# MICROBIOLOGY PRACTICAL CLASS

YEAR ONE, FOUNDATION BLOCK

## THIS MICROBIOLOGY PRACTICAL CLASS IS DESIGNED BY:


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- Dr. Malak El-Hazmi
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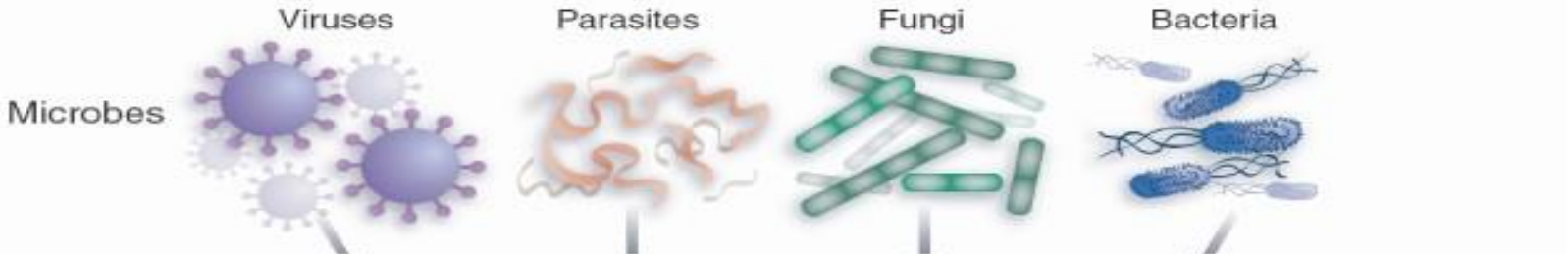
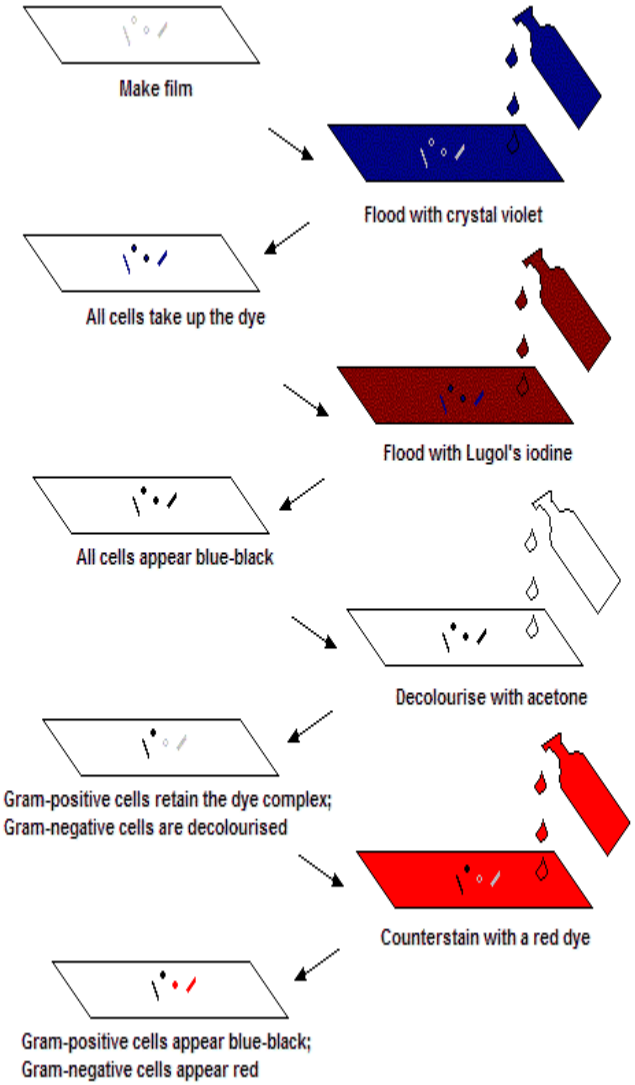
- Dr Ahmed Albarrag


