Neisseria and Moraxella

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Infectious Diseases and Clinical Microbiology

Neisseriaceae

- *Neisseria*
- *Acinetobacter*
- *Eikenella*
- *Kingella*
- *Moraxella (Branhamella)*

Neisseriaceae

- N.gonorrhoeae (1879) shown by Neisser, from urethral secret
- N.meningitidis (1887-Weichselbaum)) isolated from CSF
- M.catarrhalis (1896-Pfeiffer) isolated from bronch alveoli

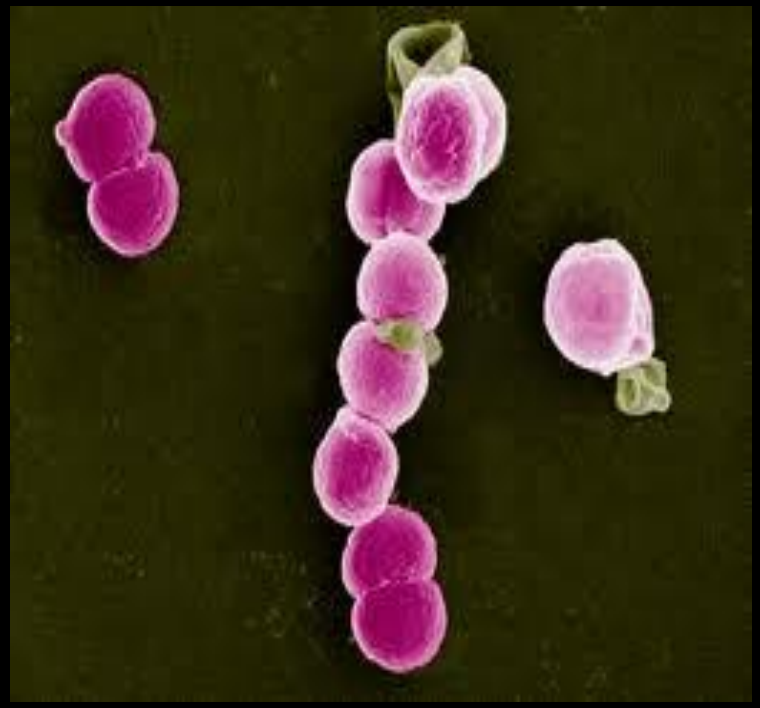
Neisseria

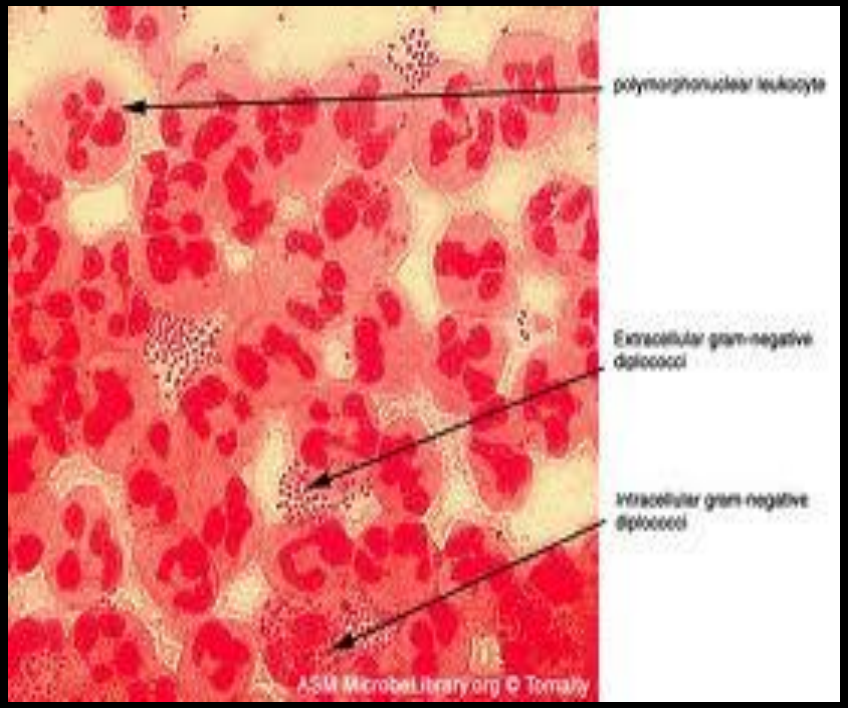
- Contains 11 species
- *N.gonorrhoeae, N.meningitidis,* →PATHOGENIC
- Others → MEMBERS OF THE NORMAL FLORA
- (N. Lactamica, sicca, subflava, mucosa, flavescens, canis, cinerea, denitrificans, elongata)

