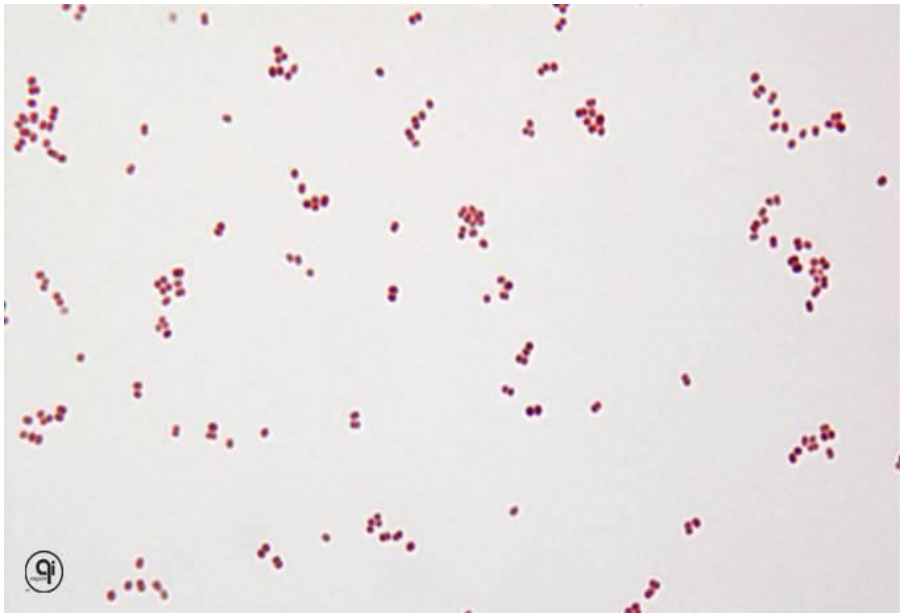
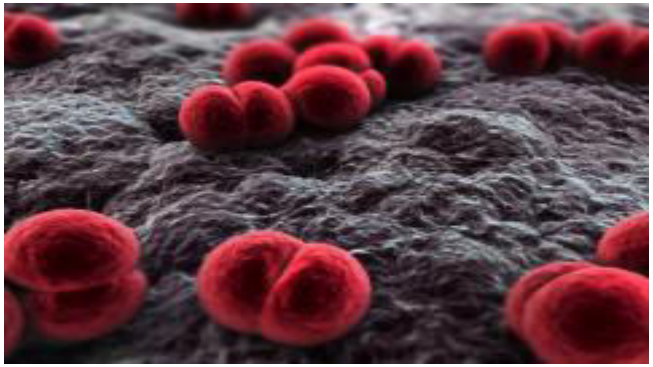
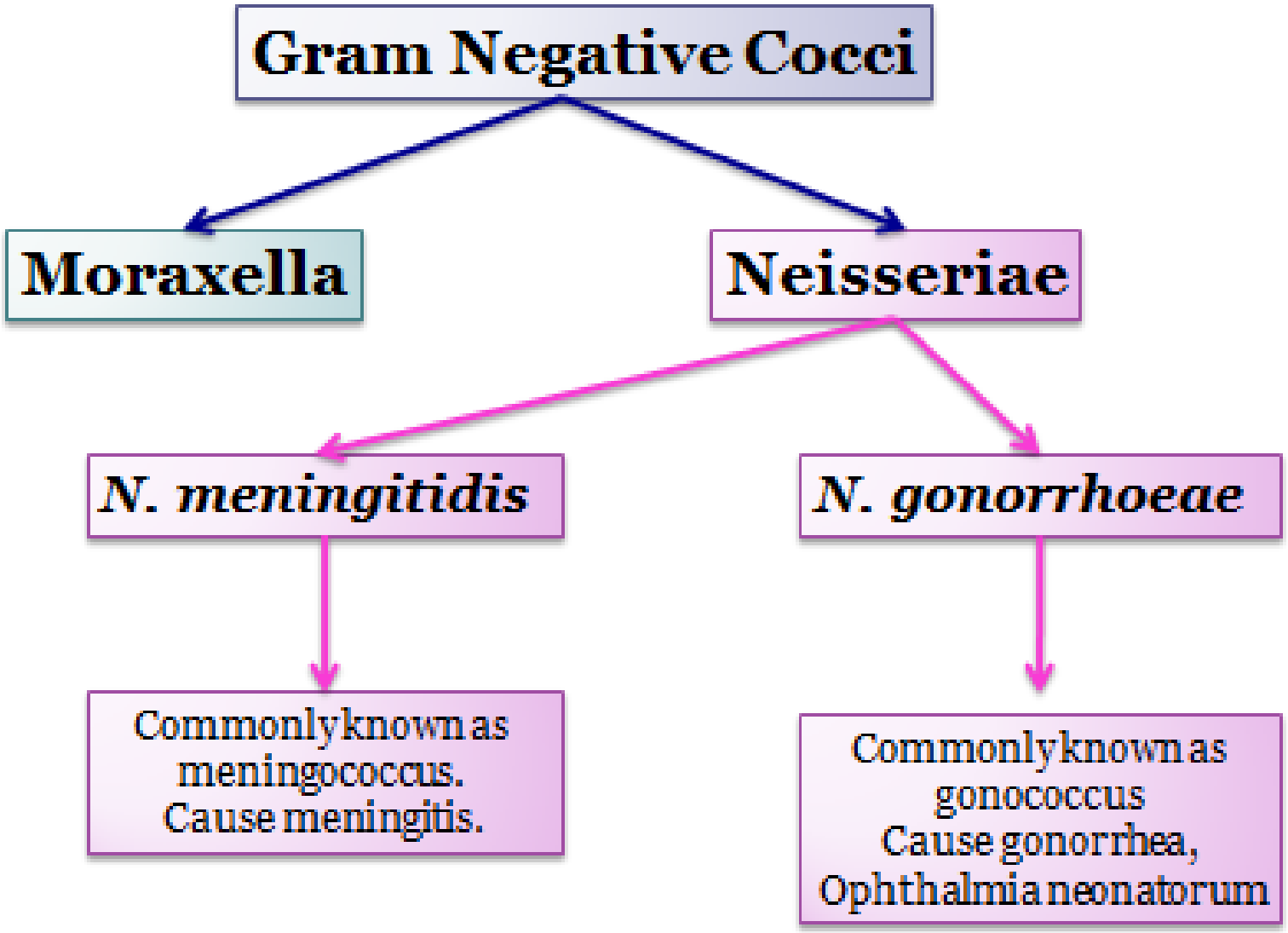
Gram Negative Cocci



