

# Neisseria

Dr. Bimal Chauhan

NEISSERIACEAE

NEISSERIA

MORAXELLA

KINGELLA

ACINETOBACTER

## Pathogenic Species of Neisseria

- *N. meningitidis* (meningococcus)
- *N. gonorrhoeae* (gonococcus)

## Non-Pathogenic Species

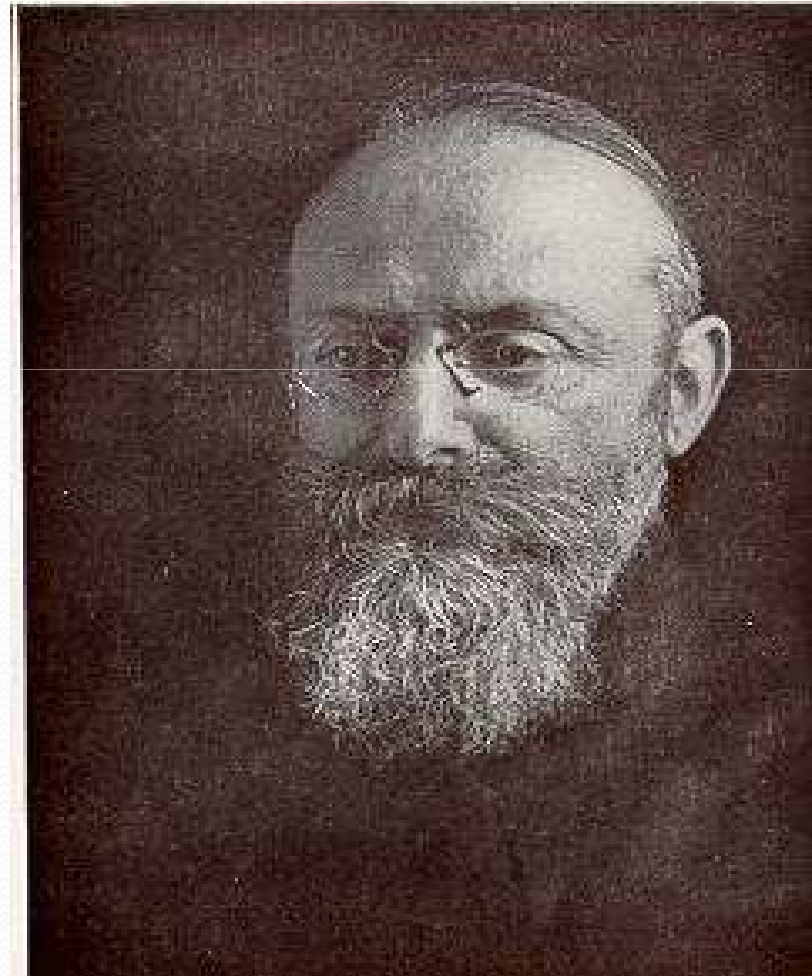
- *N. cinerea*
- *N. elongata*
- *N. flavescens*
- *N. lactamica*
- *N. mucosa*
- *N. polysaccharea*
- *N. sicca*
- *N. subflava*

## **Neisseria meningitidis (Meningococcus)**

- First described and isolated in **1887** by **Weichselbaum** from spinal fluid of a patient.
- Human nasopharynx – only reservoir of it.

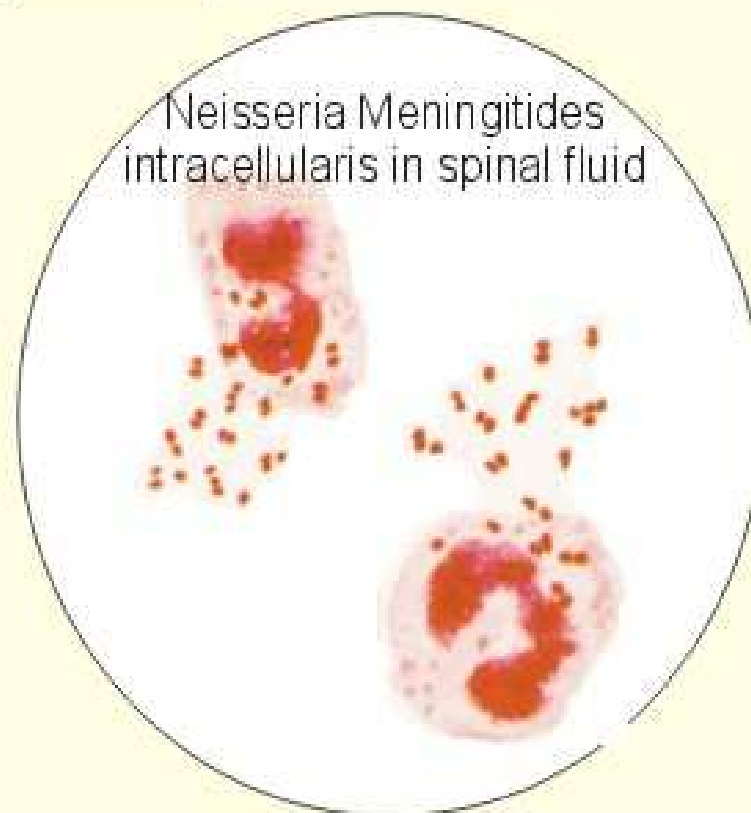
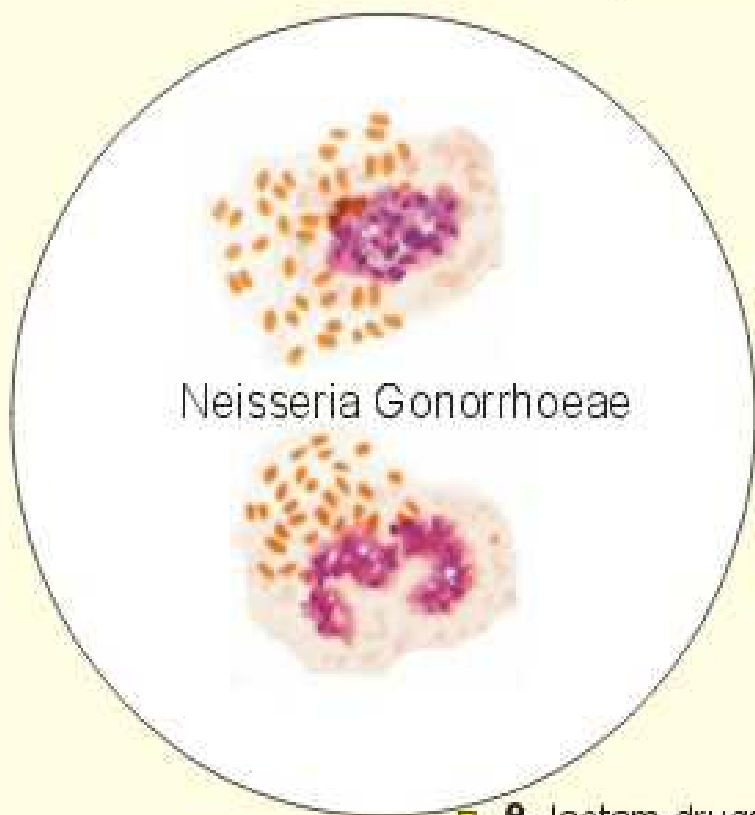
## Neisseria gonorrhoeae (Gonococcus)