Neisseria

- Gram negative diplococci (coffee beans shaped)
- Non motile
- Do not form spores
- Catalase positive, oxidase positive, indol negative
- The species are distinguished by carbonhydrate utilization tests (glucose, maltose, lactose, saccarose)
- Optimal grows heat 37 degree
- N.meningitidis, N.gonorrhoeae can not grow under 30 degree

Neisseria




polymorphonuclear leukocyte
Extracellular gram-negative diplococci
Intracellular gram-negative diplococci
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Neisseria

Neisseria gonorrhoeae

- Causative agent of gonorrhea
- Fastidious, requires complex media to grow
- Very susceptible to drying(1-2 hrs) and fatty acids
- Requires 5-10 % carbondioxide (capnophilic)
- Growth takes 24-48 hrs (up to 72 hrs)
- Colony morphology is variable
- Utilize glucose
- Putative capsule

Neisseria gonorrhoeae

- Antigenic structure and virulence factors

- Pili:
  - Directly associated with virulence
  - Attachment to host cells (initial binding)
  - Interfere with neutrophil killing
  - Numerous antigenic types exist
  - Antigenic variation is common

Neisseria gonorrhoeae

- Outer membrane proteins:

Por proteins (PI):
Inhibit phagolysosome fusion in PMN'S

Opa proteins (P II)
Firm attachment of gonococci to host cells
Adherence to each other within colonies

Rmp proteins (P III)
Generally find in all gonococci
Protects other surface antigens from bactericidal antibodies
(stimulates antibodies that block serum bactericidal activity)

Neisseria gonorrhoeae

- Antigenic structure and virulence factors
- Lipooligosaccharide (LOS):
  - Possesses endotoxin activity
- Iron binding proteins (Fbp):
  - Bind iron required for bactericidal metabolism
- IgA1 protease:
  - Destroys secretory IgA

Neisseria gonorrhoeae

- Epidemiolgy of gonorrhea
- Occurs only in humans
- Transmitted most commonly by sexual contact (direct contact)
- Major reservoir is the asymptomatically infected person
- Acute infection is more commonly diagnosed in men; asymtptomatic infection is more common in women

Neisseria gonorrhoeae

- Pathogenesis
- Acute pyogenic infection of columnar and transitional epithelial cells (urethra, endocervix, anal canal, pharynx and conjunctiva)
- Attach to mucosal cell surfaces
- Penetrate into the epithelial cells and multiply
- Pass through the cells and reach to the subepithelial space
- Intense inflammatory respone is triggered by LOS

Neisseria gonorrhoeae

GENITAL INFECTIONS

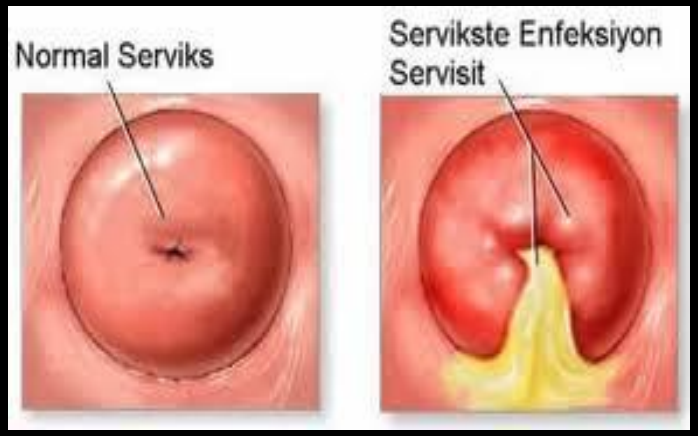
In males⇒

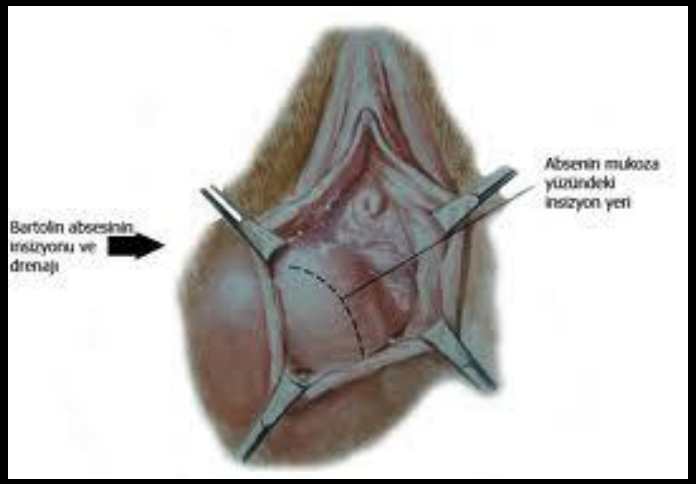
- *Acute urethritis: Purulent discharge & dysuria
- Asymptomatic infections (3%-5% of cases)
- Prostatitis, epididymitis (Complications of urethritis)