Microbes
Viruses
Parasites
Fungi
Bacteria

# Clinical Bacteria

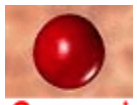




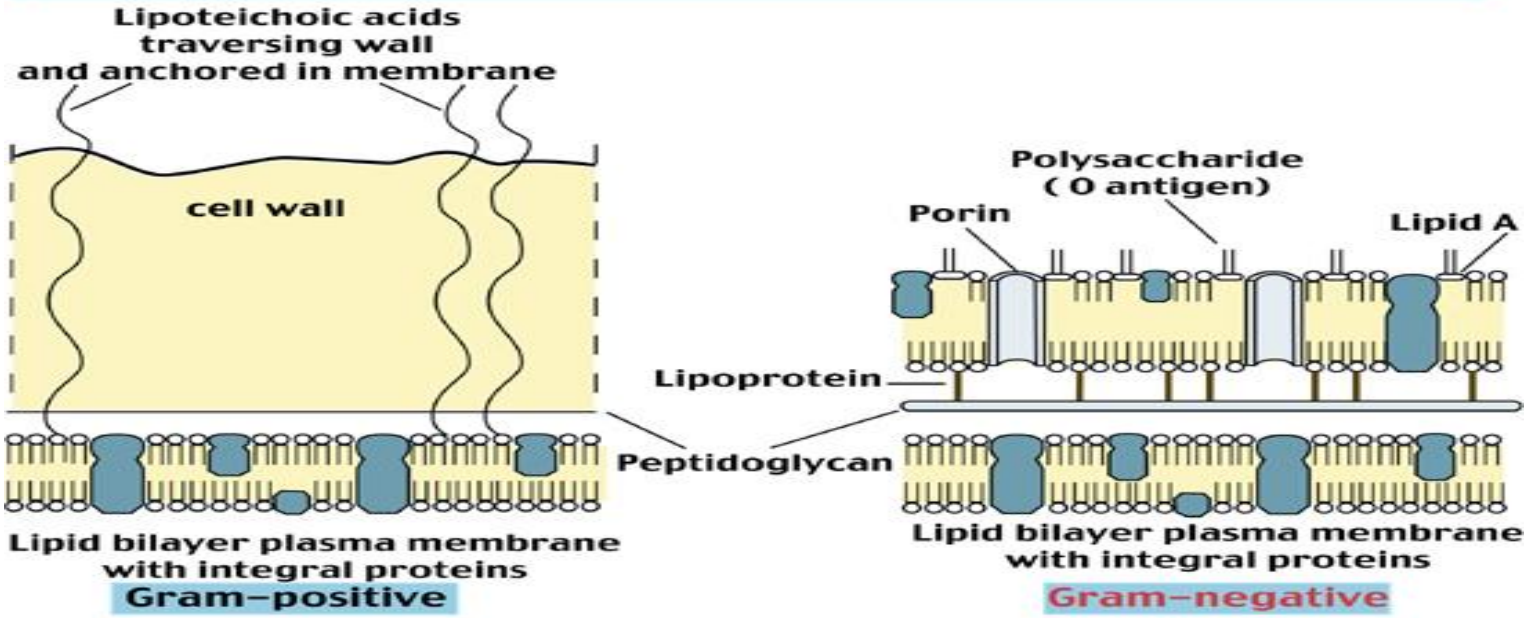
G+ bacilli


G- bacilli

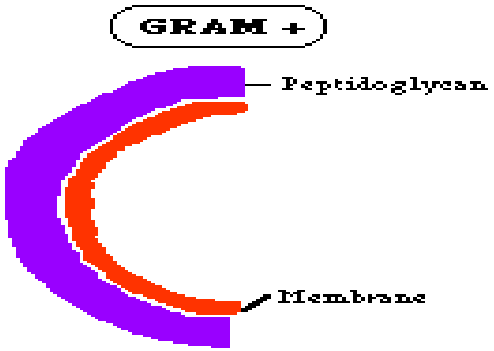

G+ cocci

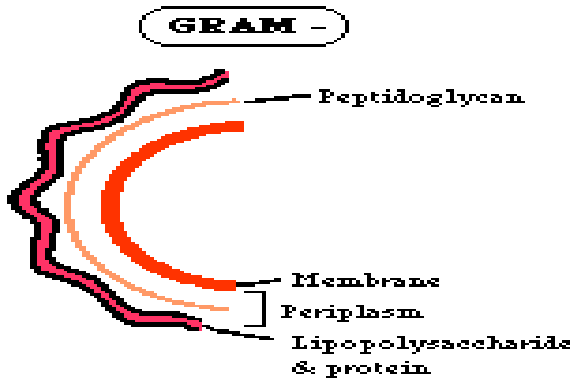

G- cocci

# BACTERIAL CELL WALLS

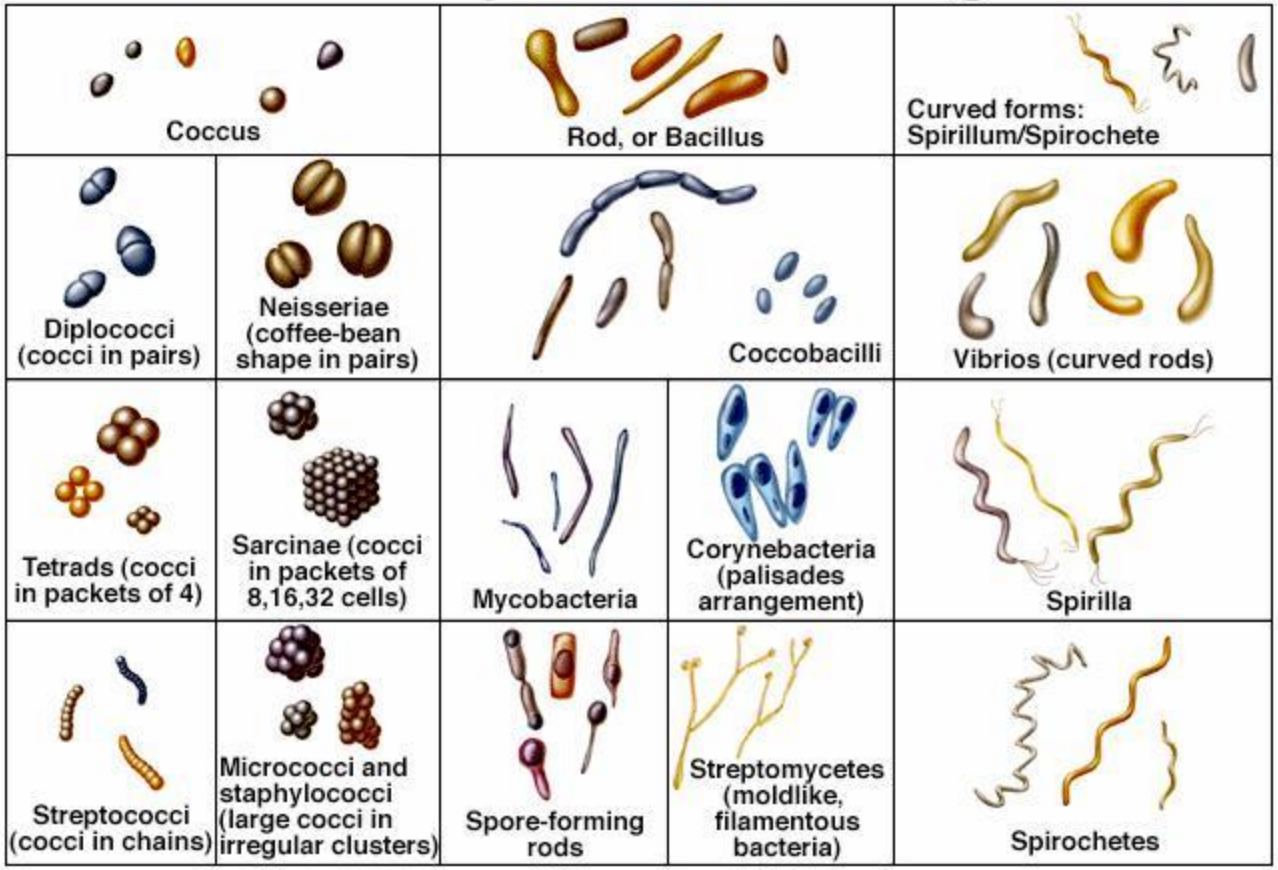


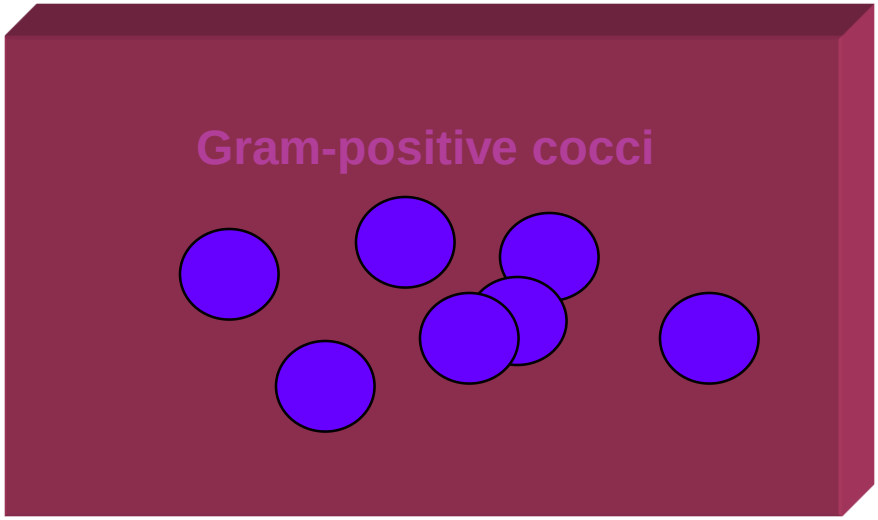


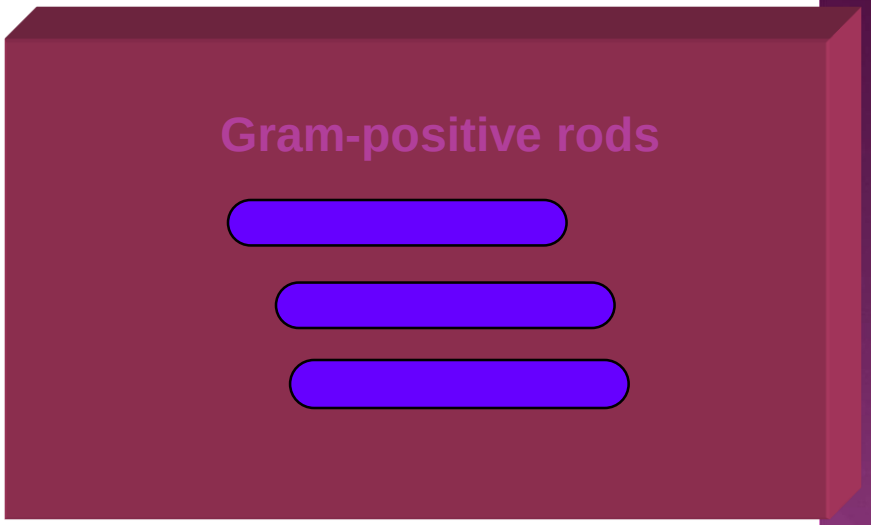



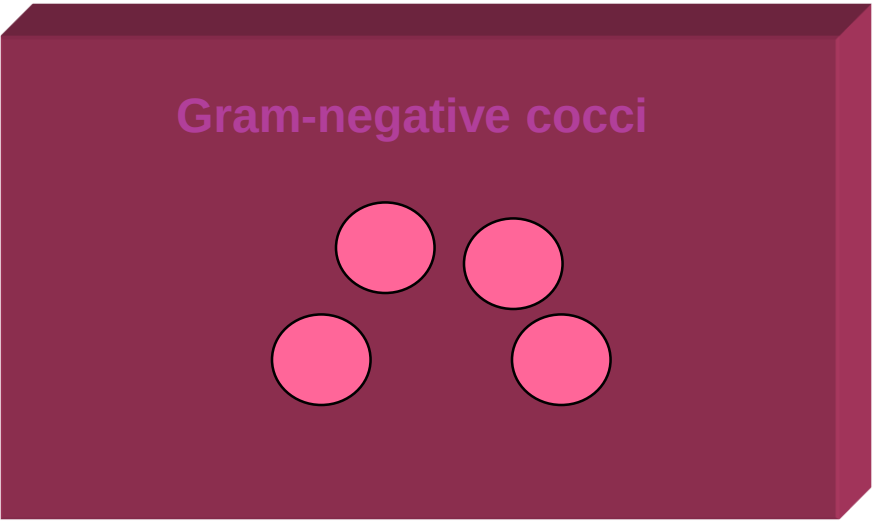



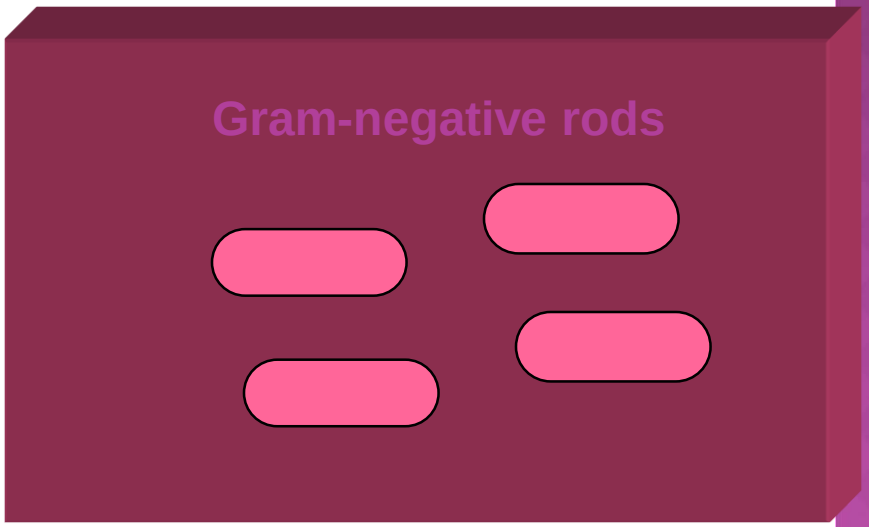
# Bacterial shapes and arrangements

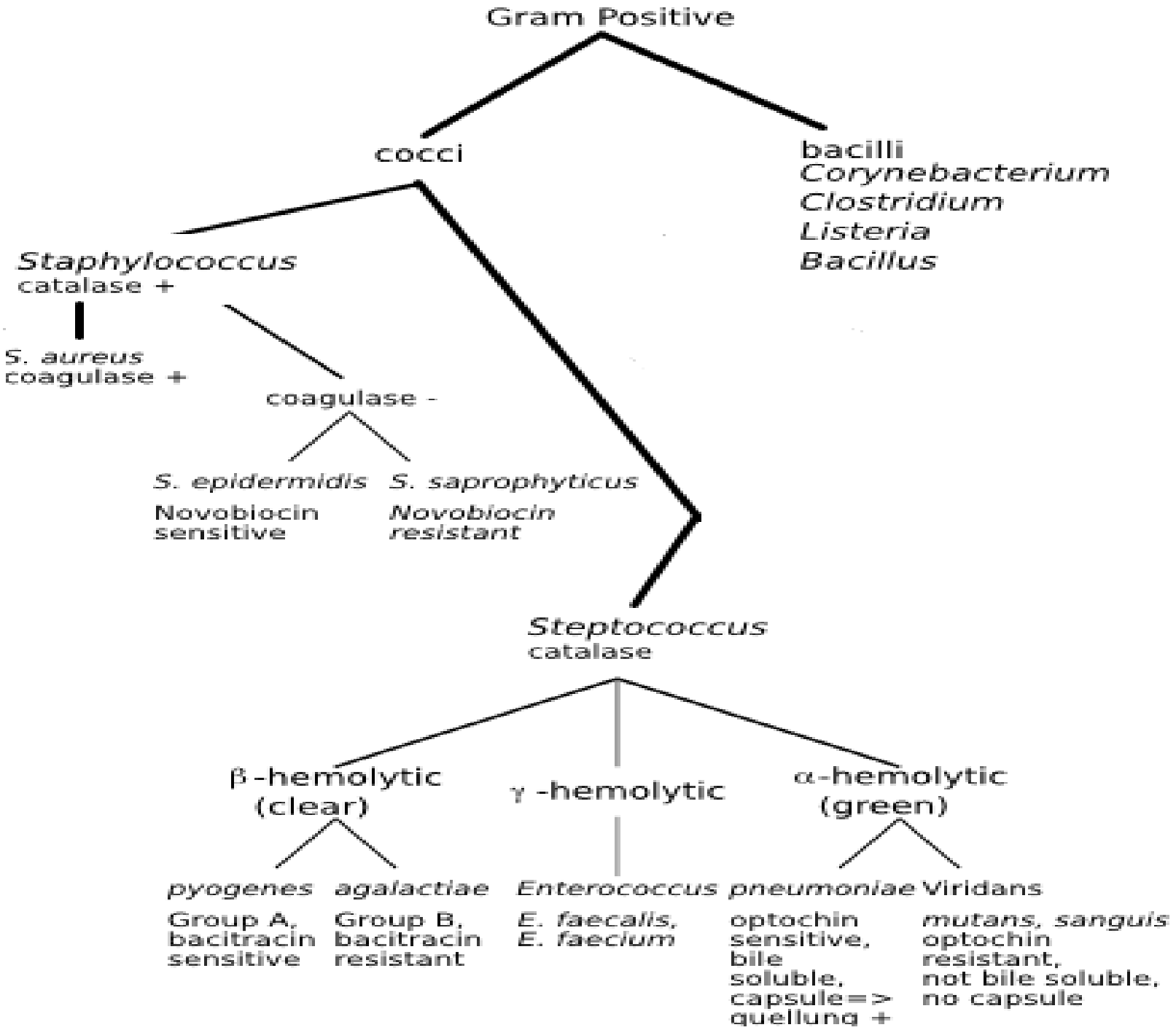


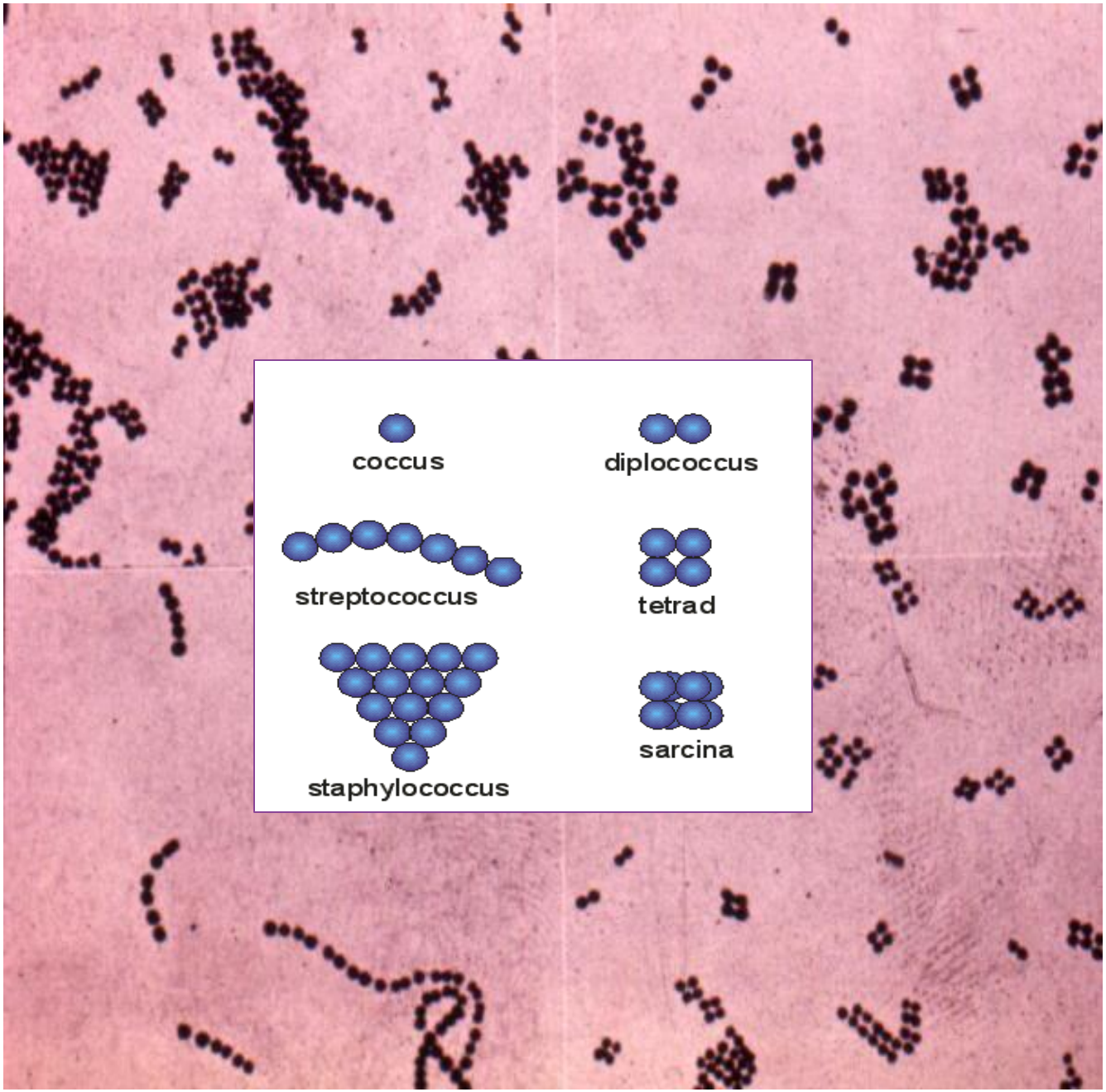

Gram-positive cocci