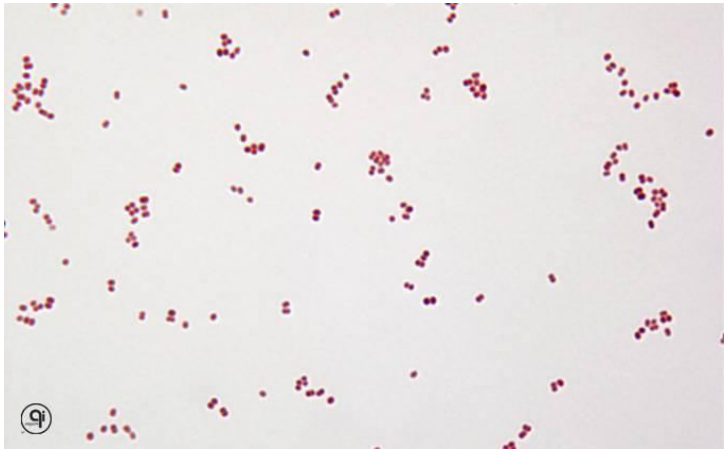



Gram Negative Cocci
Moraxella
Neisseriae
N. meningitidis
N. gonorrhoeae
Commonly known as meningococcus. Cause meningitis.
Commonly known as gonococcus Cause gonorrhea, Ophthalmia neonatorum

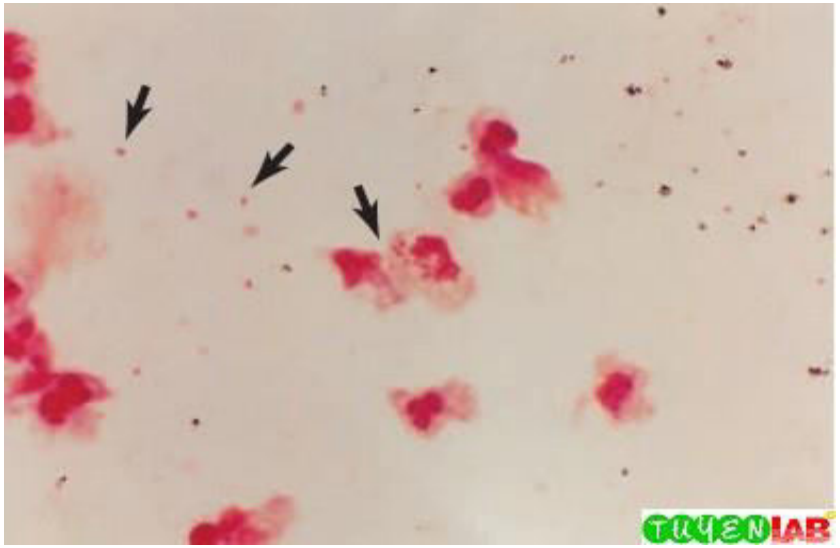
Neisseria spp.