Neisseria gonorrhoeae

GENITAL INFECTIONS

- In females⇒
- *Cervicitis: Vaginal discharge, dysuria & abdominal pain
- Asymptomatic infections (50 % of cases)
- Salpingitis, tubo-ovarian abscess, pelvic inflammatory disease (PID) (Complications)





Neisseria gonorrhoeae

DISSEMINATED INFECTIONS

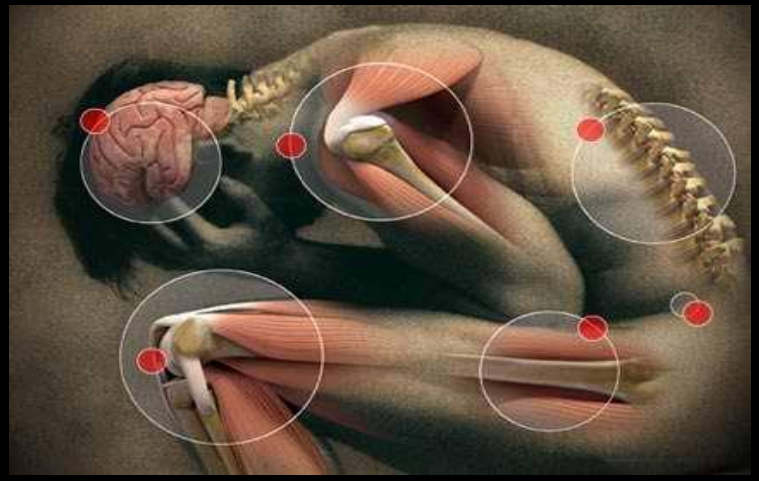
In females (1%-3%) & in males (↓↓)

Septicemia, endocarditis, menengitis, arthritis,infection of the skin

OTHER DISEASES

- Purulent conjunctivitis In newborns (ophtalmia neonatorum)
- Anorectal gonorrhea in homosexual men (proctitis)
- Oro-Pharyngitis
- Perihepatitis (Fitz-Hugh-Curtis syndrome)

Neisseria gonorrhoeae



Neisseria gonorrhoeae

Laboratory Diagnosis:

Specimens:Urethral discharge, genital secretions, blood, joint fluid

Microscopic examination: Gram Stain (and methylene blue)

Culture:Chocolate agar

Blood agar

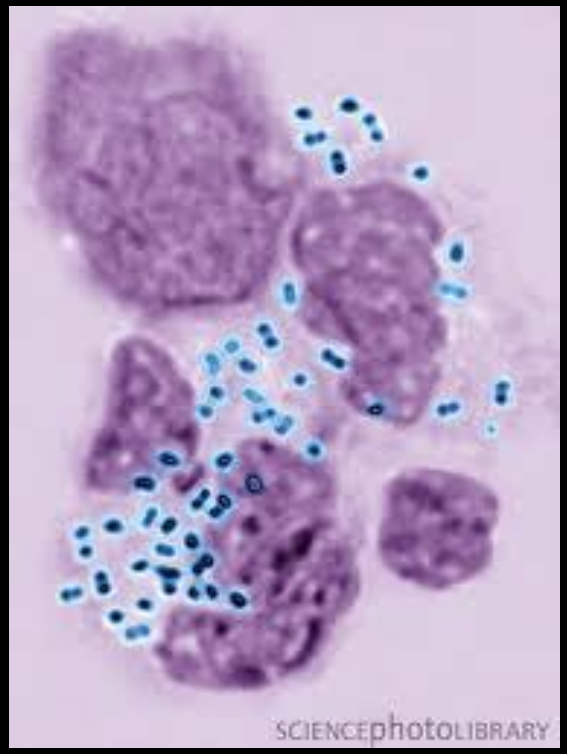
Thayer-Martin medium (selective)