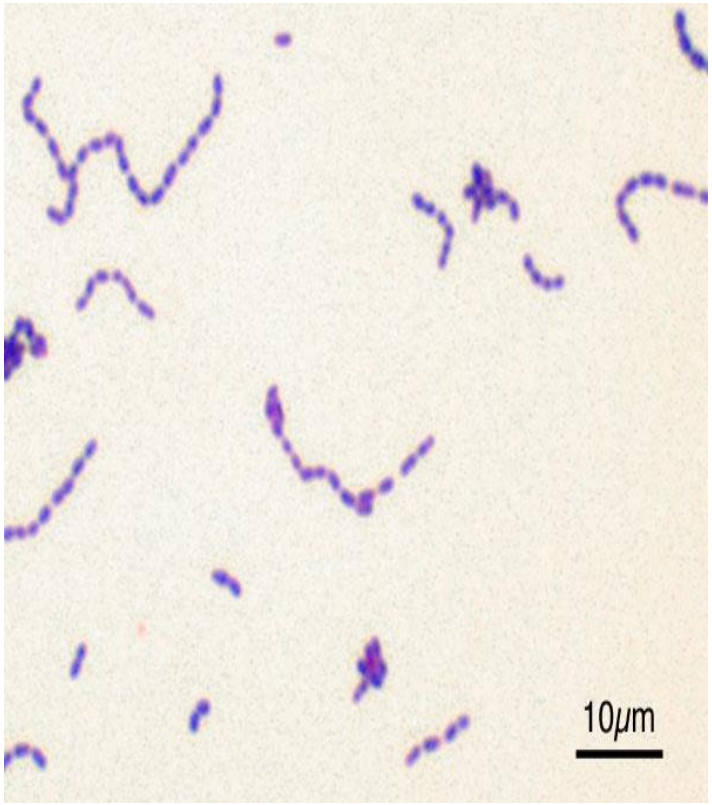

Gram-positive rods


Gram-negative cocci


Gram-negative rods

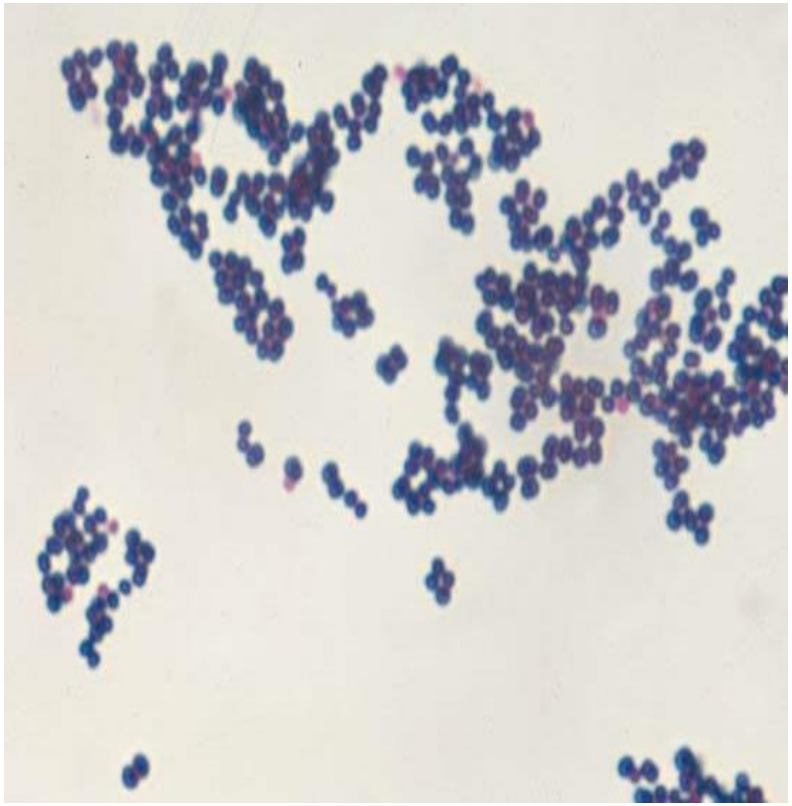

Gram Positive
cocci
bacilli
Corynebacterium
Clostridium
Listeria
Bacillus
Staphylococcus
catalase +
S. aureus
coagulase +
coagulase -
S. epidermidis
Novobiocin
sensitive
S. saprophyticus
Novobiocin
resistant
Steptococcus
catalase
β -hemolytic
(clear)
γ -hemolytic
α-hemolytic
(green)
pyogenes
Group A,
bacitracin
sensitive
agalactiae
Group B,
bacitracin
resistant
Enterococcus
E. faecalis,
E. faecium
pneumoniae
optochin
sensitive,
bile
soluble,
capsule=>
quellung +
Viridans
mutans, sanguis
optochin
resistant,
not bile soluble,
no capsule