- Discovered in 1879 by **Albert Ludwig Sigismund Neisser** at the age of 21
- He was working with a dermatologist and researching sexual transmitted diseases and leprosy
- He studied and isolated the pathogen for gonorrhoea, *Neisseria gonorrhoeae*

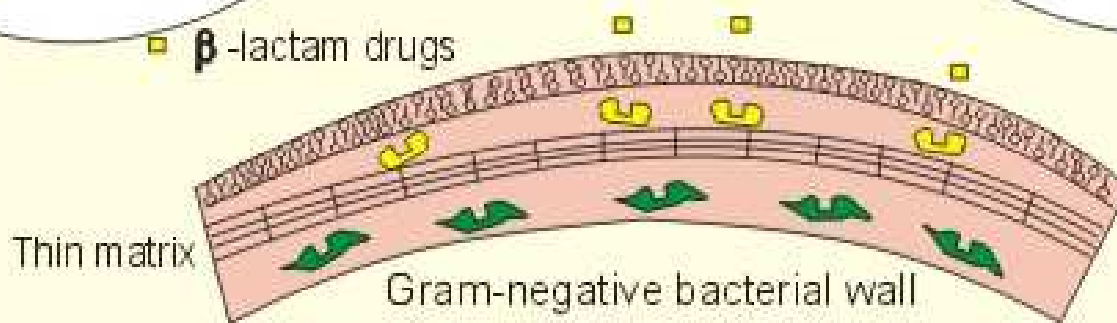


# Morphology

## Microscopic Pictures Of Neisseria (Gram-negative Diplococci)

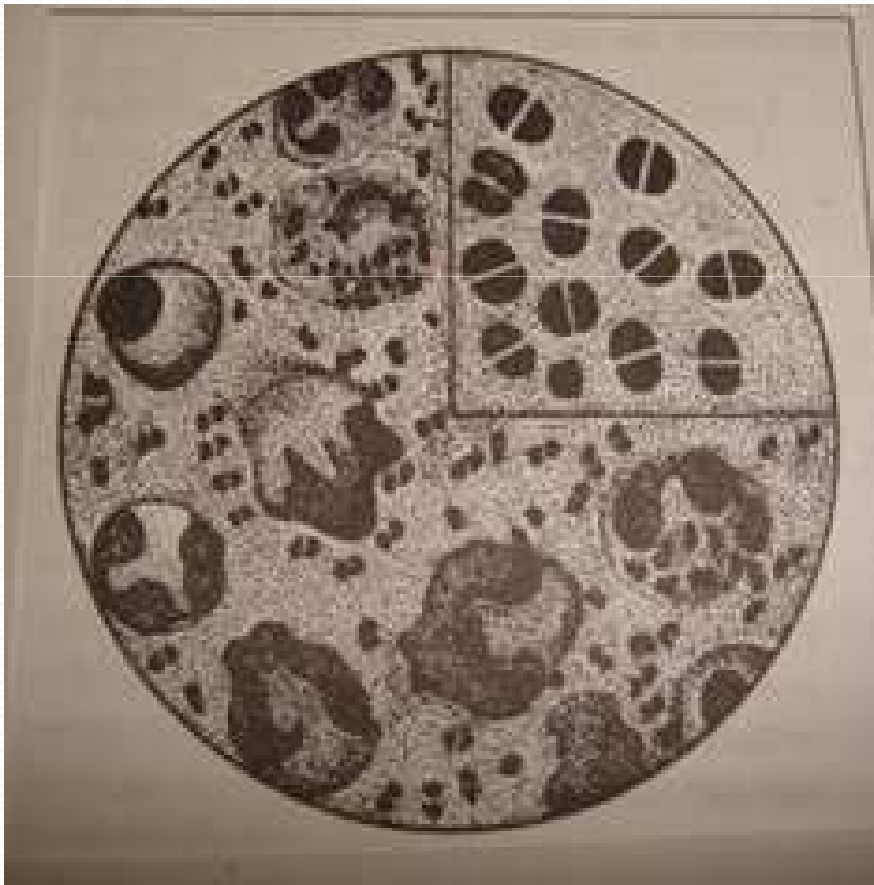


□  $\beta$ -lactam drugs

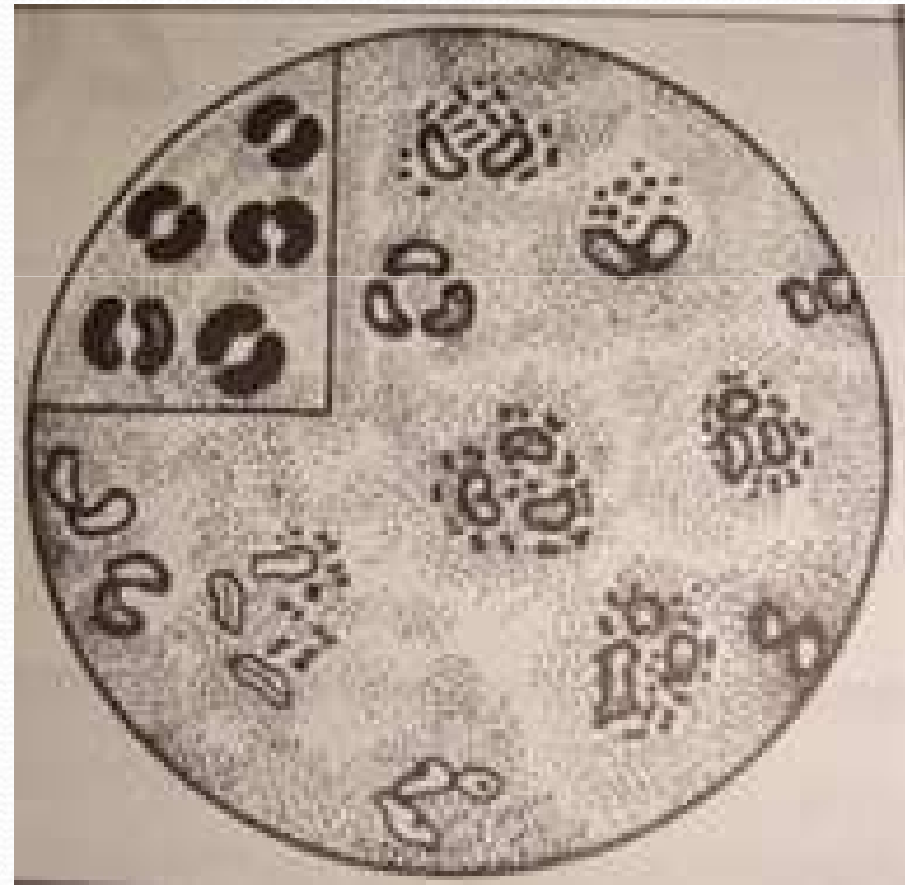


# Morphology

## Meningococci



## Gonococci





# Isolation and Cultivation

- Do not grow on ordinary media
- Grow on media enriched with blood, serum or ascitic fluid.
- Strict aerobes. Growth is facilitated by 5-10%  $\text{CO}_2$  and high humidity
- **Chocolate agar**
- **Blood agar**
- **Muller Hinton agar**

- 
- **Thayer-Martin agar (TM)**
    - Chocolate agar designed to isolate *N. gonorrhoeae*.
    - Contains the following:
      - **Vancomycin**
        - kills all Gram Positive organisms
      - **Colistin (polymyxin)**
        - kills all Gram Negative organisms (except *Neisseria*)
      - **Nystatin**
        - kills all Fungi
  - **Modified New York City medium (MNYC)**

# Chocolate Agar Culture

## Meningococci

Small, translucent, round, convex, bluish grey with a smooth glistening surface and entire edges.