5-10% CO_2 atmosphere, 48hrs. incubation

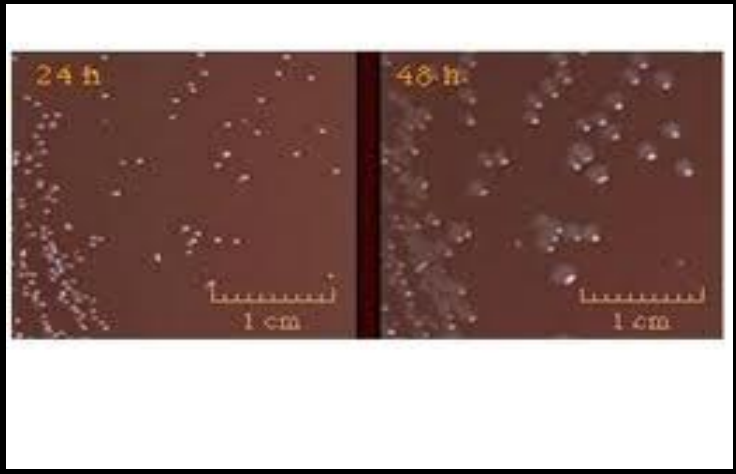
Identification: Colony morphology, oxidase test, carbohydrate utilization*, immunologic methods (FAT)