coccus
diplococcus
streptococcus
tetrad
staphylococcus
sarcina




Gram positive cocci in chain

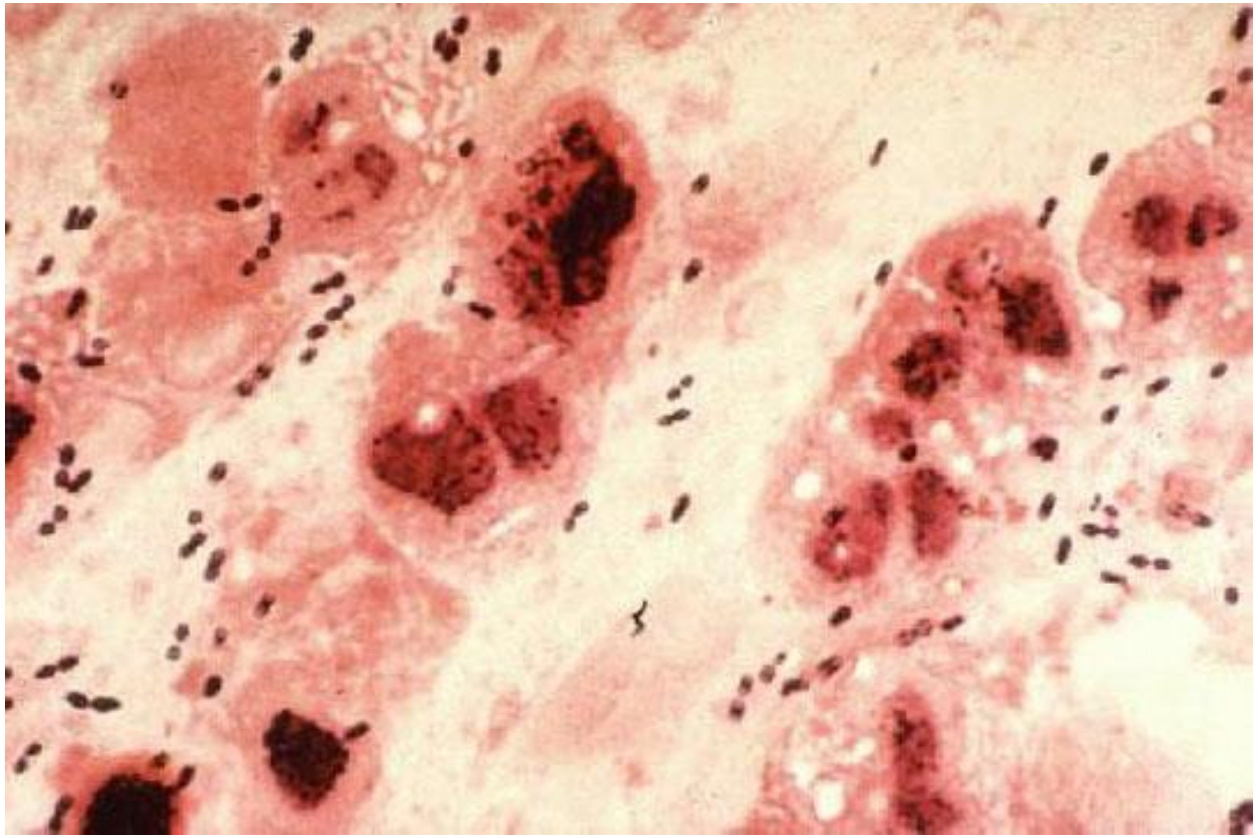
**Streptococci**



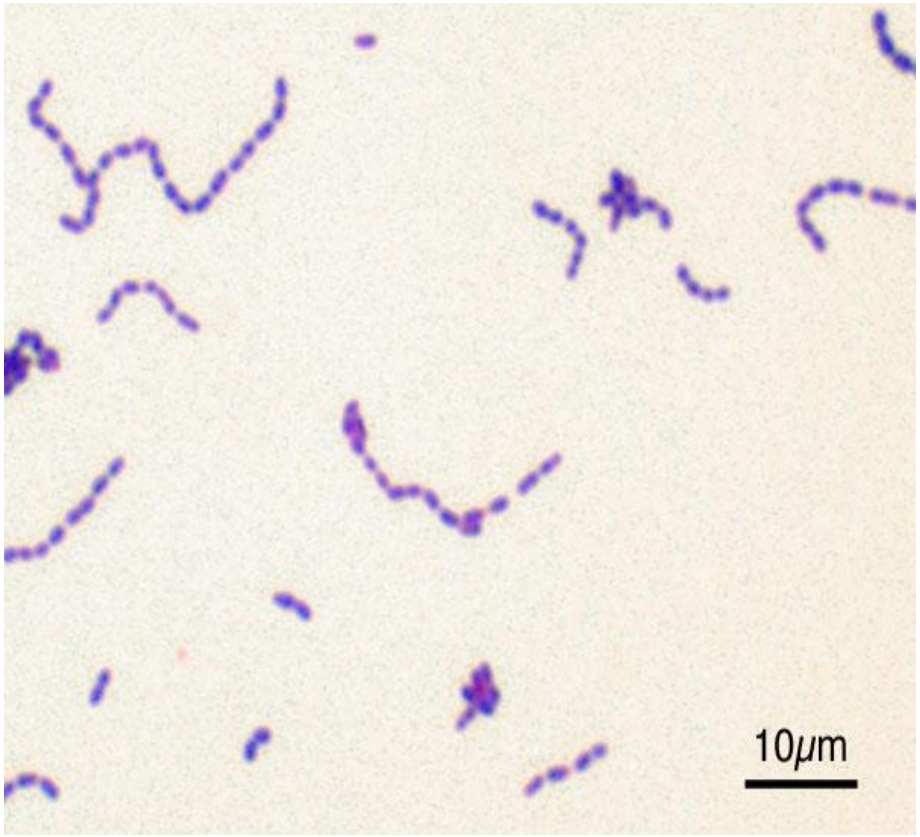
**Gram positive cocci in clusters**

**Staphylococci**

A gram-stained smear of a CSF sample from a 3 year old child seen in the emergency department presenting with fever and neck stiffness.



**Gram-positive diplococci**
***Streptococcus pneumoniae***

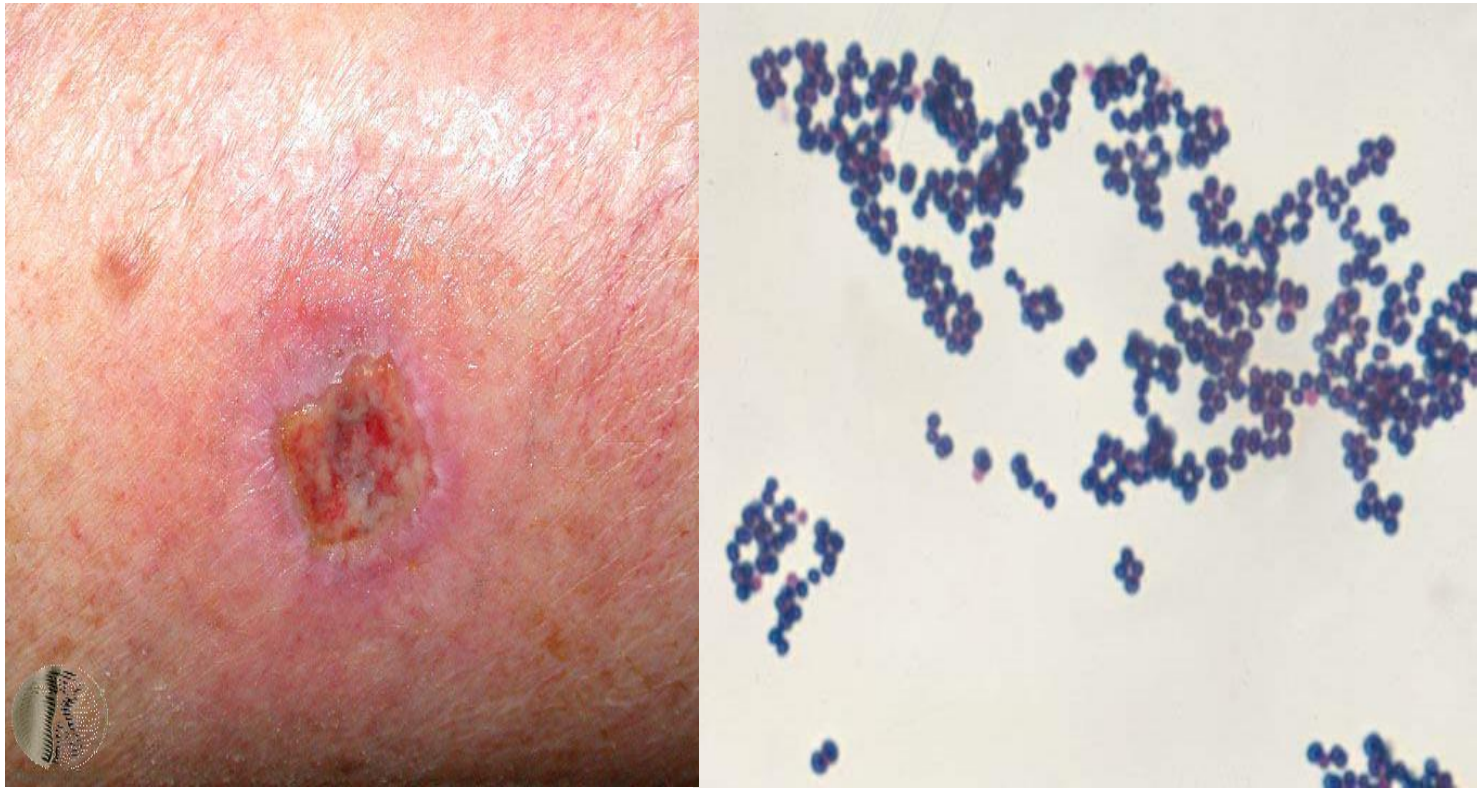



This is a bacterium isolated from a child with sore throat and tonsillitis .