## Gonococci :

### Kellogg's classification of colony

- **Type T<sub>1</sub> & T<sub>2</sub>** : small & brown - palliated autoagglutinable & virulent strains
- **T<sub>3</sub> & T<sub>4</sub>** : Large, granular & non pigmented non piliated avirulent strains

# Biochemical reactions

## Meningococci

- Catalase test : Positive
- Oxidase test : Positive
- Sugars :

Glucose A +

Maltose A +

## Gonococci

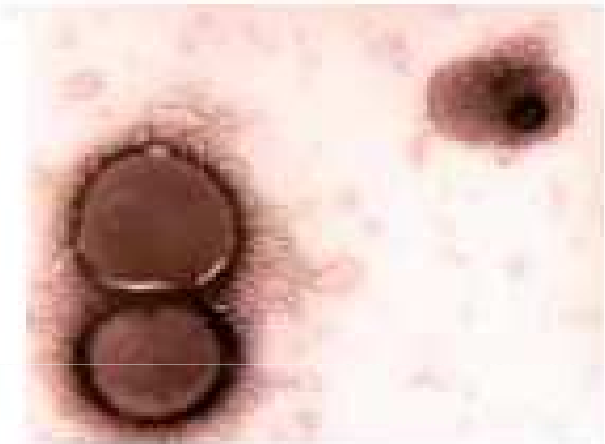
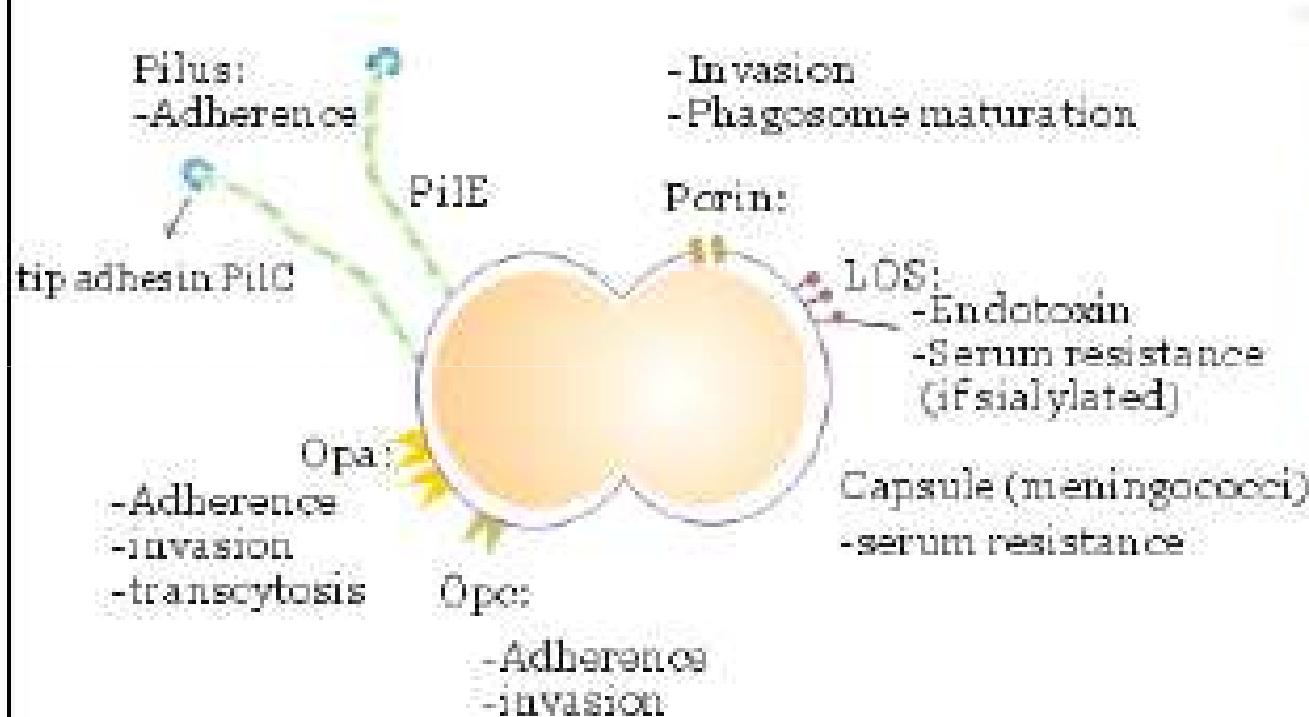
- Catalase test : Positive
- Oxidase test : Positive
- Sugars :

Glucose A +

Maltose A -

# *Neisseria meningitidis*

## plus virulence factor - polysaccharide capsule



[www.inmed.co.uk](http://www.inmed.co.uk)

- **13** serotypes
- **A, B, C, D, X, Y, Z, 29E, W135, H, I, K, L**

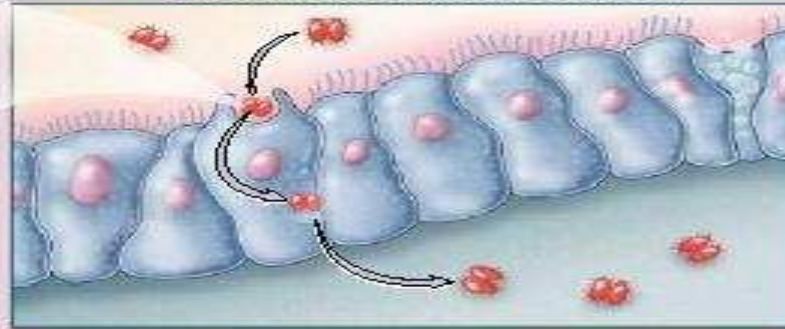
**Asymptomatic  
Rhinitis,  
Pharyngitis**

Nasopharyngeal mucosa



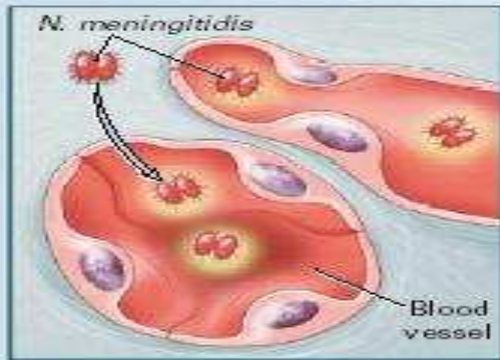
Attachment to and interaction with nasopharyngeal epithelium

Passage through the mucosa



Blood

Survival in the bloodstream



- Factors affecting intravascular survival**
- Capsule: protects against complement-mediated bacteriolysis and phagocytosis
  - Acquisition of iron from transferrin

Endotoxin and other cell components

Host-cell cytokine production

Alternative complement pathway

Inflammatory cytokines (tumor necrosis factor  $\alpha$ , interleukin- $1\beta$ , 6, 8)

Antiinflammatory cytokines (interleukin-10)