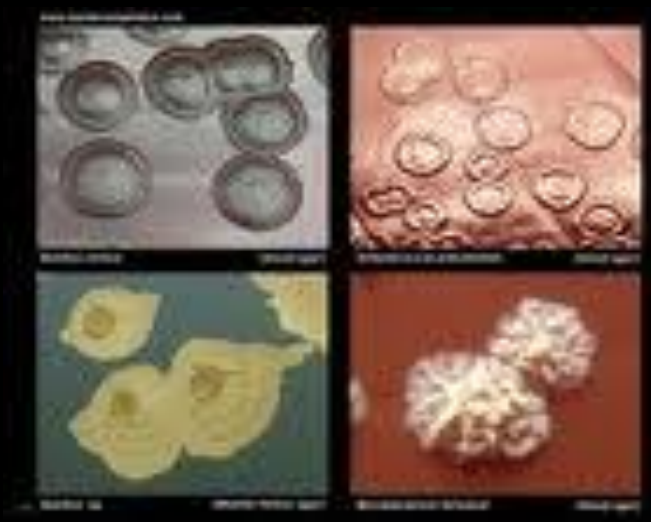
Molecular methods: PCR

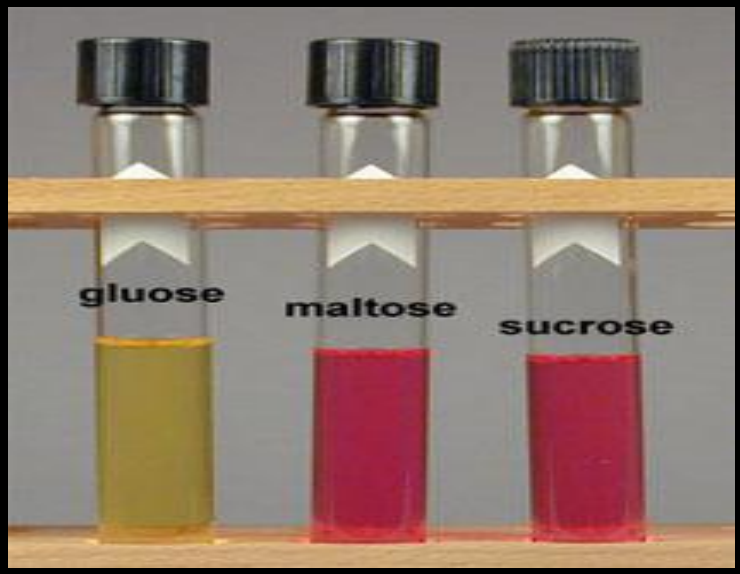
Neisseria gonorrhoeae



Neisseria gonorrhoeae







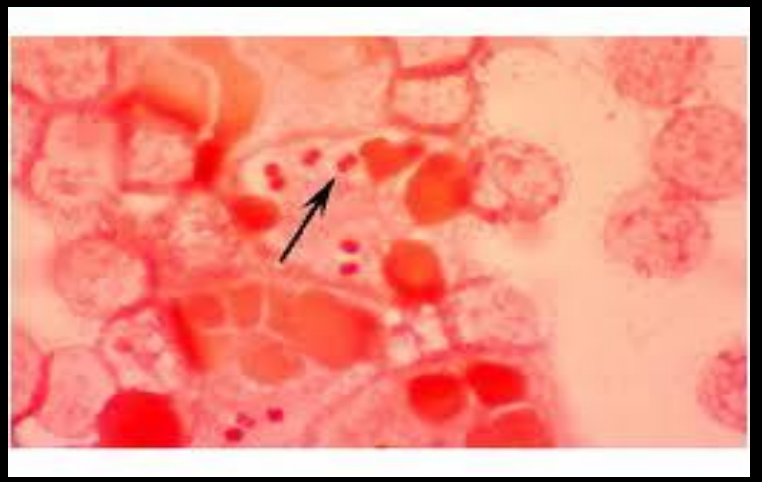
Neisseria gonorrhoeae

- Treatment:
- Antibiotic resistance↑ (beta lactamese+)
  - Ceftriaxone
  - Floroquinolones

Neisseria meningitidis

- Asymptomatic carriage
- Severe infections (meningitis & meningococcemia)
- Encapsulated (polysaccharide capsule), gram negative diplococci
- Fastidious
- Capnophilic (24-48 hrs)
- Colonies are transparent, non pigmented.
- Oxidase positive
- Utilize glucose and maltose

Neisseria meningitidis



Neisseria meningitidis

- Antigenic determinants:
- Capsular polysaccharide: Thirteen serogroups (A, B, C, D, 29E, H, I, K, L, X, Y, Z and W135)
  - A, B, C, Y, W 135 serogroup is important
- Outer membrane proteins: >20 serotypes
  - 2 and 5 serotypes most epidemic agent
- Lipooligosaccharide: 12 serotypes

Neisseria meningitidis

Virulence factors:

- Pili $\rightarrow$ adherence factor nasopharyngeal colonization
- IgA_1 ptotease $\rightarrow$Invasion
- Polysaccharide capsule (inhibits intracelluler killing) $\rightarrow$systemic spread
- Lipooligosaccharide $\rightarrow$expression of toxic effects

Neisseria meningitidis

- Epidemiology:
- Humans are the only natural host
- The primary source is oral secretions or respiratory droplets from asymptomatic carriers (close and prolonged contacts in closed populations)
- Carriage rate $\rightarrow$3%-30%
  - Highest for school aged children and young adults
  - Higher in lower socio-economic populations
  - It can be seen in every period of the year

Neisseria meningitidis

- Epidemiology:
- Endemic meningococcal disease occurs worldwide, most common in children younger than 5 years of age

- Epidemics are common in developing countries, most often occur in young adults

Neisseria meningitidis

- Pathogenesis:

- Exposure to meningococci
- Nasopharyngeal colonization

  Asymptomatic carriage $\rightarrow$Systemic infection
  - Specific bactericidal antibodies
  - Complement activity
- Infants< 2 yrs. of age
- Individuals with C5-C8 deficiencies are at increased risk

Neisseria meningitidis

- Pathogenesis:

- Subepithelial space $\rightarrow$blood stream
- Resistance to intraphagocytic killing
- Continous hyperproduction of LOS

Neisseria meningitidis

- Meningitis:
  - Abrupt onset of headache, fever, vomiting and meningeal signs
  - Mortality is very high in untreated cases
  - The incidence of neurologic sequela is low

Neisseria meningitidis

- Meningococcemia
  - May occur with or without meningitis
  - Mortality rate is 25%
  - Charactherized by: Thrombosis of small blood vessels (petechial skin lesions) and multiorgan involvement
  - May progress to ⇒Waterhause-Friderichsen syndrome
    - Bilateral destruction of the adrenal glands
    - Sepsis ⇒ DIC
    - Death may occur in 12 to 48 hours from onset

Neisseria meningitidis

Neisseria meningitidis

Laboratory diagnosis:

Specimens: Blood, CSF, punctured material from petechiae, nasopharyngeal culture for carrier state

Direct microscopic examination: Gram stained (methylene blue) smears from CSF, punctūred material

Antigen detection: In CSF

Culture:
Blood $\rightarrow$Blood culture media
CSF, skin material $\rightarrow$Blood agar, chocolate agar
Nasopharyngeal cultures $\rightarrow$Modified Thayer-Martin medium