A: Describe the Gram stain — Gram positive

B: Describe the shape and arrangement of the bacteria — Cocci in chains

**Following is the Gram stained smear of an organism isolated from a wound infection.**

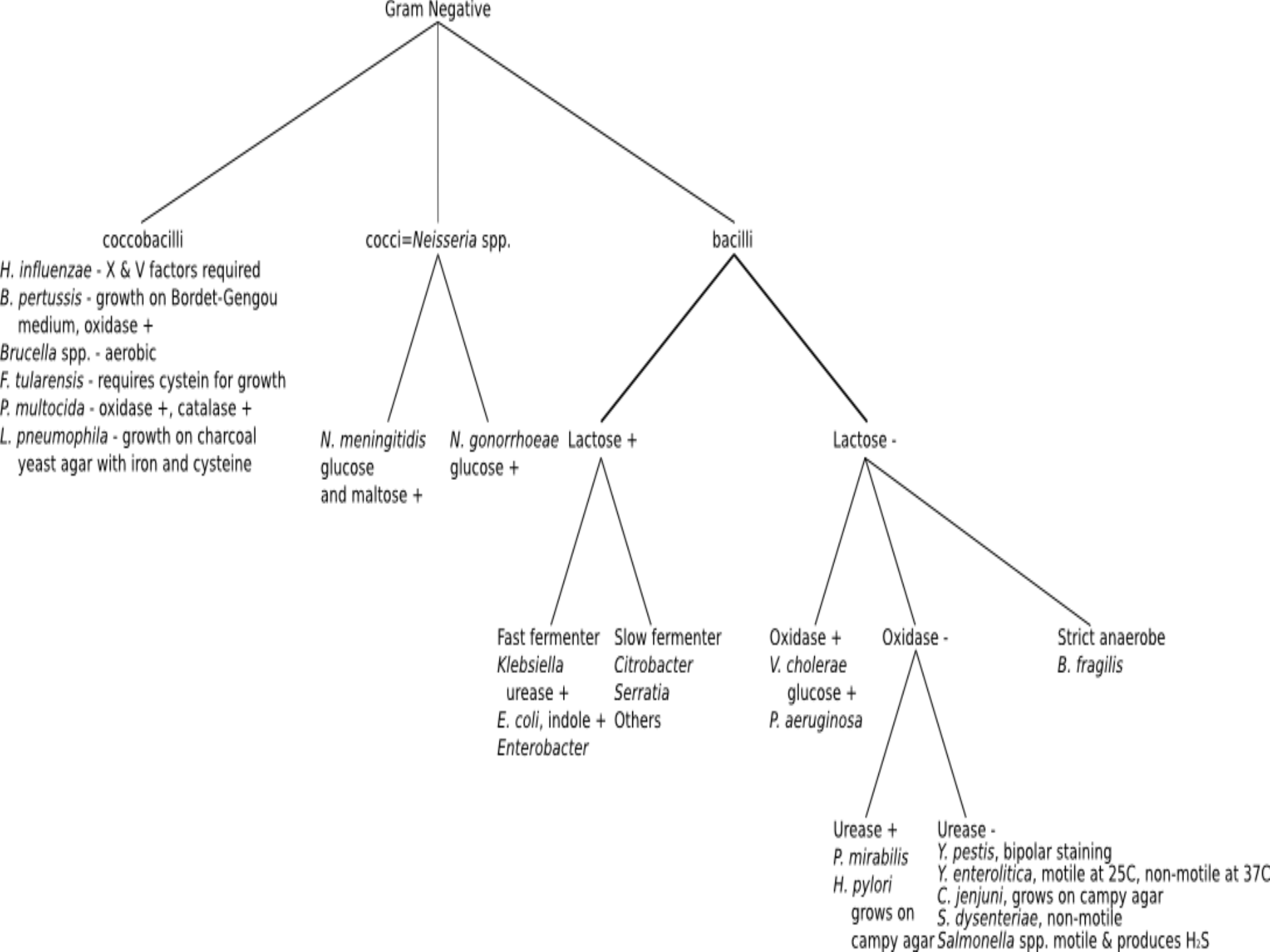


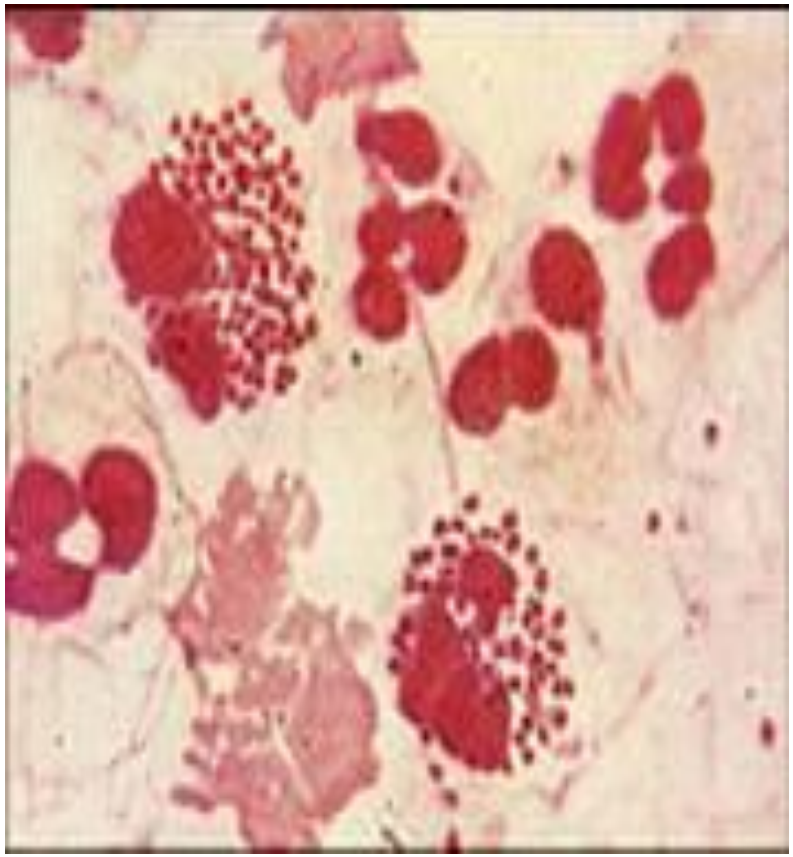
Describe what you see in the slide above

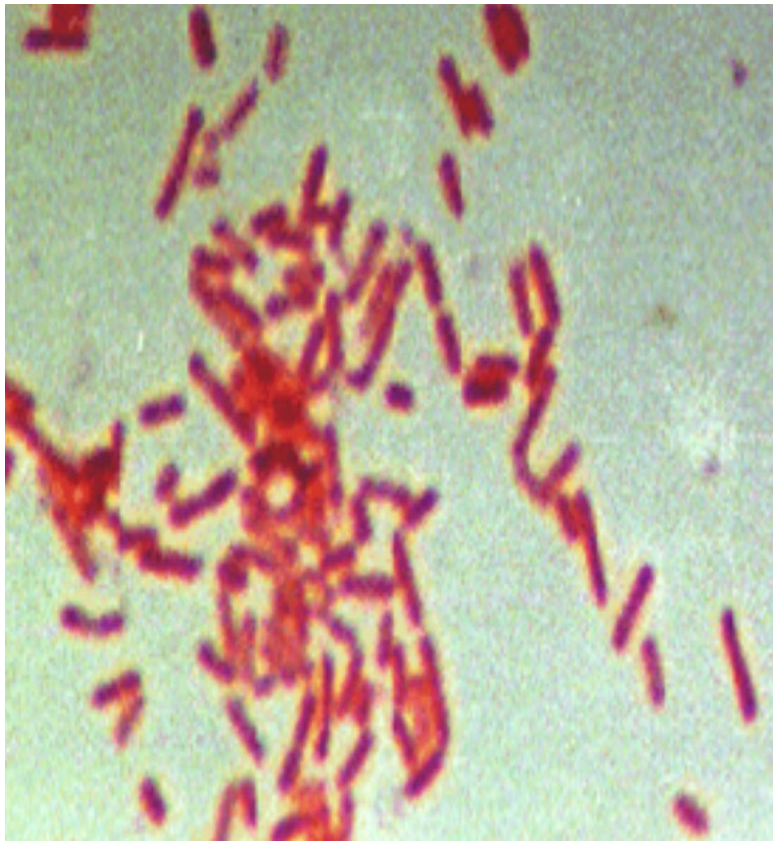
Gram-positive cocci

What is the likely organism

Staphylococcus aureus


Gram Negative
coccobacilli
cocci=*Neisseria* spp.
bacilli
*H. influenzae* - X & V factors required
*B. pertussis* - growth on Bordet-Gengou medium, oxidase +
*Brucella* spp. - aerobic
*F. tularensis* - requires cystein for growth
*P. multocida* - oxidase +, catalase +
*L. pneumophila* - growth on charcoal yeast agar with iron and cysteine
*N. meningitidis* glucose and maltose +
*N. gonorrhoeae* glucose +
Lactose +
Lactose -
Fast fermenter *Klebsiella* urease + *E. coli*, indole + *Enterobacter*
Slow fermenter *Citrobacter* *Serratia* Others
Oxidase + *V. cholerae* glucose + *P. aeruginosa*
Oxidase -
Strict anaerobe *B. fragilis*
Urease + *P. mirabilis* *H. pylori* grows on campy agar
Urease - *Y. pestis*, bipolar staining *Y. enterolitica*, motile at 25C, non-motile at 37C *C. jenjuni*, grows on campy agar *S. dysenteriae*, non-motile *Salmonella* spp. motile & produces $H_2S$





Gram negative cocci

(Diplococci )