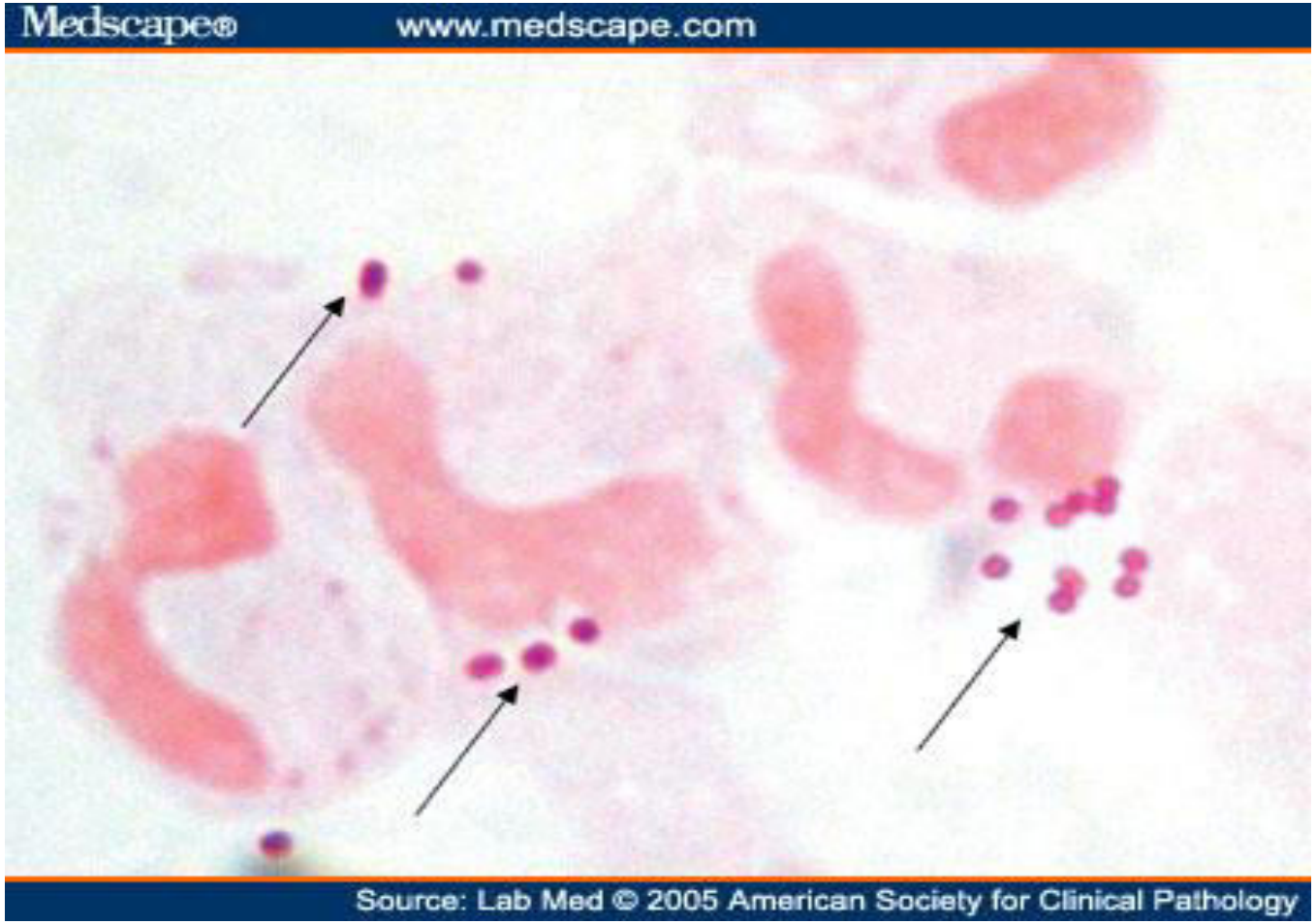
Morphology:

- ✓ Gram negative diplococci



- ✓ Found inside (intracellular) and outside (extracellular) of pus cells

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Neisseria spp.

There are two clinical significance spp.:

1. *N. meningitidis (meningococcus)*

2. *N. gonorrhoeae (gonococcus)*

- Other members of the Neisseria genus are commensals of the upper respiratory tract.

Characteristics of N. meningitidis & N. gonorrhoeae

1. Morphology

2. Culture:

- Can't grow in ordinary media, need chocolate agar, and need 5-10 % CO_2(**Capnophiles**), incubate at 35-37 °C for 24 - 48 hrs.
- Colonies appear>> grey, convex, 0.5-1 mm in diameter
- Non-pathogenic Neisseria can grow on ordinary media and grow at room temperature

3. Non-spore forming, non-motile.

4. Not part of the normal flora.

5. They are very sensitive to environment, so:

✓ Specimen should be transported to the lab as soon as possible.
✓ Never refrigerate specimen.
✓ A transport media should be used.

