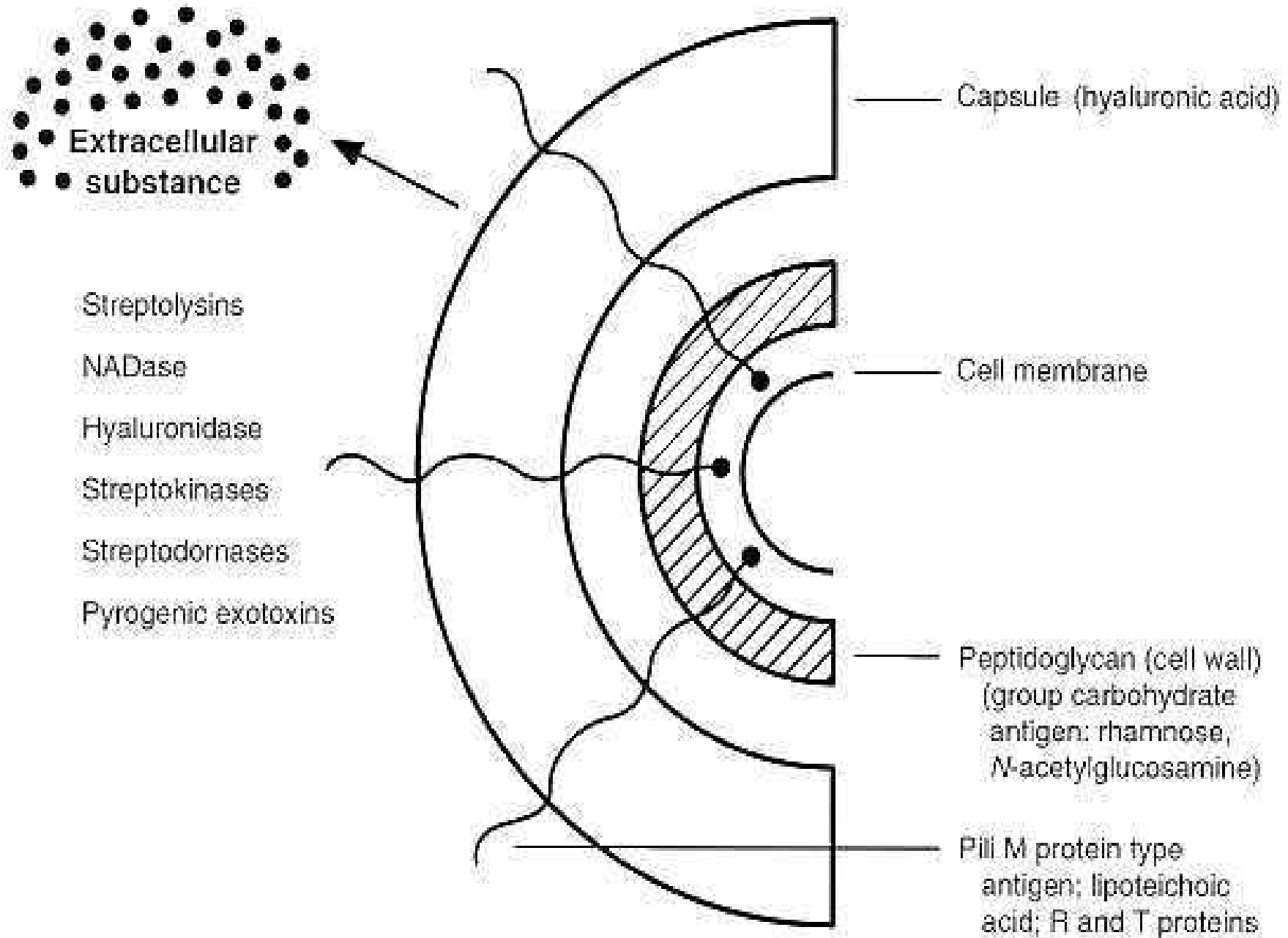
A throat culture taken from a 5 year-old with Streptococcal pharyngitis.