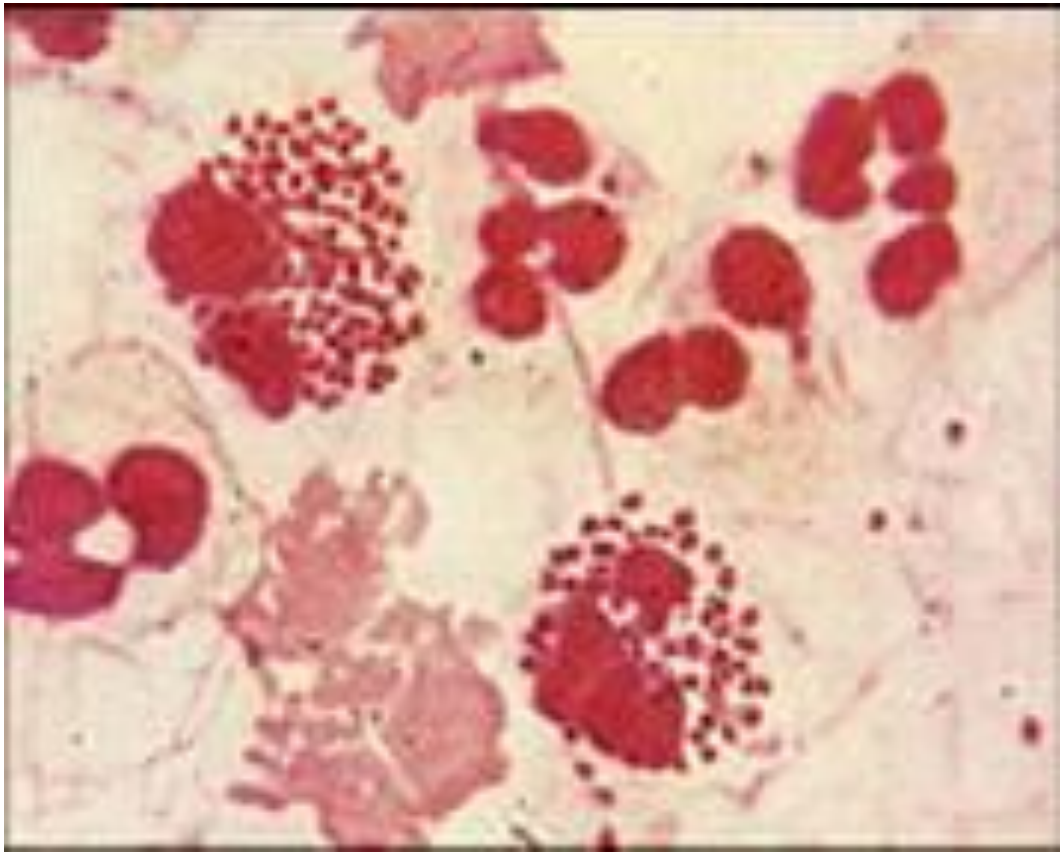
*e.g Neisseria*

**Gram negative bacilli**

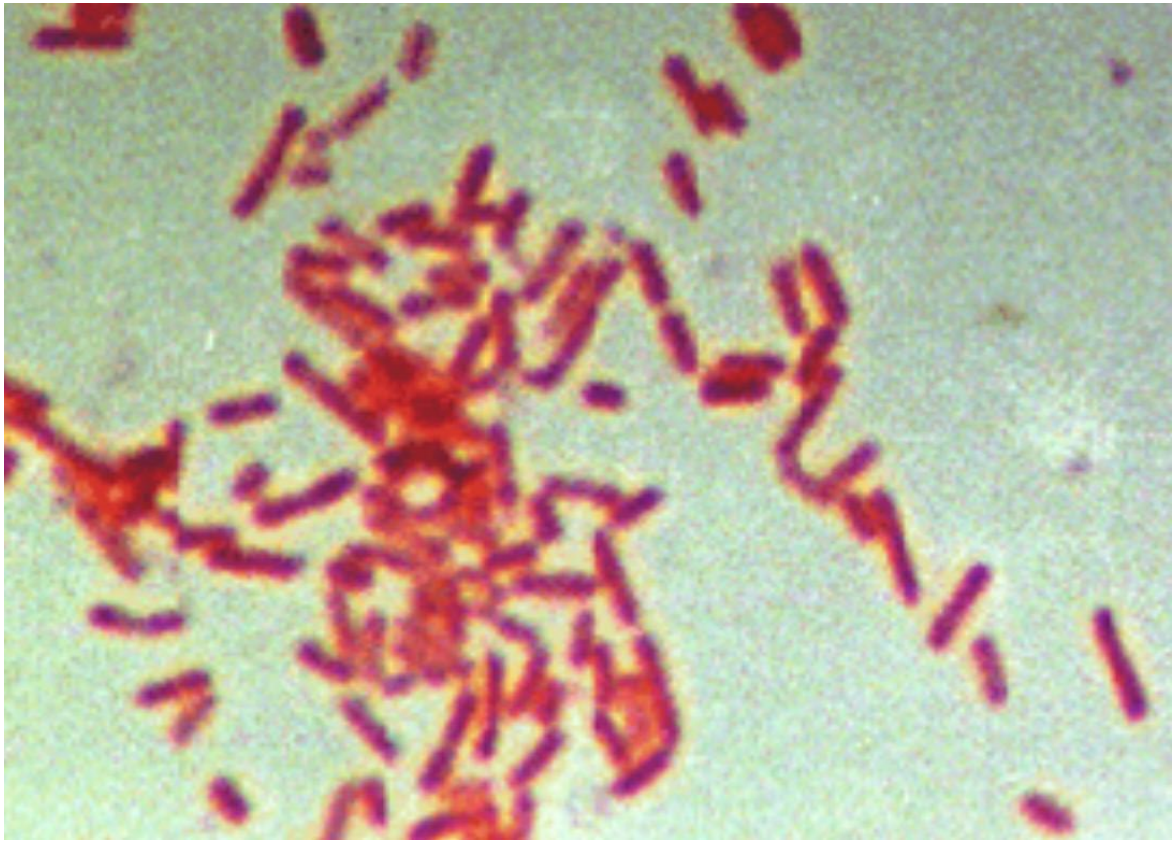
*e.g E. coli*

*Salmonella*

**Following is the Gram-stained smear of from urethra of a 25 –year old male complaining of urethral discharge**



| | |
|---|---|
| Describe the Gram stain of the intracellular bacteria | Gram negative |
| Describe the shape of the bacteria | cocci ( diplococci) |



**Describe the Gram stain of this organism:** Gram negative

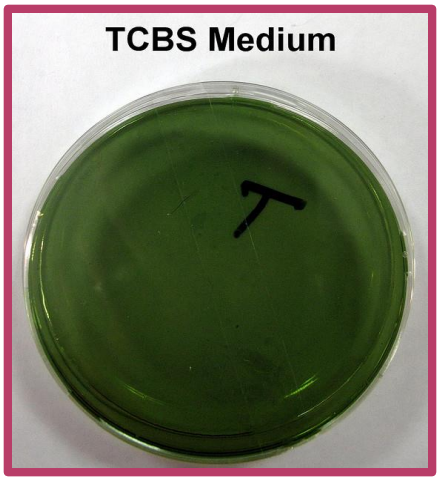
**Describe its shape** **bacilli ( rods )**

# Microbial growth or culture media


a general culture medium

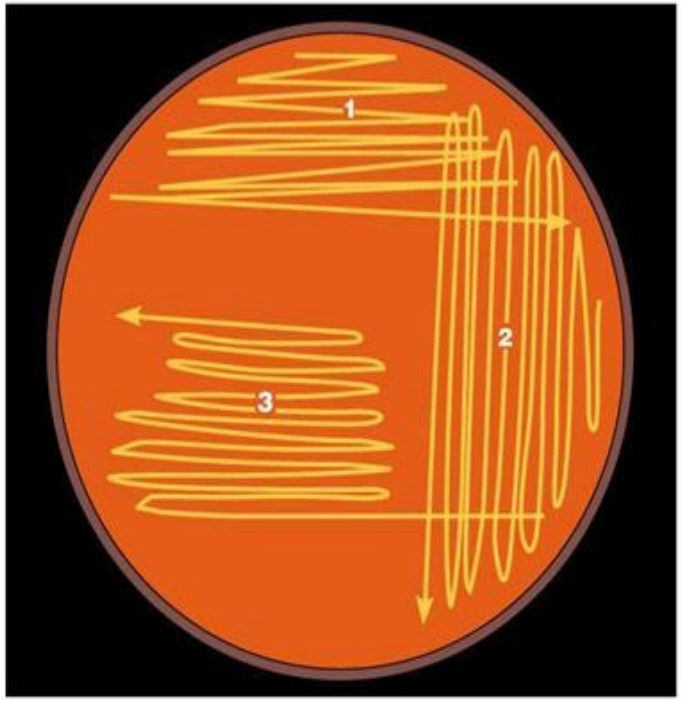

an enriched media


a differential media

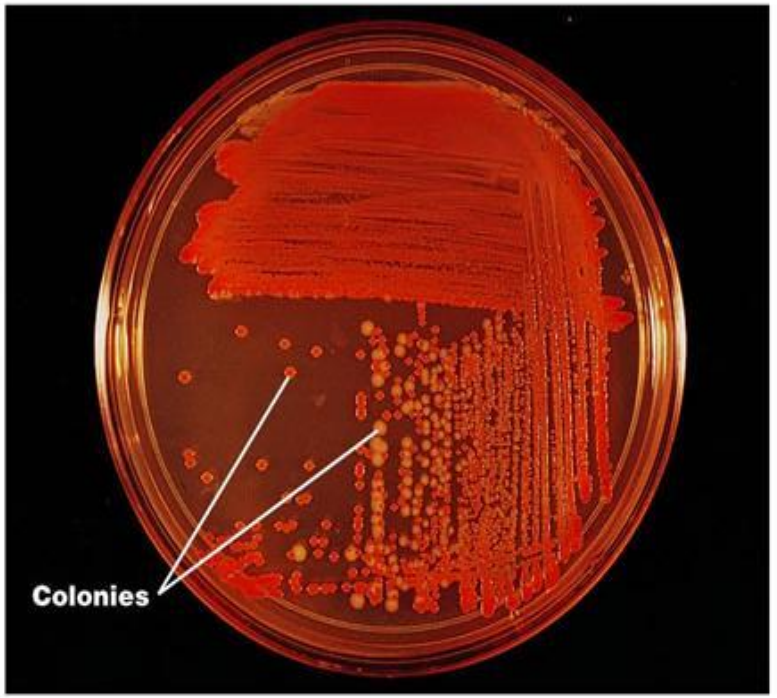



Thiosulphate citrate bile salt sucrose ( TCBS) **is a selective medium**

| Type | Purpose |
|---|---|
| **Chemically defined** | Growth of chemoautotrophs and photoautotrophs; microbiological assays. |
| **Complex** | Growth of most chemoheterotrophic organisms. |
| **Reducing** | Growth of obligate anaerobes. |
| **Selective** | Suppression of unwanted microbes; encouraging desired microbes. |
| **Differential** | Differentiation of colonies of desired microbes from others. |
| **Enrichment** | Similar to selective media but designed to increase numbers of desired microbes to detectable levels. |




**(a)** The direction of streaking is indicated by arrows. Streak series 1 is made from the original bacterial culture. The inoculating loop is sterilized following each streak series. In series 2 and 3, the loop picks up bacteria from the previous series, diluting the number of cells each time. There are numerous variants of such patterns.

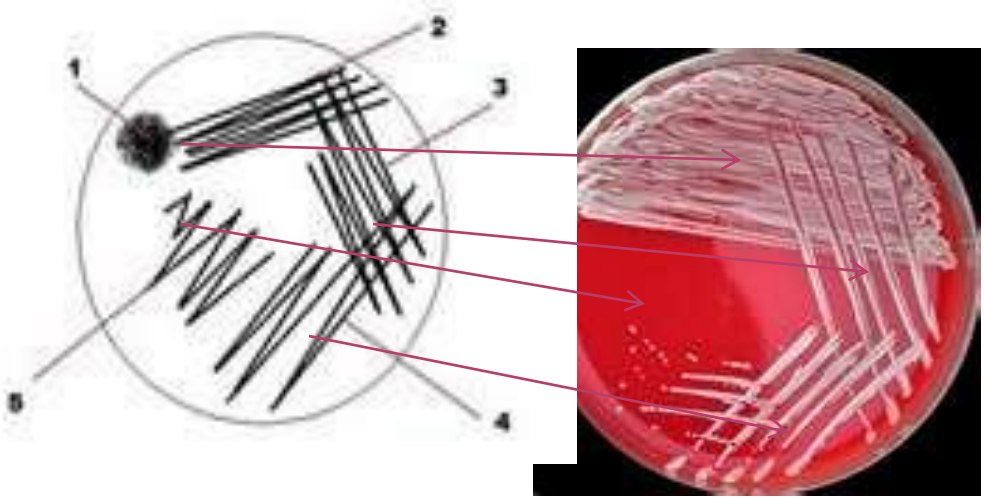



**(b)** In series 3 of this example, notice that well-isolated colonies of bacteria of two different types, red and yellow, have been obtained.