- *Neisseria gonorrhoeae* on Chocolate agar

- Transport media

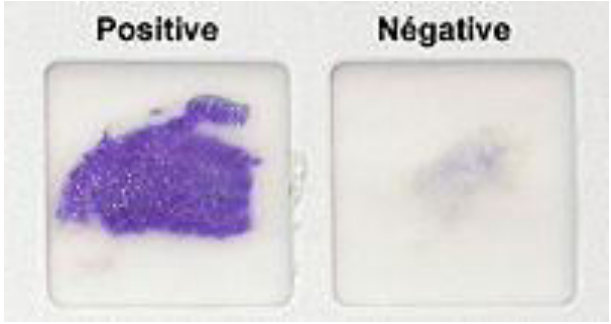
6. Biochemical reactions:

- ✓ Ctalase test>> positive
- ✓ Oxidase test>> positive
- ✓ Carbohydrate utilization test>> N. gonorrhoeae produce acid from glucose only (not maltose), N. meningitidis produce acid from glucose and maltose

Oxidase test:

- On filter paper add 2-3 drops of oxidase reagent, then add bacterial colony, after few seconds>>

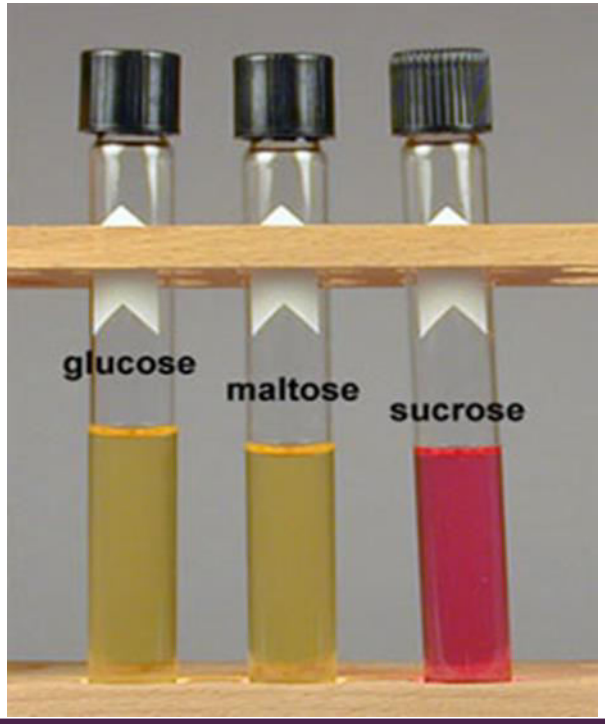
- ➢ Purple color>> oxidase positive
- ➢ No purple color>> oxidase negative



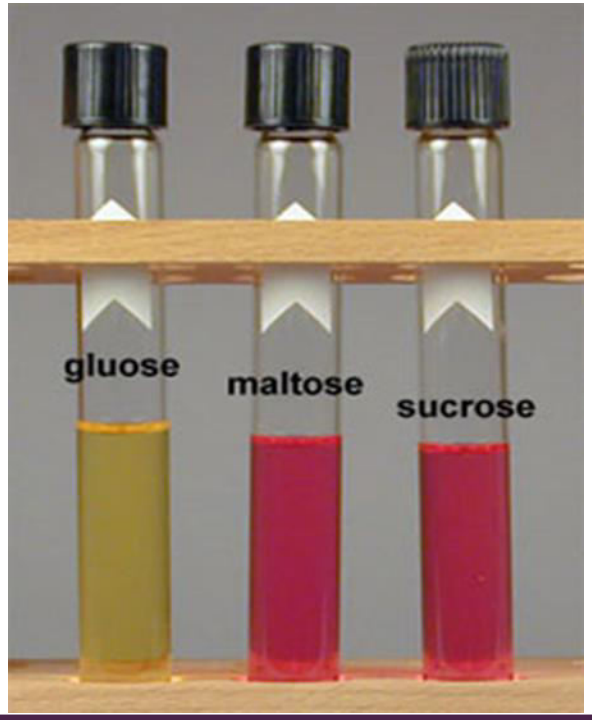
Carbohydrate utilization test:

- Use Hiss medium (broth + serum + sugar + indicator (phenol red))
- Inoculate the bacteria in Hiss medium then incubate the media at 37°C for 24 hrs
- See the result

N. gonorrhea utilizes glucose, change color from red to yellow, and *N. meningitidies* utilizes gulcose and maltose



Neisseria meningitides



Neisseria gonorrhoeae

Surface Structure

- Pathogenic Neisseria have an extraordinary capability to vary their surface structures.

- This is done to:

✓ Protect the organism form the host immune response.