Notice the non-hemolytic bacterial colonies

Notice the clear zone of hemolysis around the *Streptococcus pyogenes* grown on a blood agar plate.

Antigenic structure

- Outer capsule and pili
- Cell wall composed of outer layer of protein and lipoteichoic acid, a middle layer of group specific carbohydrate and an inner layer of Peptidoglycan.
- Serological grouping depends on C carbohydrate.
- Done by Ring precipitation test
- *S.pyogenes* have been typed based on surface proteins M, T and R.



Antigenic cross reactions

No.	Part of S.pyogenes	Part of Human cells
1	Capsular hyaluronic acid	Synovial fluid
2	Cell wall protein	myocardium
3	Group A carbohydrate	Cardiac valves
4	Cytoplasmic membrane	Vascular intima
5	peptidoglycans	Skin antigens

Toxins and other virulence factors

1) Hemolysins- two types `O` and `S`

ASO titre is the standard serological procedure for retrospective diagnosis of Streptococcal infection.

Titre >200 is considered positive.

2) Pyrogenic Exotoxin (Erythrogenic, Dick, scarlatinal toxin) : produce scarlet fever -(a type of acute pharyngitis with erythematous rash)

Streptococcal pyrogenic exotoxin (SPE) are three types –A,B and C

They are super antigens.