Neisseria meningitidis

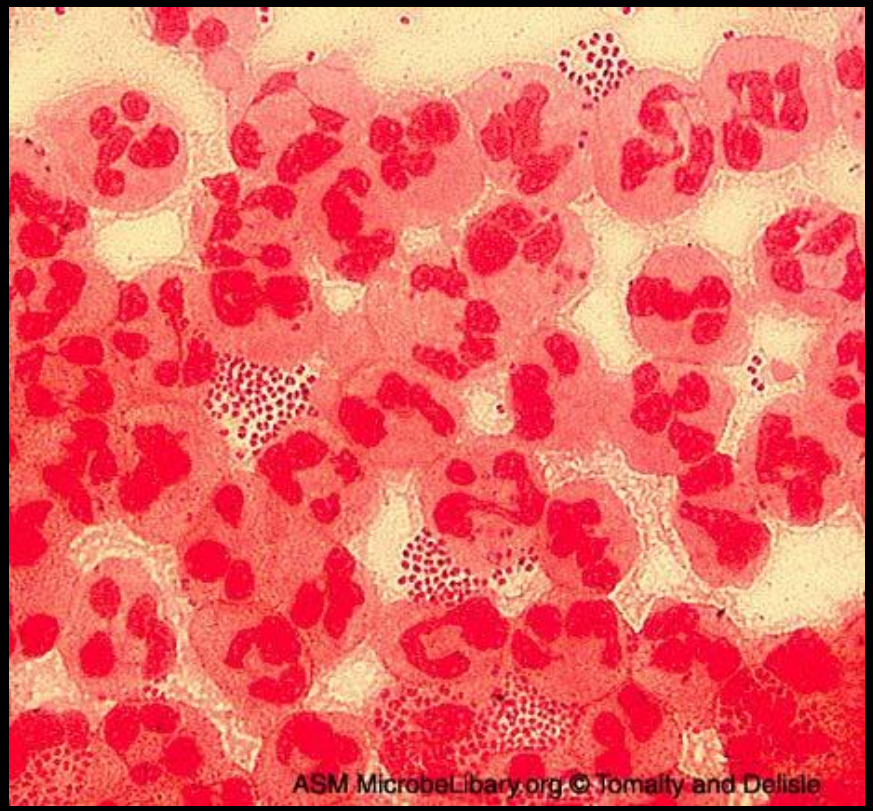
Laboratory diagnosis:

Identification:

Colony morphology, oxidase test +, CHO utilization, agglutination with type specific or polyvalent antiserum

Neisseria meningitidis

Neisseria meningitidis



Neisseria meningitidis

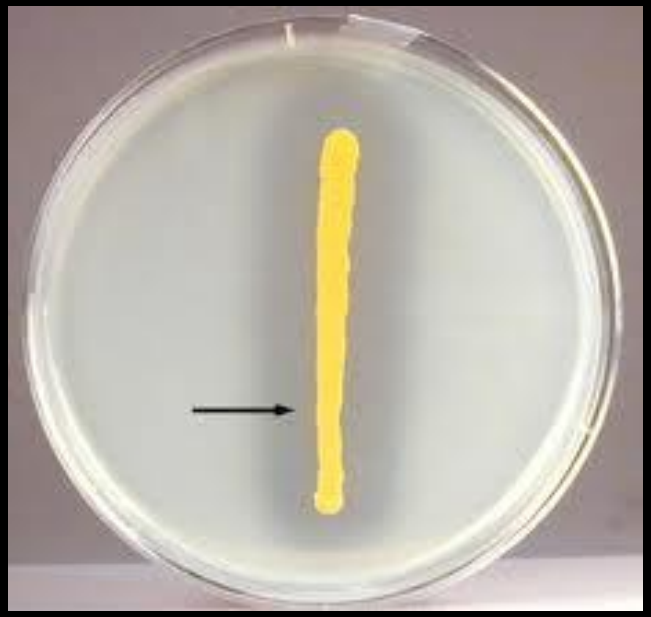
- Treatment and prevention:
- Penicillins, ceftriaxone, ampicillin, chloramphenicol,
- Vaccines directed against group specific capsular polysaccharide (A, C, Y, W135)

Moraxella catarrhalis

- Gram negative diplococcus
- Grows both on blood and chocolate agar media
- The colonies are smooth, opaque, gray to white
- Oxidase and catalase positive
- Asaccharolytic
- Produces DNase
- Most clinical isolates are beta lactamase positive

Moraxella catarrhalis

Moraxella catarrhalis



Moraxella catarrhalis

- Found in the upper respiratory tracts of
  - 40-50% of healthy school children
  - 1.5%-5% of healthy adults
- In children:
  - Otitis media
  - Sinusitis
  - Conjunctivitis
  - Bronchitis
  - Pneumonia
- In immunocompromised host
  - Opportunistic infections

Don’t forget !