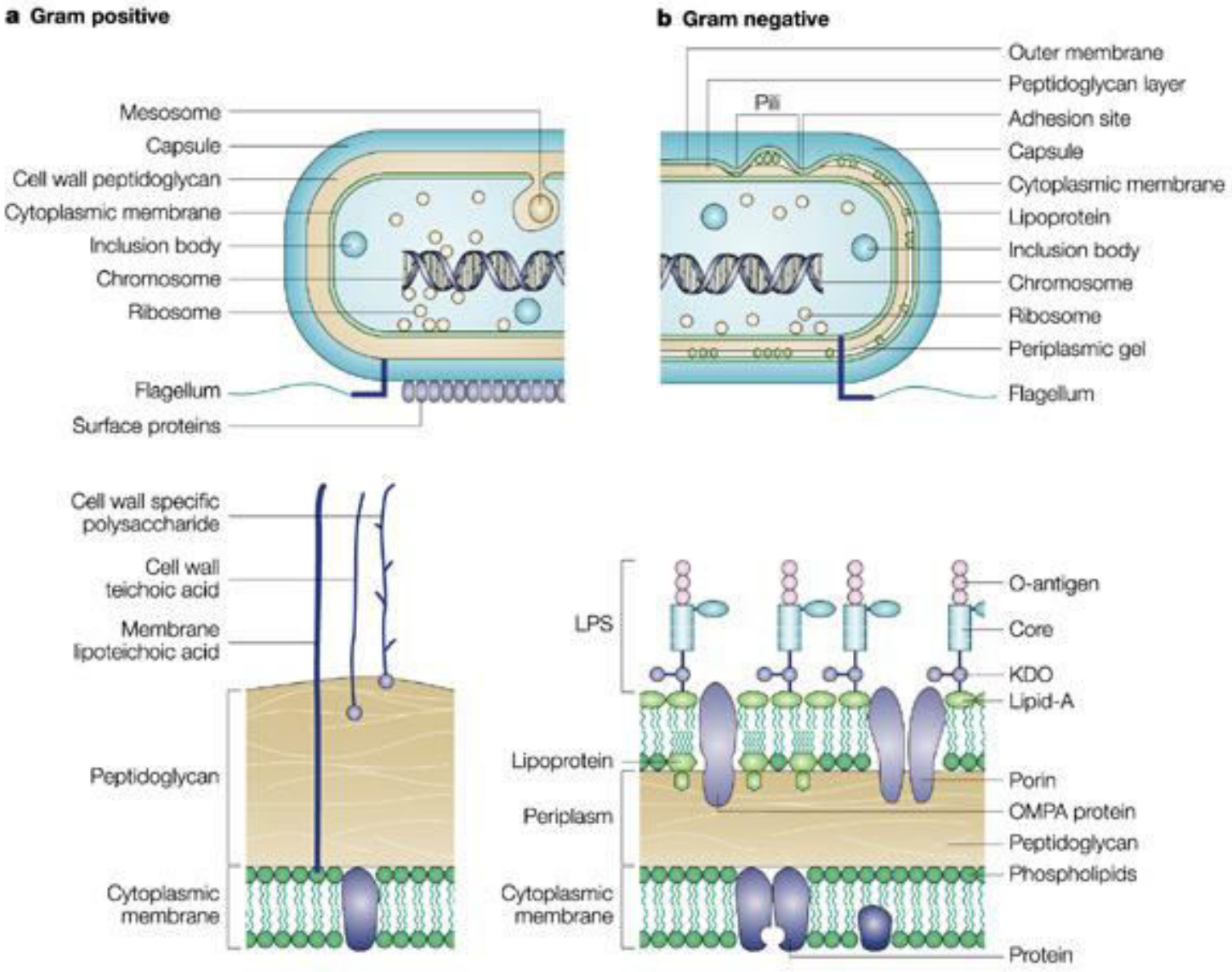
✓ It affects the function of factors that interact with host cells (interaction with epith cells, phagocytic cells, adherence to cells and cell invasion.)

Gram-negative LPS

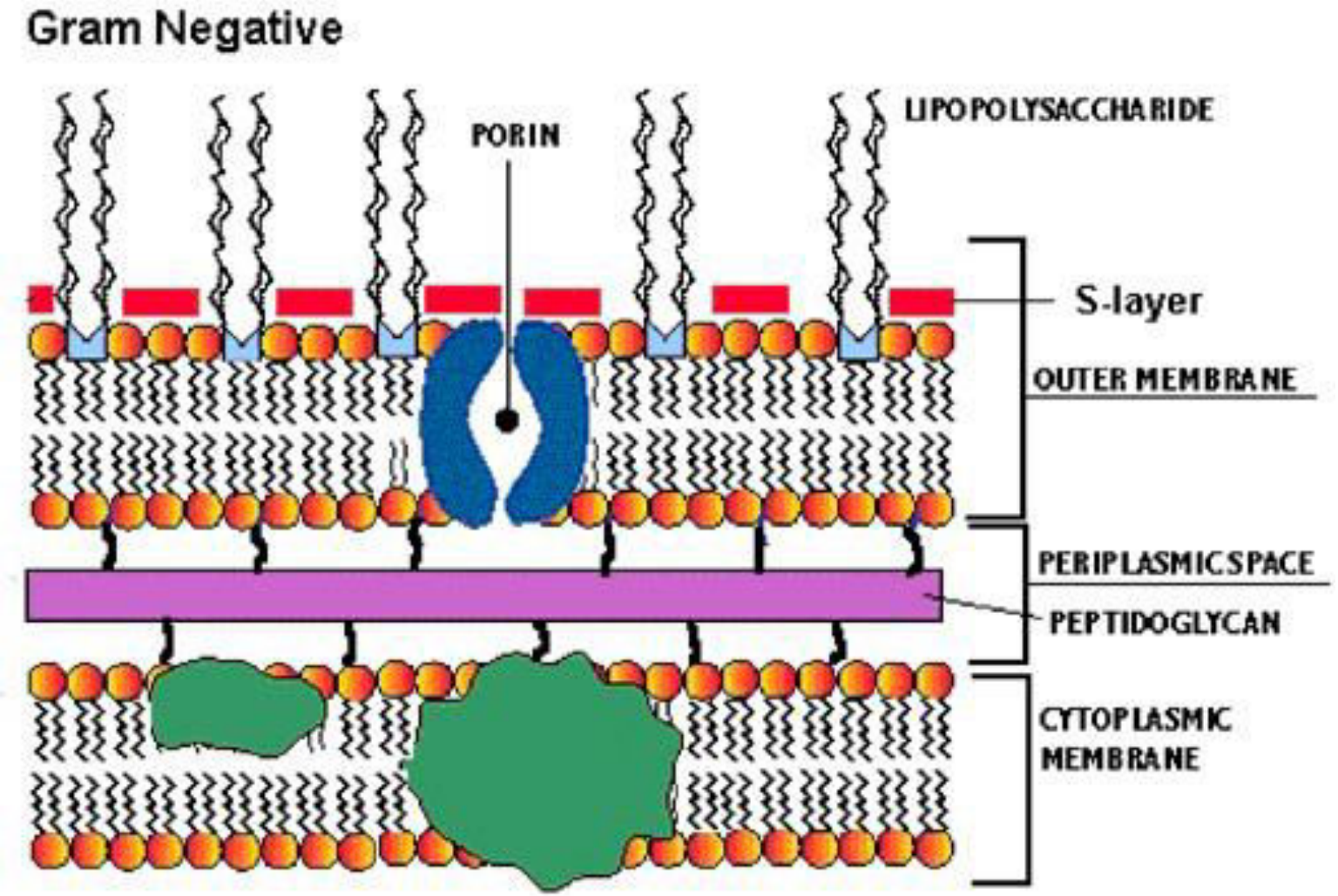
Lipopolysaccharides (LPS):