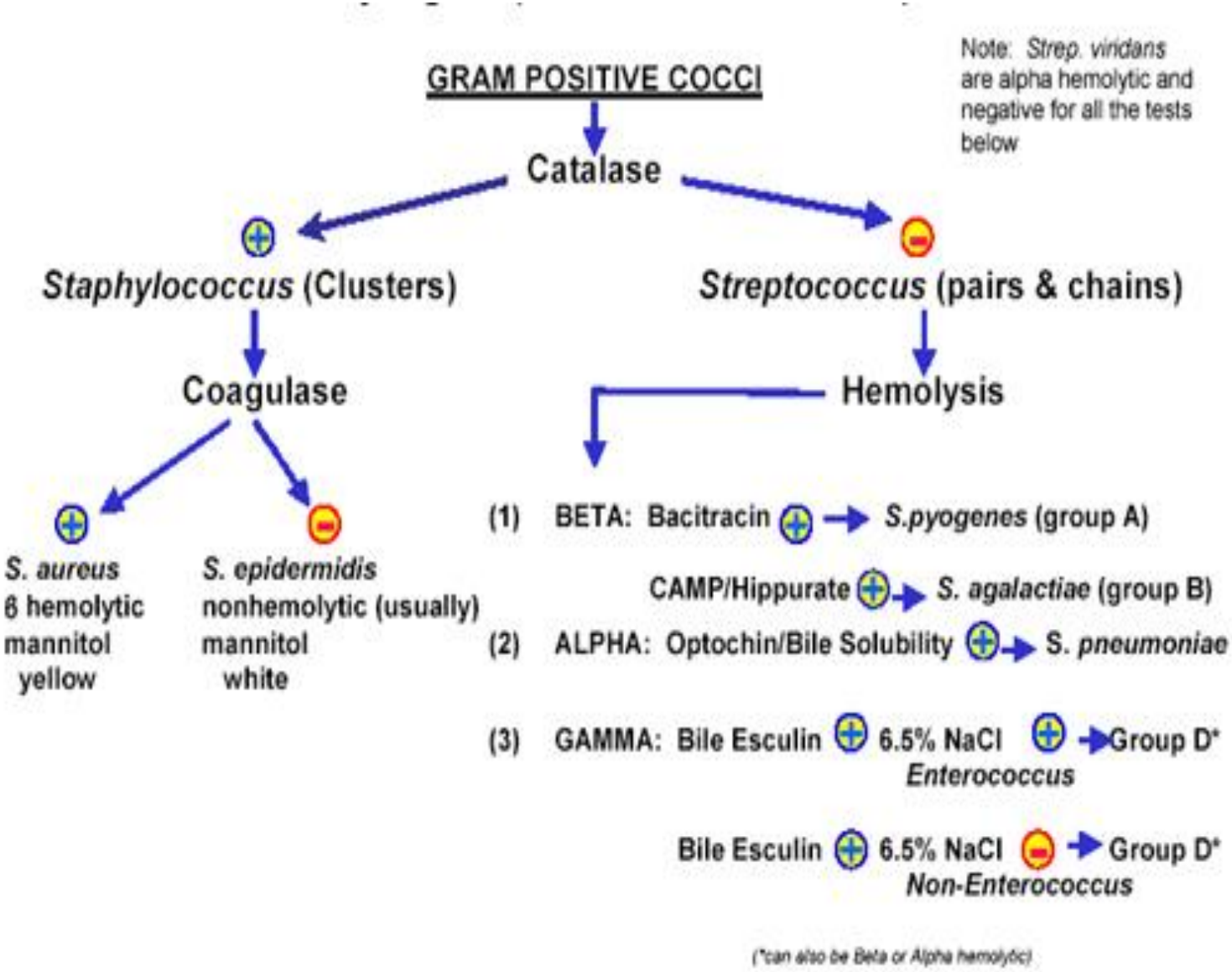


Figure 6.10 - Overview

Blood agar

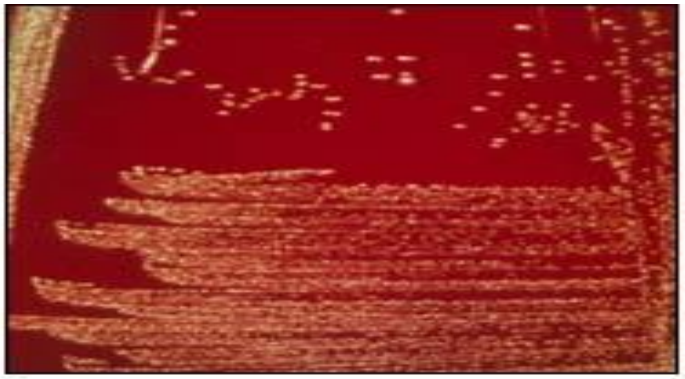



**This is a general culture medium used for culture of bacteria.**


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
6 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*
Enterococcus
Bile Esculin 6.5% NaCl → Group D*
Non-Enterococcus
(*can also be Beta or Alpha hemolytic)

# Identification of streptococci by hemolytic reaction

Gamma-hemolytic *Streptococcus* colonies

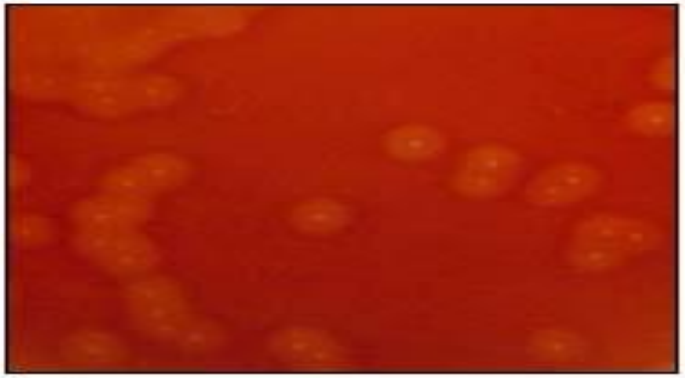


Gamma

Alpha-hemolytic *Streptococcus* colonies

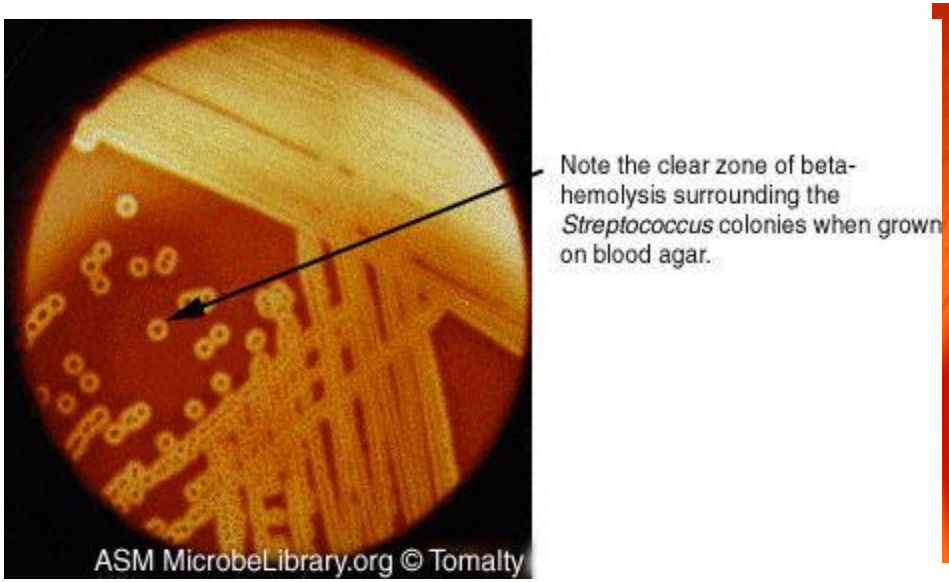
Alpha

Beta-hemolytic *Streptococcus* colonies

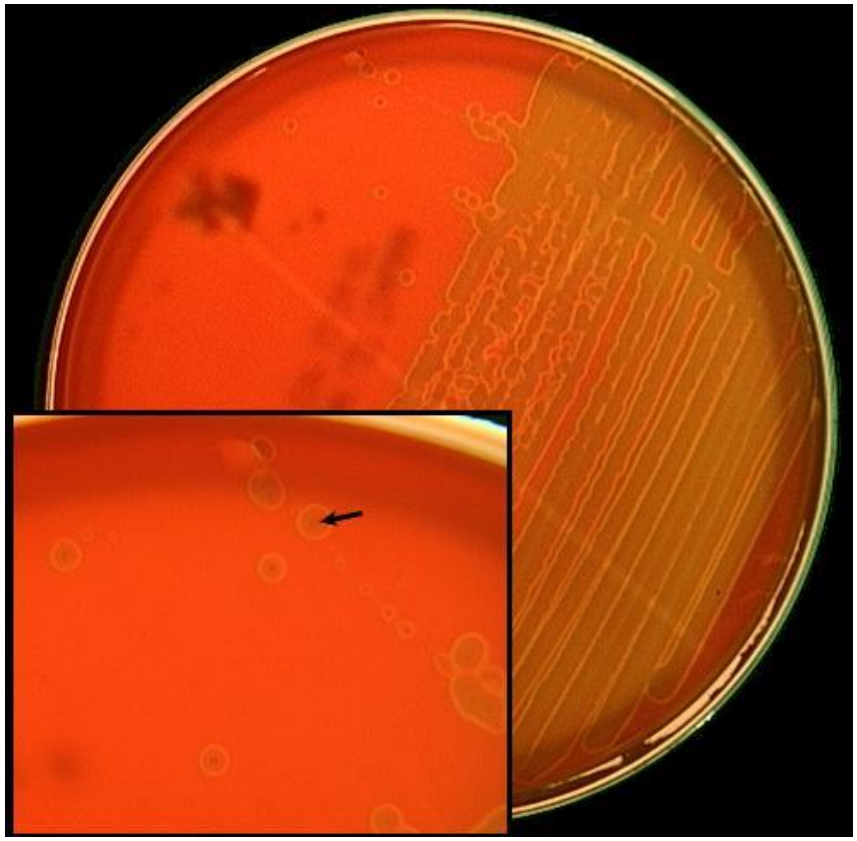


Beta

This is a blood agar growing beta hemolytic streptococci.

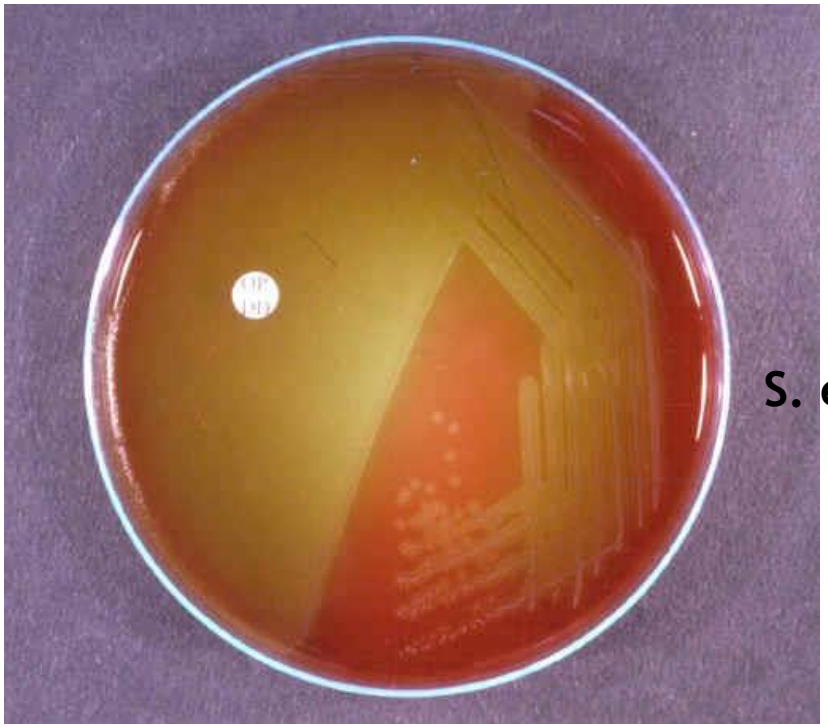



This culture was grown from a sputum specimen of a 60 year old man complaining of cough, fever and chest pain.