Cerebrospinal fluid

Crossing of the blood-brain barrier

Blood vessel Blood-brain barrier endothelium

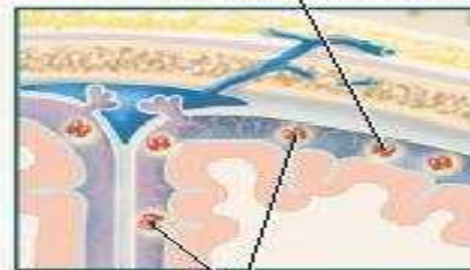


*N. meningitidis*

Cerebrospinal fluid



Multiplication in subarachnoid space



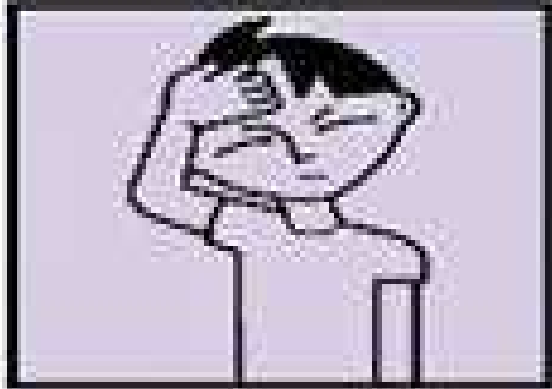
*N. meningitidis*

# PATHOGENICITY MENINGOCOCCI

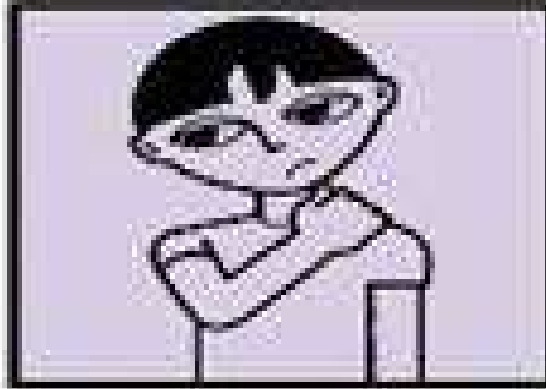
- Cerebrospinal meningitis
- Meningococcal septicemia
  - Metastatic involvement of joints, ear, eyes, lungs & adrenals
  - Pneumonia
  - Fulminant meningococemia (Waterhouse-Fridrichsen syndrome) –shock, DIC, multisystem failure



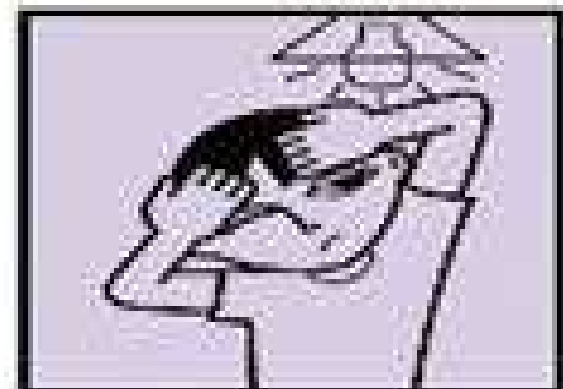
# Signs & symptoms of meningitis



Severe headache



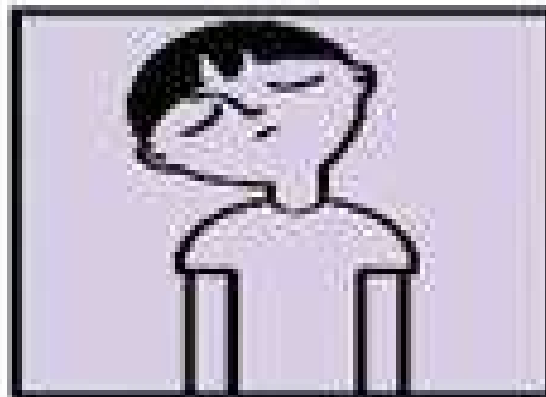
Stiff neck



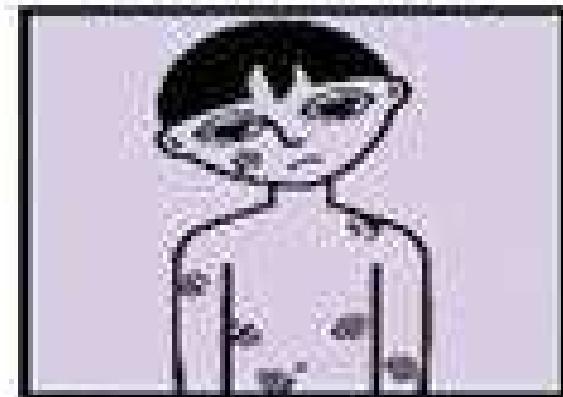
Dislike of  
bright lights



Fever/vomiting



Drowsy and less  
responsive/  
vacant



Rash (develops  
anywhere on  
body)

# Hemorrhagic Vasculature



**Small hemorrhagic skin Lesions called Petechiae**

**Bleeding tendency & coagulopathy caused by organisms**

**Coalescence of the Hemorrhagic lesions to Form cutaneous hemorrhagic necrosis**



## Petechial Lesions and Purpura in a 20 yo male



# Laboratory diagnosis

## **Bacteria causing purulent meningitis :**

- N. Meningitidis
- Stre. pneumoniae
- H.influenza type b
- Gr. B Streptococci
- Staphylococci
- E.coli
- Listeria monocytogenes