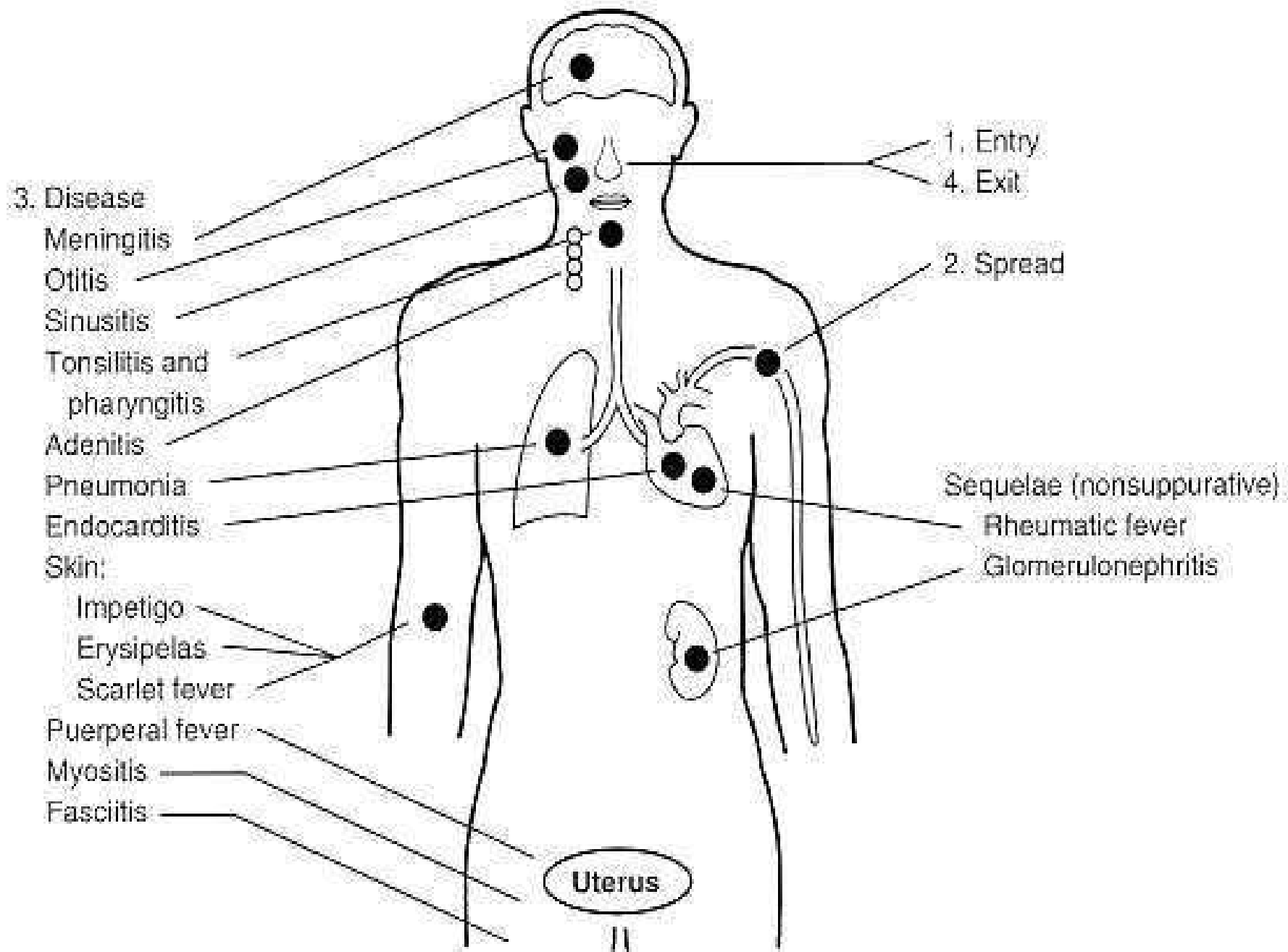
Toxins and other virulence factors

Cont..

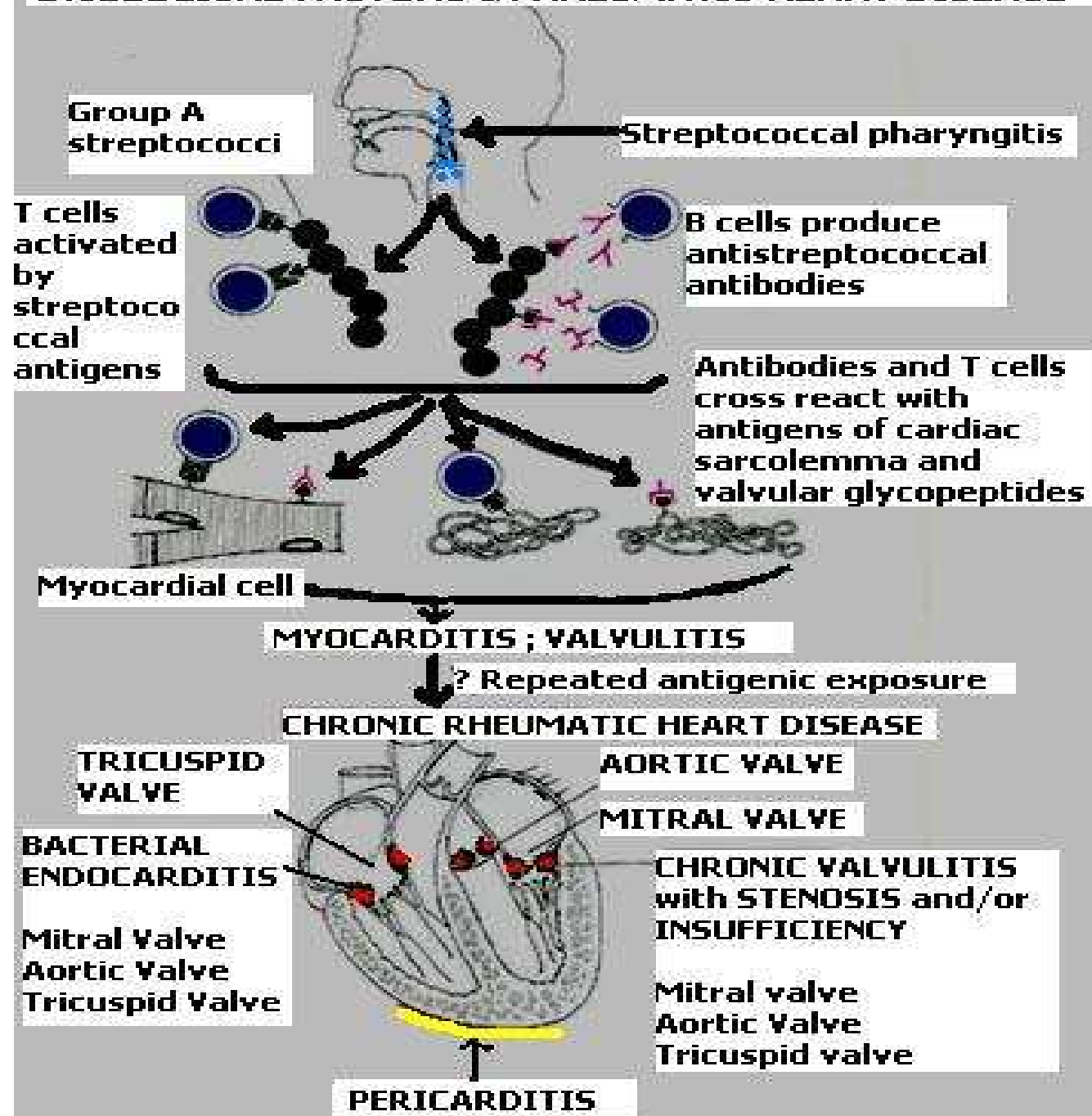
- 3) Streptokinase (fibrinolysin)
- 4) Deoxyribonucleases (DNAase) A,B,C,D
- 5) Nicotinamide adenine dinucleotidase
(NADase)
- 6) Hyaluronidase
- 7) Serum opacity factor