- It is the outer membrane (external to the cell wall) in all Gram-negative bacteria.
- It is large molecule consist of lipid and polysaccharide.
- This membrane contains many proteins, ex: porins.
- This membrane protects the cell wall from the host defense substance and imped the entrance of many antibiotics.
- Components of LPS (from inside to outside)>>

- ✓ **Lipid A:** endotoxin when released into the bloodstream may lead to endotoxic shock.
- ✓ **Core** (oligosaccharide).
- ✓ **O Ag** (polysaccharide capsule): protect from phagocytosis

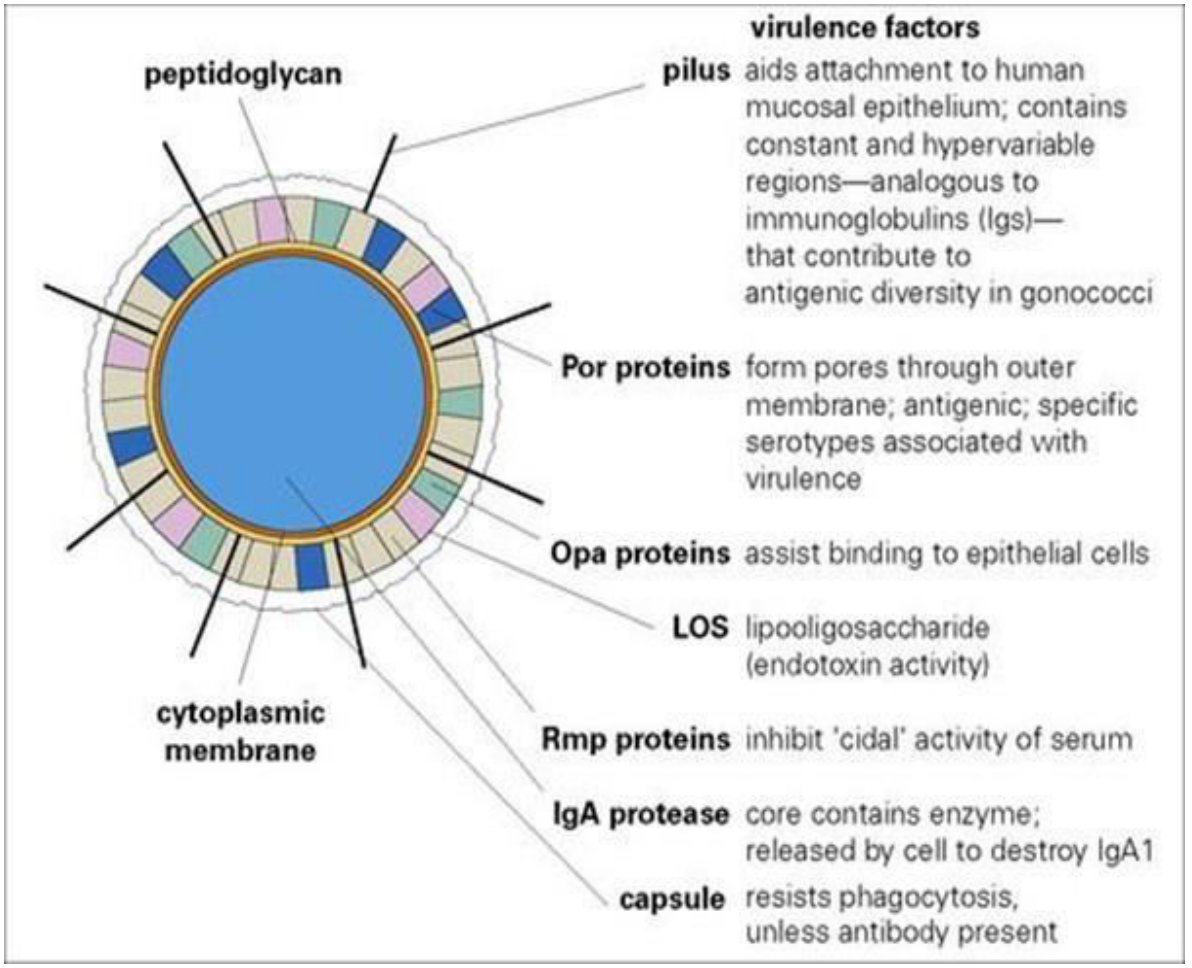

a Gram positive
Mesosome
Capsule
Cell wall peptidoglycan
Cytoplasmic membrane
Inclusion body
Chromosome
Ribosome
Flagellum
Surface proteins
b Gram negative
Outer membrane
Peptidoglycan layer
Pili
Adhesion site
Capsule
Cytoplasmic membrane
Lipoprotein
Inclusion body
Chromosome
Ribosome
Periplasmic gel
Flagellum
Cell wall specific polysaccharide
Cell wall teichoic acid
Membrane lipoteichoic acid
Peptidoglycan
Cytoplasmic membrane
LPS
O-antigen
Core
KDO
Lipid-A
Lipoprotein
Porin