## **SPECIMENS**

1. CSF
2. Blood
3. Aspirate from skin lesions & joint
4. Nasopharyngeal swab

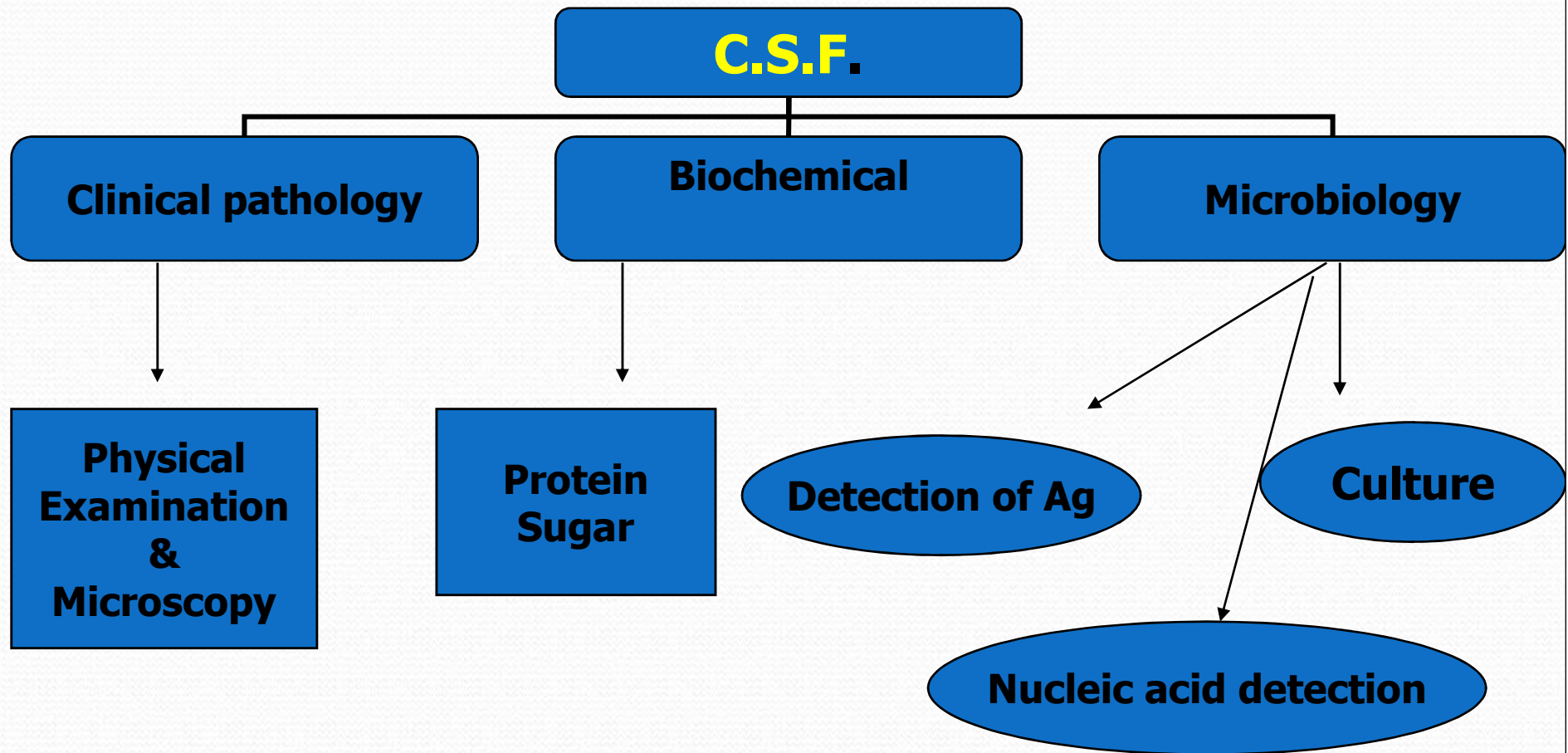
## **COLLECTION**

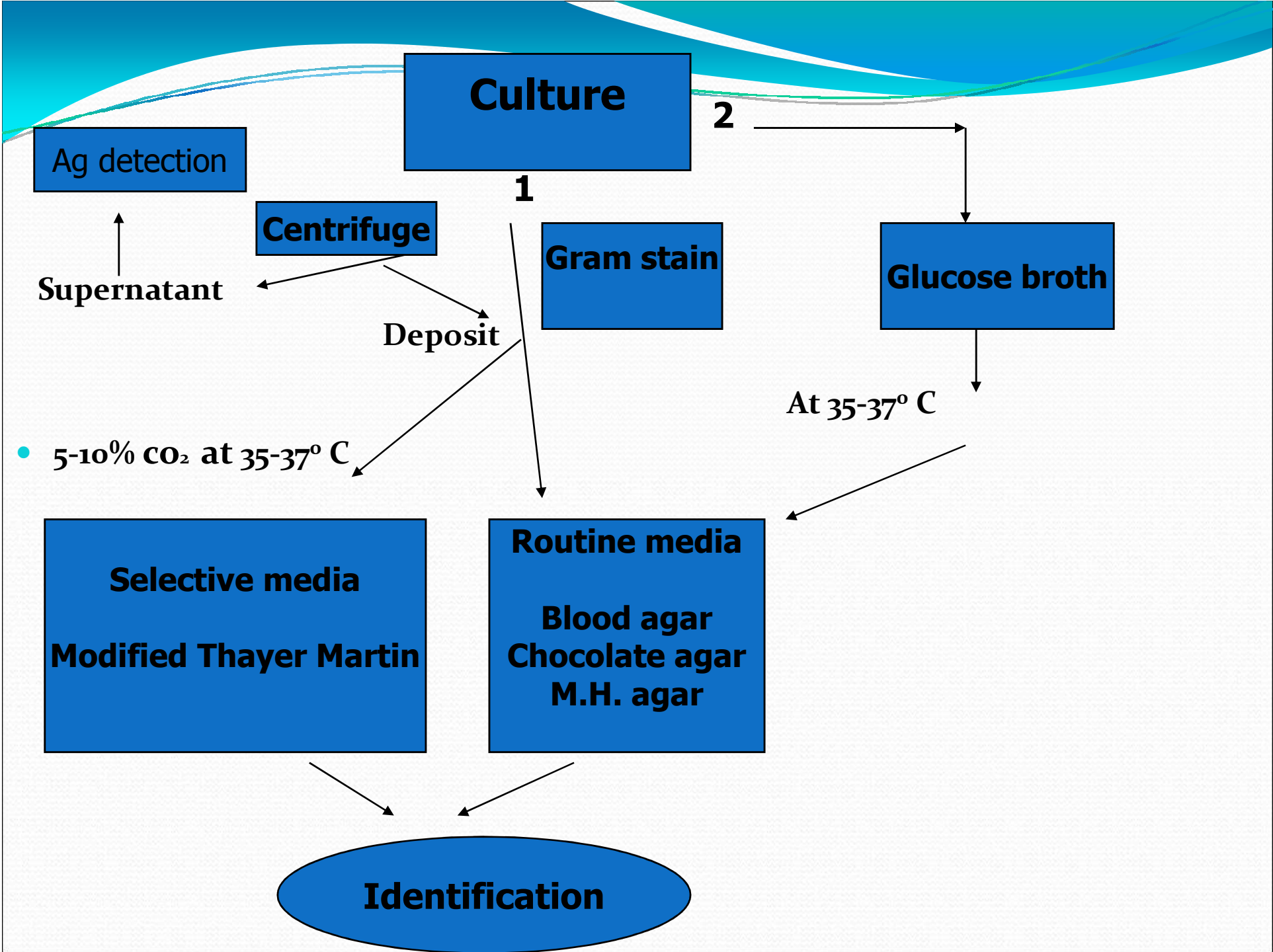
Sterile container

## **TRANSPORT**

- ✓ - Immediately (NEVER FREEZE THE CSF)
- Swab in Stuart's transport medium
- Blood in glucose broth

# Laboratory diagnosis





## 2. **Blood** – for culture

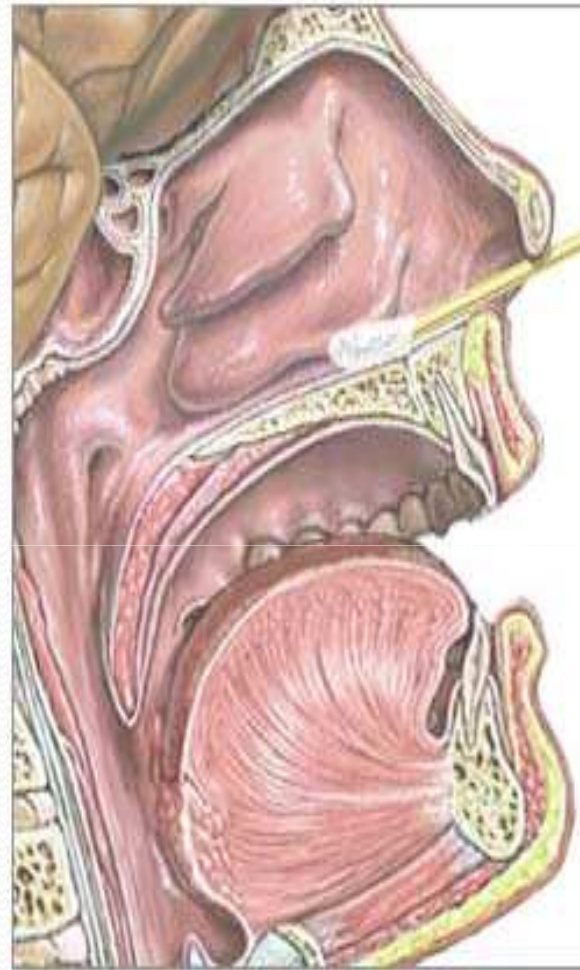
(in meningococemia & early cases of meningitis)

## 3. **Swab or aspiration** from petechial lesions – for culture & Gram stain

## 4. **Nasopharyngeal swab** – for detection of carrier

## 5. **Autopsy**

Smear examination & culture from meninges, lateral ventricles, surface of brain & spinal cord.