Pathogenicity

- Suppurative infections
 - Respiratory infections
 - Skin and soft tissue infections- erysipelas and impetigo
 - Genital infections
- Non suppurative complications
 - Acute rheumatic fever
 - Acute glomerulonephritis

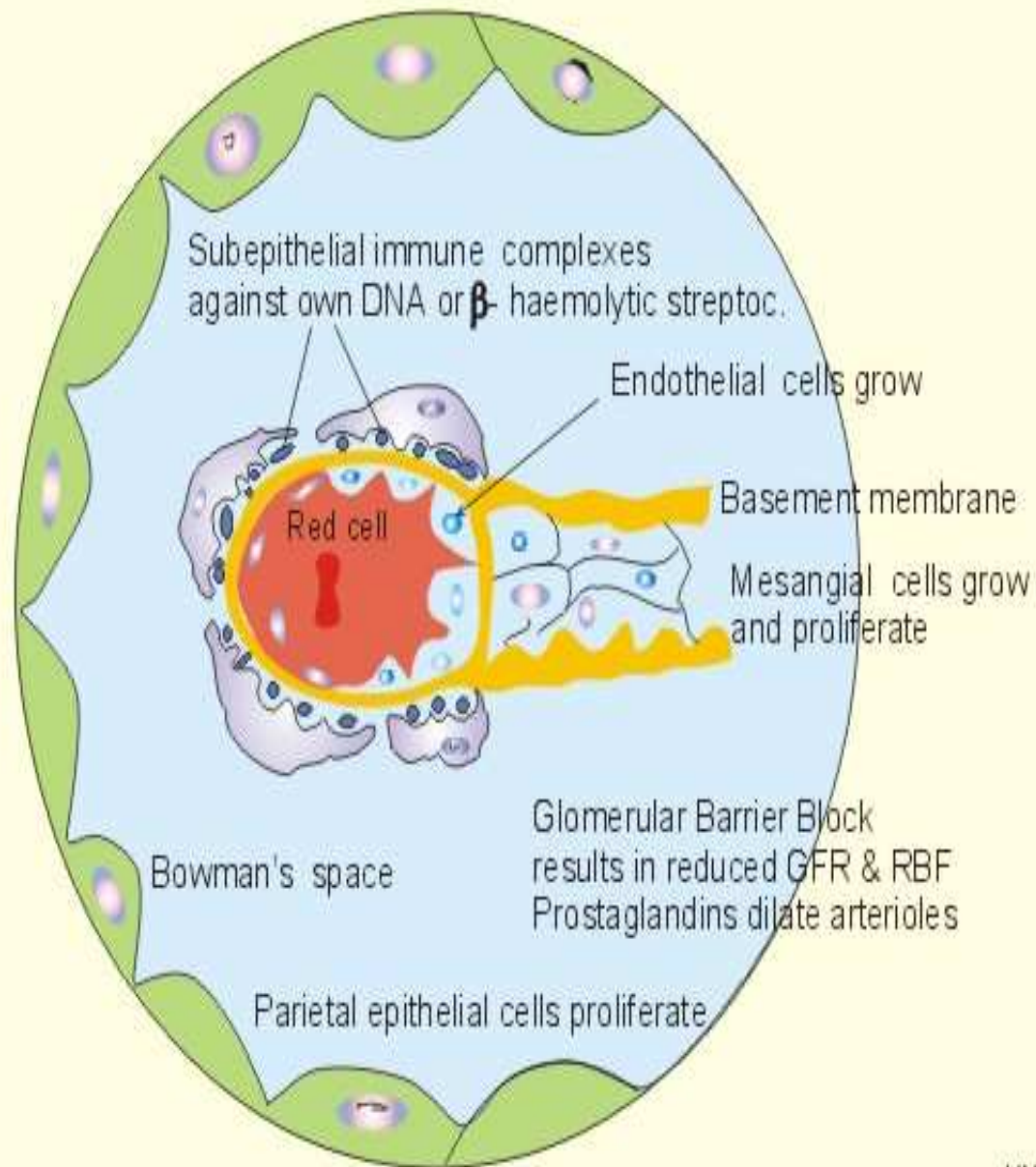


ETIOLOGICAL FACTORS IN RHEUMATIC HEART DISEASE



Antigenic
cross
reaction
between
streptococci
and
cardiac tissues

Post- Streptococcal Glomerulo-nephritis



Immune
Complex
Mediated
damage

Fig. 25-19

Laboratory diagnosis

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

- Direct microscopy → Culture on blood agar

Antibiotic sensitivity

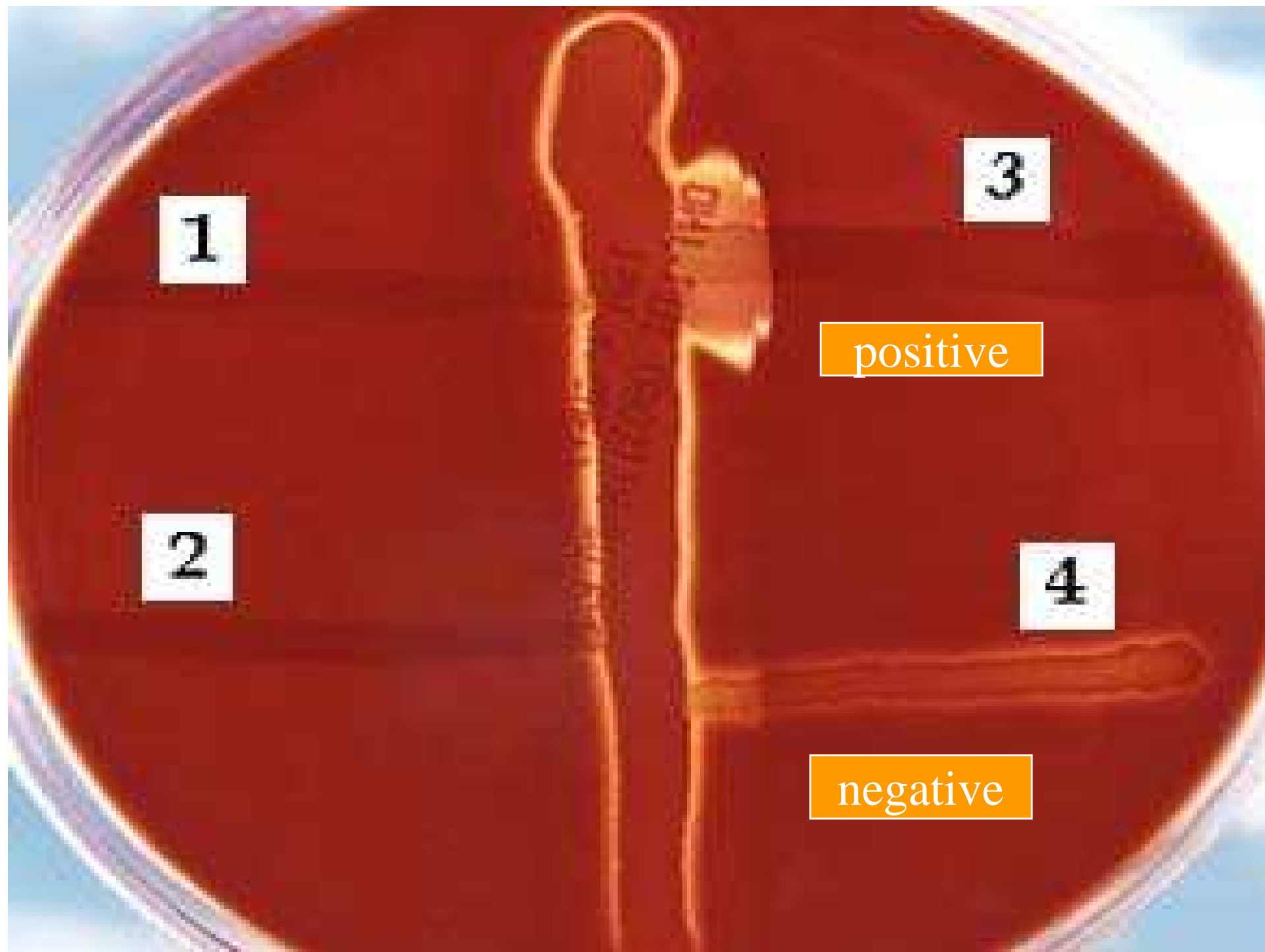
Biochemical
test

Use selective
media

- Serology (ASO titer, Anti DNAase B)

Group B streptococci

- Common cause of Neonatal meningitis
- **Early onset type** : within a week of birth presented with septicemia, meningitis or pneumonia and is often fatal. Infection is acquired from the maternal vagina.
- **Late onset type** : between 2nd and 12th week of life
- Identified by hippurate hydrolysis and CAMP reaction.



Group D Streptococci

- Two groups :
 - 1) Enterococcus group *E. faecalis*, *E. faecium*
 - 2) Nonenterococcal group *S. bovis*, *S. equinus*

Gram stain of *Enterococcus faecalis*



Enterococci in pair and short chain

Characteristics of Enterococci

- Ability to grow in the presence of 40% bile
- 6.5% NaCl
- At pH 9.6 and at 45° C
- On mac Conkey`s medium, they produce tiny deep pink colonies.
- They appear as pairs of oval cocci, the pair arranged at an angle to each other
- Non hemolytic

The viridans group

- Normal resident in the mouth and the upper respiratory tract and typically produce greenish (alpha hemolysis) discoloration on blood agar.
- Str.mitis, Str.mutans, Str.sanguis
- Causative agent for subacute bacterial endocarditis, most often Str.sanguis
- Dental caries by Str.mutans

Identification of Facultative Gram Positive Cocci

Streptococcus sp. / Enterococcus sp.