Periplasm
OMPA protein
Peptidoglycan
Cytoplasmic membrane
Phospholipids
Protein

LPS


Gram Negative
PORIN
LIPOPOLYSACCHARIDE
S-layer
OUTER MEMBRANE
PERIPLASMIC SPACE
PEPTIDOGLYCAN
CYTOPLASMIC MEMBRANE

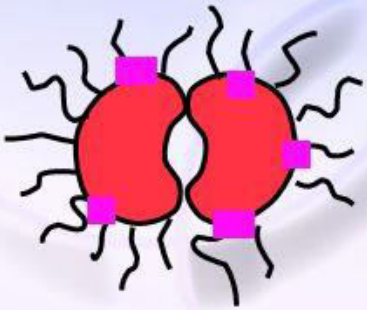
Surface Structure of N.gonorrhoeae

- Lipooligo-saccharide (LOS)= LPS without O Ag
- Porin proteins
- Opacity proteins
- Pili



Pathogenesis

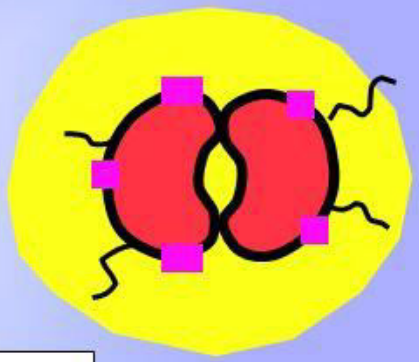
N. gonorrhoeae



Virulence Factors

Similar, but –
Differences
in utilization

N. meningitidis



LOS
IgA1 protease
iron-binding proteins

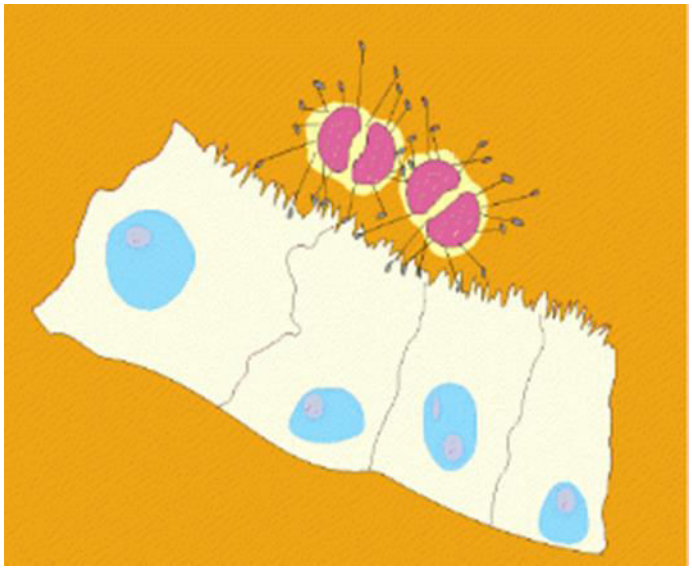
PILI
Outer Membrane Proteins
(Por,Opa, Rmp proteins)

LOS
Capsule

IgA1 protease
iron-binding proteins
PILI
Outer Membrane Proteins

1. Pili:

- Hair like projection made of proteins called pilin.
- *N.gonorrhoeae* can produce anti-genically different pilin molecules at high frequency.
- Facilitate adhesion



2. Lipooligosaccharide (LOS):

- N.gonorrheae have lipooligosaccharide which is more branched and is also capable of high-frequency antigenic varation.