A sterile swab is passed gently through the nostril and into the nasopharynx



## Treatment

I/V Penicillin

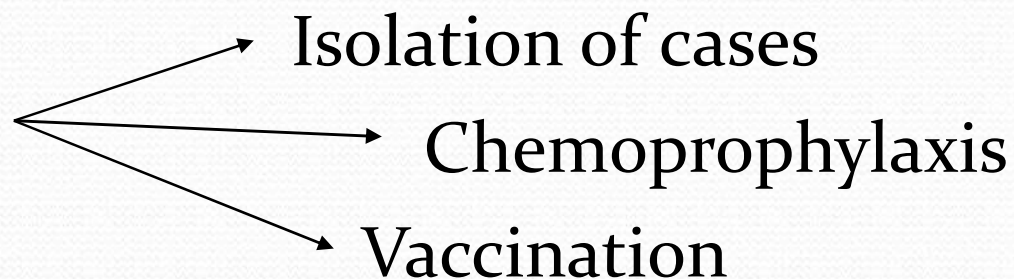
Cephalosporin

Prophylactic Rifampicin or ciprofloxacin to prevent carrier state

## Prophylaxis

Rifampicin or ciprofloxacin

## Prevention

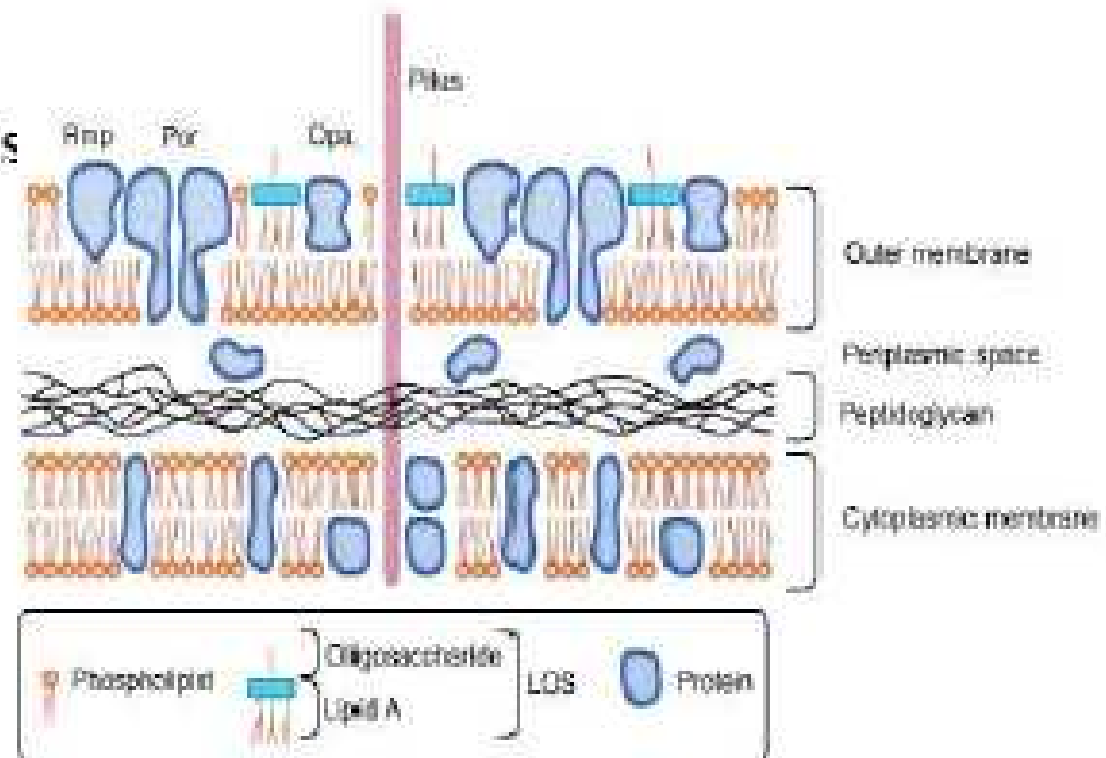


# VACCINES

- Serogroup B is poorly immunogenic, so conjugate vaccines are under development
- A polyvalent vaccine is available that contains capsular polysaccharide from serotypes A, C, Y & W135; recommended for young adults (military recruits & college students)
- Patients <2 years do not respond to polysaccharides

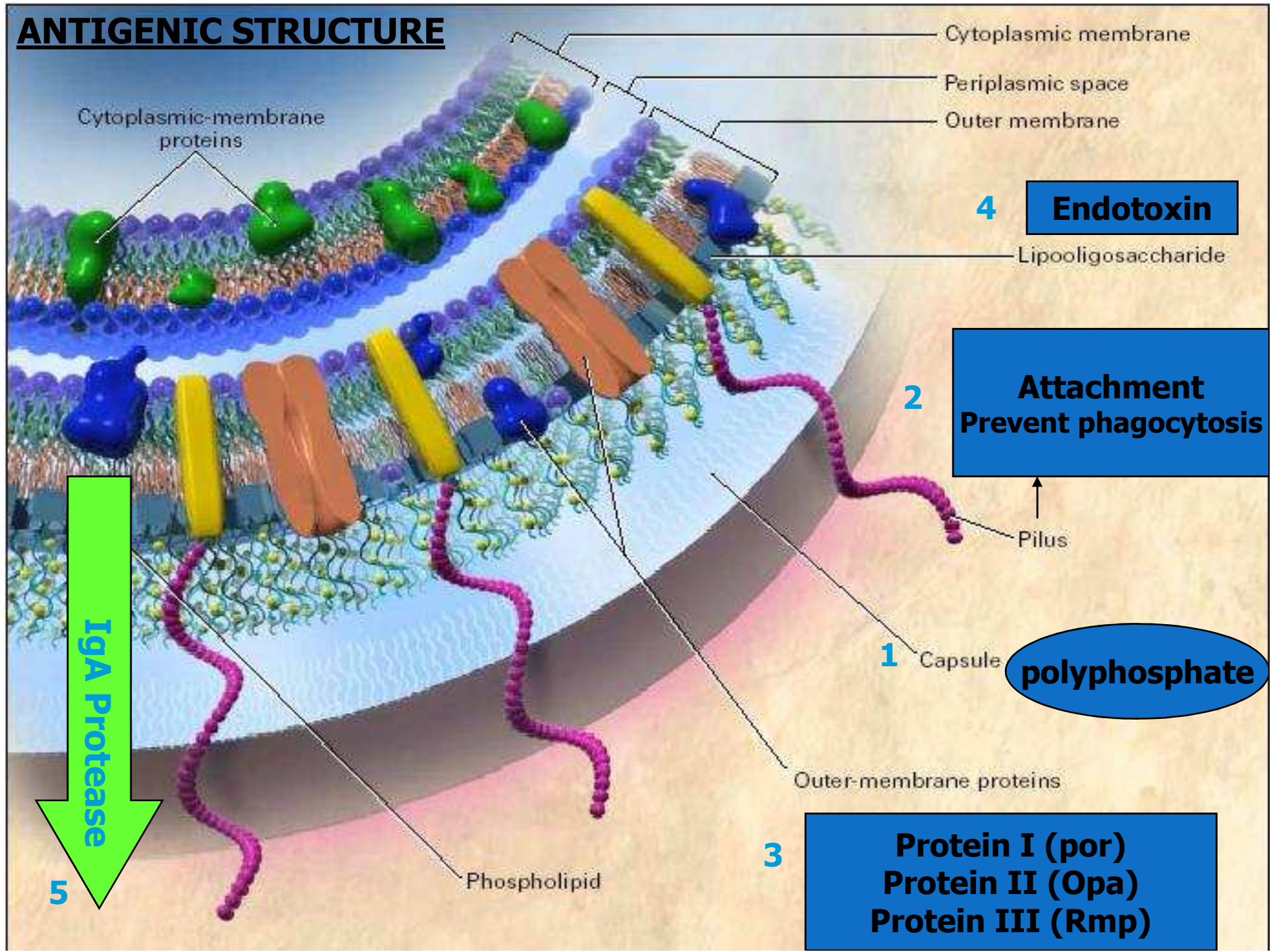
## *Neisseria gonorrhoeae* - virulence factors

- Pili, membrane proteins (Por, Opa, Rmp)
- transferrin and Hb binding receptors
- LOS
- IgA protease, beta-lactamase

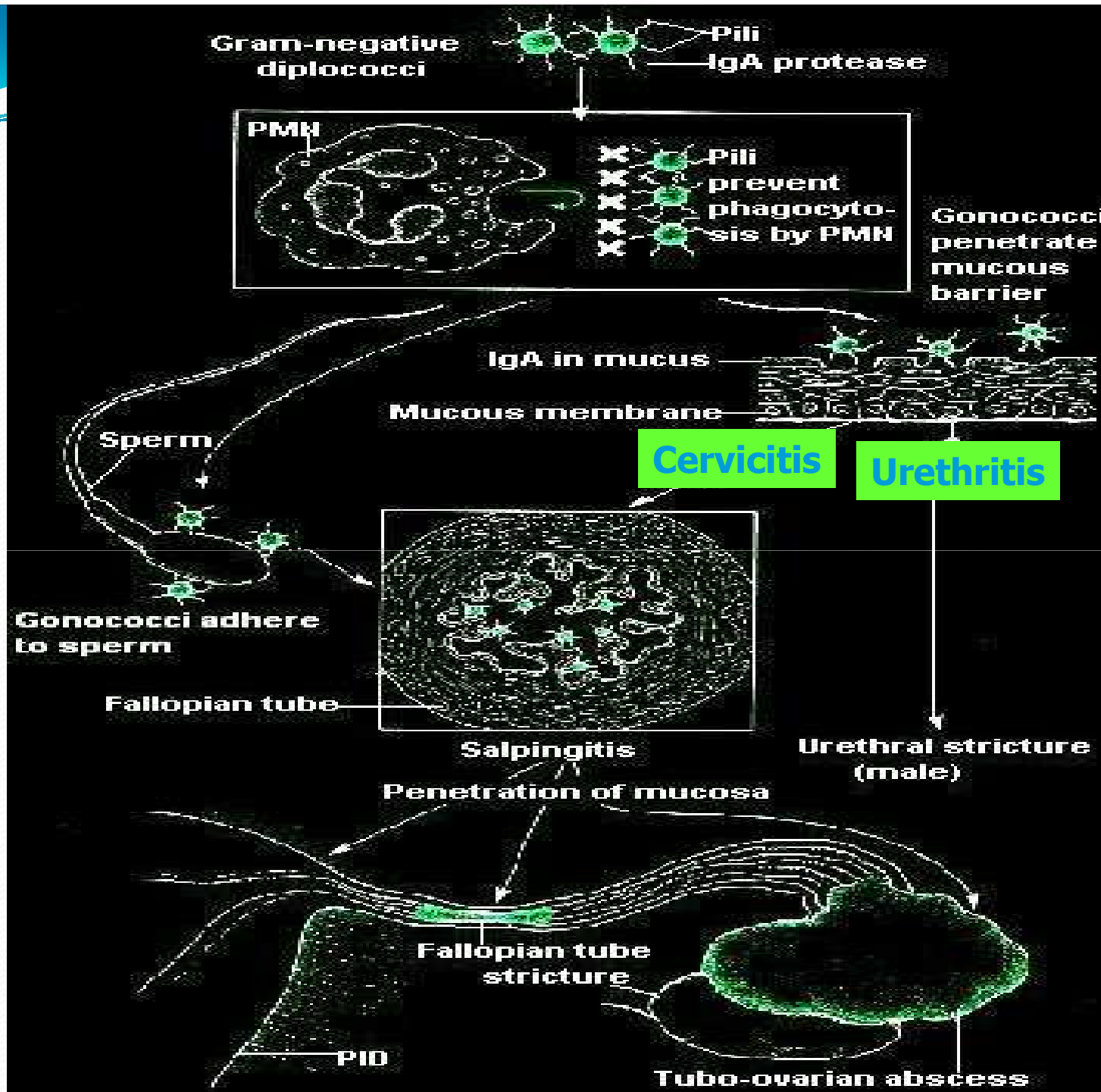


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# ANTIGENIC STRUCTURE



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**3-10 days**

# Pathogenicity

## Gonorrhea

### MALE

- Acute urethritis
- Epididymitis
- Epididymo-orchitis
- Prostatis
- Periurethral abscess
- Urethral stricture
- Proctitis (homosexual)
- Conjunctivitis

### NEW BORN

- Ophthalmia neonatorum

### FEMALE

- Cervicitis
- urethritis
- Infection of Bartholin's gland
- Endometritis
- Salpingitis
- PID
- Sterility
- Proctitis
- Conjunctivitis

### PREPUBERTAL GIRLS

- Vulvovaginitis

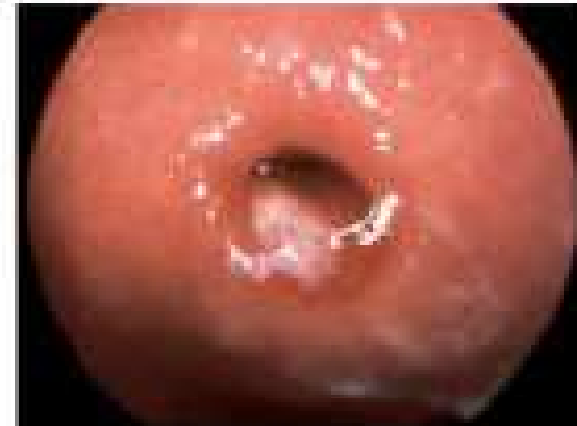


## Disseminated gonococcal infections (DGI)

- More common in females than males
- Fever
- Hemorrhagic skin lesions – painful
- Tenosynovitis, polyarthralgia, frank arthritis
- Complications – perihepatitis ( Fitz-Hugh-Curtis syndrome), Endocarditis, Meningitis