3. Porin Proteins (Por):

- It is an important factor in gonococcal invasion of epithelial cells.
- Selective permeability.
- Porin proteins are not subject to high frequency antigenic variation like other outer membrane Ag.

4. Opacity proteins (Opa):

- Gonococus have multiple Opa proteins.
- Those Opa proteins help in adherance.
- Different Opa proteins bind to distinct receptors on host cells.

Other virulence factor:

Produce IgA protease >> cleaves Ig A1.

Note:

- ✓ If the host has antibodies against one or more of these proteins they would be removed and the bacteria would shift the expressing of pili or other proteins in which there is no immunologic experience.

- ✓ Immune responses to gonococcus after natural infection ordinarily result in little immunity to re-infection, due to antigenic variation of the gonococcus, and redirection or suppression of immune responses.

Clinical significance of N. gonorrhoeae

1. Gonorrhea(e.g urethritis, cervicitis)
2. Rectal infections.
3. Pharyngitis.
4. Ophthalmia neonaturom.
5. Disseminated infection.

Treatment N. gonorrhoeae

- The organism shows resistant to penicillin and tetracycline (PPNG penicillinase producing *N.gonorrhoeae*).

- Usually treatment is by third generation cephalosporin's (eg. ceftriaxone).

- Many patient with gonorrhea have coexisting chlamydial infections.

Ophthalmia neonatorum

Prophylactic treatment:

- After cleansing of face and lid of baby apply 1% silver nitrate solution, or other antibiotic ointment.

- Monitor the baby's eye in the first week.

- If the mother is known to be colonized, systemic antibiotic may be given to the new born baby.

Curative treatment:

- Frequent washing with normal saline.
- Applying antibiotic to the eye every hour (due to general resistance to penicillin and tetracycline)
- Systemic treatment with antibiotic is needed (e.g. ceftriaxone or cephotaxime; either IV or IM)

N. meningitidis

- It looks like *N. gonorrhoeae.*
- Have pili which help it to attaches to nasopharyngeal mucosa.
- It has a polysaccharide capsule (O Ag) which is the most important virulence factor since it inhibit phagocytosis.

- N. meningitidis can be classified according to the capsular polysaccharide into different serogroups.
- Most infections are caused by serogroups A, B, C, W-135 and Y.
- MCV4 is a tetravalent vaccine that is used nowadays.
- It is sensitive to penicillin.

Clinical Significance of N. meningitidis

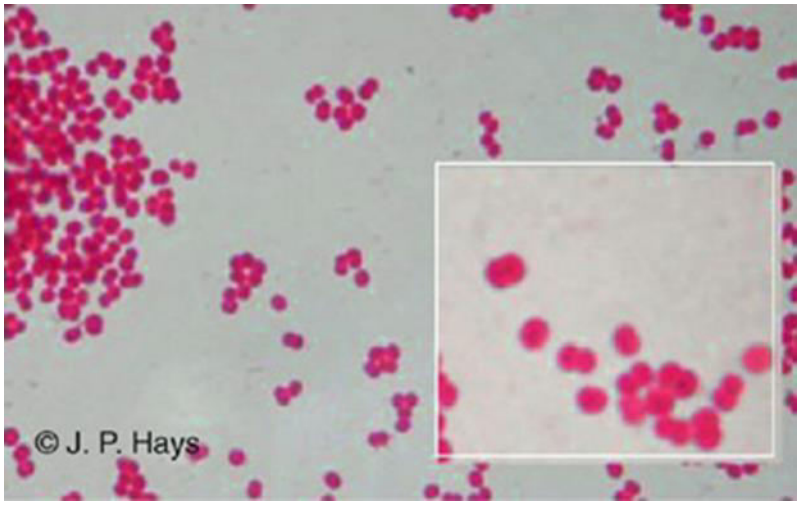
- One of the most frequent causes of meningitis.
- Symptoms have rapid onset and great intensity (high fever , headache, & rash).
- Outbreaks most common in winter and early spring.
- Meningococcal septicaemia which can cause death within hours of the appearance of symptoms.

N. Meningitidis VS N. gonorrhoeae

Species	Portal of Entry	Maltose fermentation	B-lactamase production	Available vaccine
N. Meningitidis	Respiratory tract	+	None	+
N. gonorrhoeae	Genital tract	-	Yes	-

Moraxella spp.

- Gram negative cocobacilli
- Arranged in pairs.
- Aerobic.



- Oxidase positive (like Neisseria spp.).
- Fastidious organism, they can grow on blood agar.
- Dose not ferment carbohydrate.

- It is a normal flora in the upper respiratory tract.

- It can gain access to the lower respiratory tract in immuno-copromised patients or patients with chronic chest diseases.

- Person-to person transmission may also be possible.

Moraxella Infections

- The most important species is M. catarrhalis.
- It can cause infections of the respiratory system , middle ear, eye or CNS and joints.
- Can cause angular conjunctivitis: dirty-white foamy discharge at the angles.