# *Neisseria gonorrhoeae* - diseases 1 sexually or vertically transmitted

- Acute:  
urethritis,  
cervicitis,  
conjunctivitis



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# LABORATORY DIAGNOSIS

## SPECIMENS

### In males

- Purulent urethral discharge (morning drop of secretion or obtained by prostatic massage)
- Urine

### In females

- Urethral discharge /swab
- Endocervical swab
- Rectal swab

# LABORATORY DIAGNOSIS : SPECIMENS

<b>PATIENT</b>	<b>PRIMARY SITE</b>	<b>SECONDARY SITE</b>
Female	Endocervix	Urethra, Rectum
Male, heterosexual	Urethra	Pharynx
Male, bisexual/homosexual	Urethra, rectum, pharynx	Pharynx
Female, DGI	Blood, endocx, rectum	Pharynx, skin lesions, jt.fluid
Male, DGI	Blood, urethra	Pharynx, skin lesions, jt.fluid, rectum



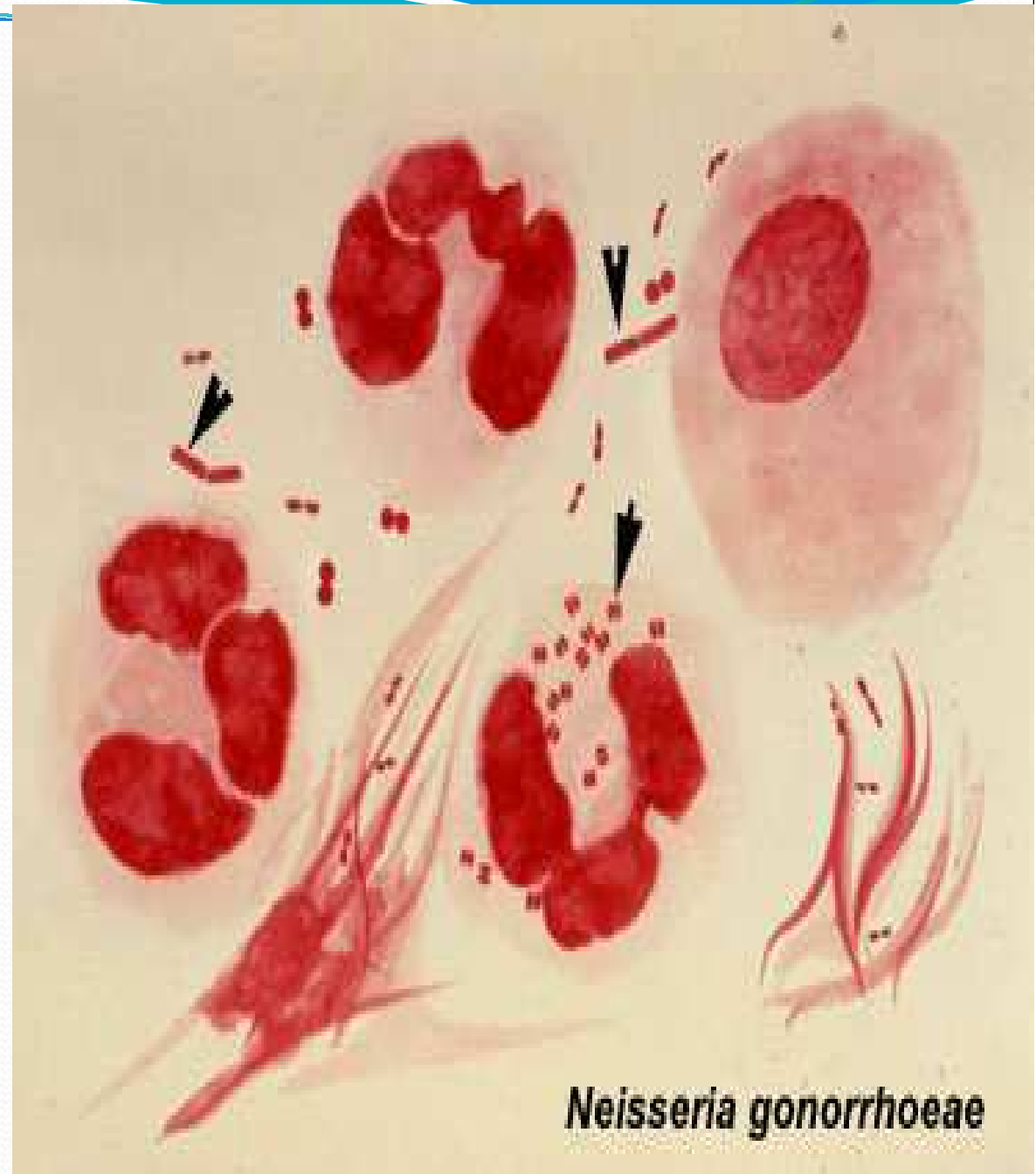
## **TRANSPORTATION**

- Immediately
- Swab in Stuart's / Amies transport medium
- Blood & Synovial fluid in tryptic soya broth

# MICROSCOPY

**Gram stain**

**Fluorescent  
Ab tech.**



## CULTURE

**Chocolate agar  
Muller-Hinton agar**

35-37<sup>0</sup> C

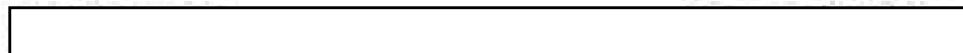
**Modified Thayer-Martin  
or  
MNYC**

Candle jar/ CO<sup>2</sup> incubator

**Identification**

## Gonorrhoea - treatment and prevention

- 3. generation cephalosporin  
(ceftriaxone)  
or spectinomycin  
(aminoglycoside)
- safe sex, partner follow up
- for prevention of the  
ophthalmia neonatorum:  
1% silver nitrate  
(Crede's eye drops)
- high antigenic variability-  
no vaccine!





# Non gonococcal urethritis (NGU)

## Definition

The term given to a condition of urethritis in which no gonococci are identified either by Gram stain or culture.

## Causes of nongonococcal urethritis

### 1. Bacterial causes

- Chlamydia trachomatis (most common)
- Ureaplasma urealyticum
- Mycoplasma hominis
- Gardnerella vaginalis
- Acinetobacter spp.

### 2. Viruses

- Herpes virus
- Cytomegalo virus

### 3. Fungus -Candida albicans

### 4. Protozoa -Trichomonas vaginalis



# Questions?



A vibrant, 3D-rendered landscape of rolling green hills. The hills are covered in lush green grass and are arranged in a series of gentle, undulating slopes. In the distance, two small, white, barn-like structures are visible on a hillside. The overall scene is bright and cheerful, with a clear blue sky. Overlaid on the center of the image is the text "THANK YOU" in large, bold, 3D letters. The letters are a bright yellow-orange color with a gradient and a shadow effect, making them stand out prominently against the green background.

**THANK YOU**