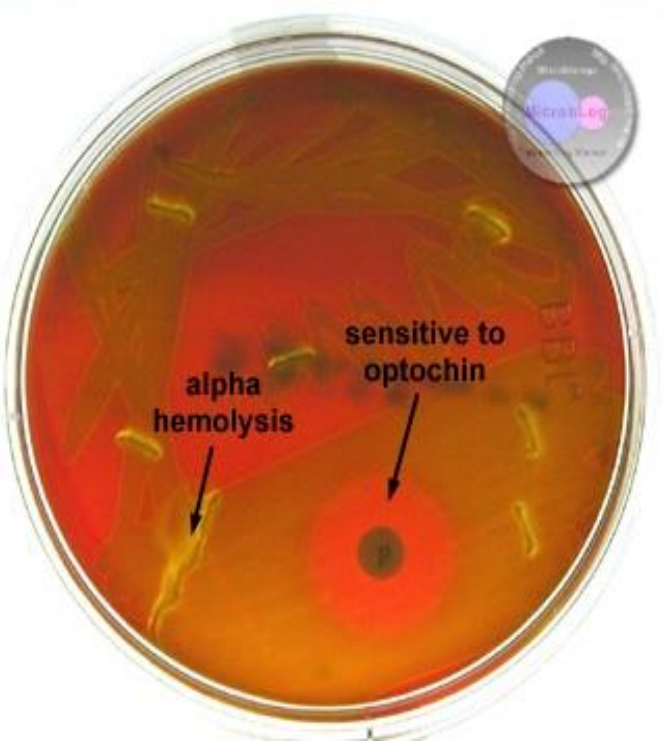


α hemolytic streptococci on blood agar

# Optochin test

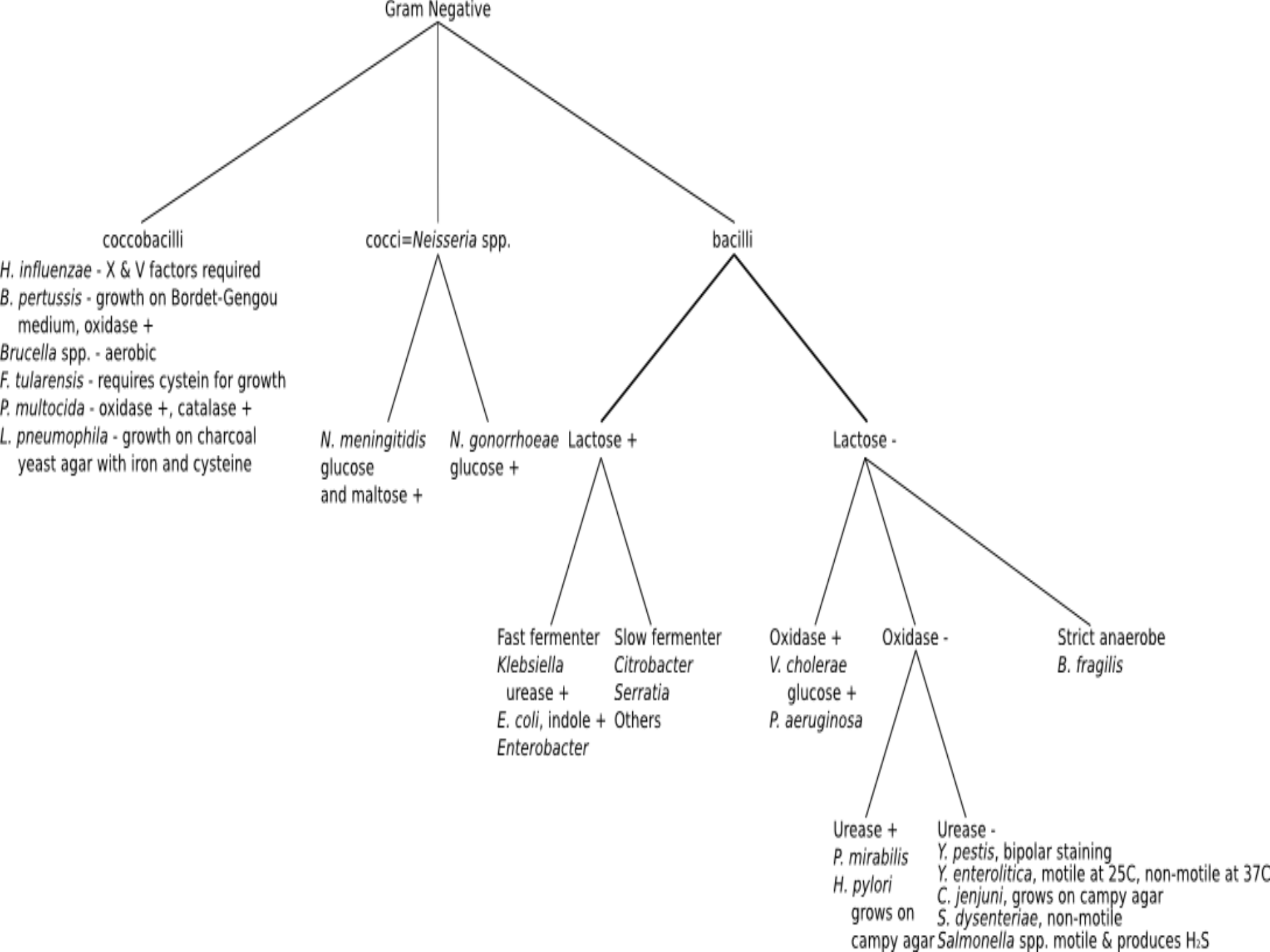


S. e

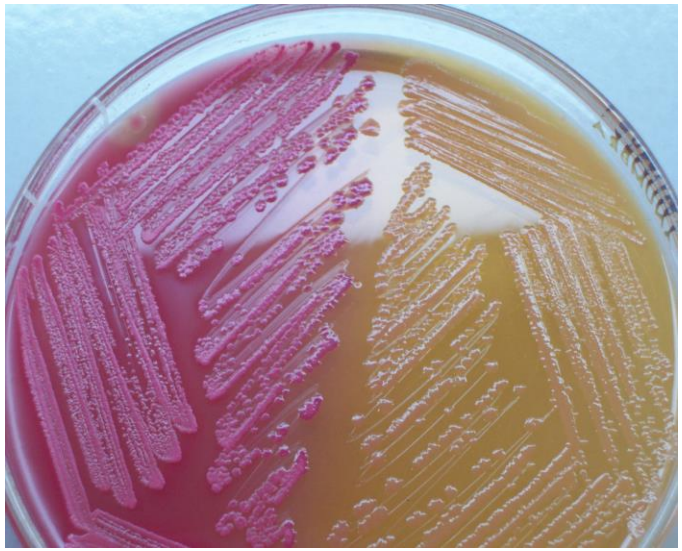



*S. viridans*

*S pneumonia*

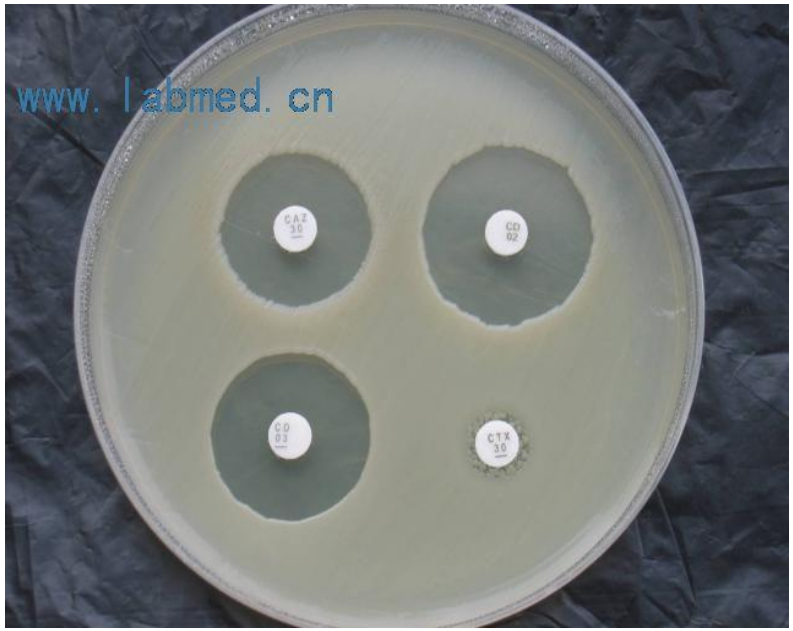

Gram Negative
coccobacilli
cocci=*Neisseria* spp.
bacilli
*H. influenzae* - X & V factors required
*B. pertussis* - growth on Bordet-Gengou medium, oxidase +
*Brucella* spp. - aerobic
*F. tularensis* - requires cystein for growth
*P. multocida* - oxidase +, catalase +
*L. pneumophila* - growth on charcoal yeast agar with iron and cysteine
*N. meningitidis* glucose and maltose +
*N. gonorrhoeae* glucose +
Lactose +
Lactose -
Fast fermenter *Klebsiella* urease + *E. coli*, indole + *Enterobacter*
Slow fermenter *Citrobacter* *Serratia* Others
Oxidase + *V. cholerae* glucose + *P. aeruginosa*
Oxidase -
Strict anaerobe *B. fragilis*
Urease + *P. mirabilis* *H. pylori* grows on campy agar
Urease - *Y. pestis*, bipolar staining *Y. enterolitica*, motile at 25C, non-motile at 37C *C. jenjuni*, grows on campy agar *S. dysenteriae*, non-motile *Salmonella* spp. motile & produces $H_2S$

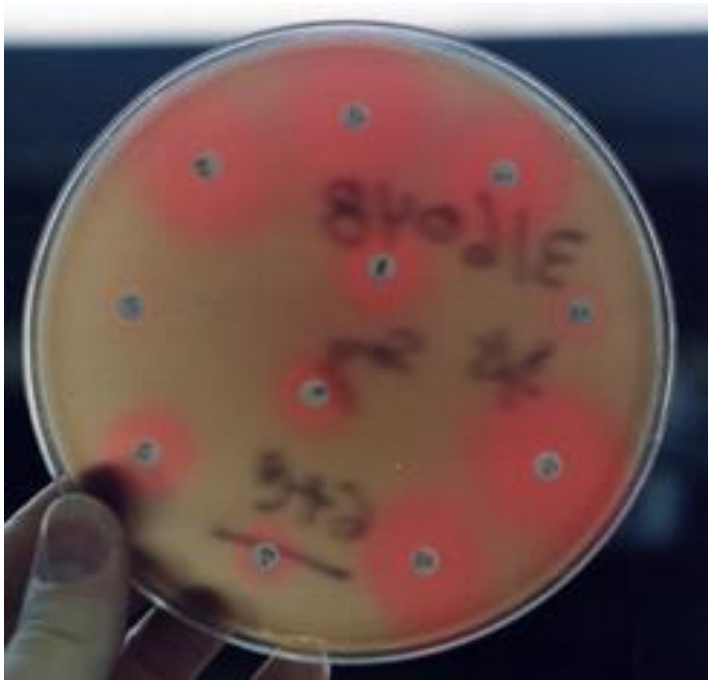
MacConkey's agar showing both lactose and non-lactose fermenting colonies. Lactose fermenting colonies are pink whereas non-lactose fermenting ones are colourless or appear same as the medium.}} |Source=Own work by upload



ASM MicrobeLibrary.org © Chamberlain

# Sensitivity testing



Name the medium

Blood agar

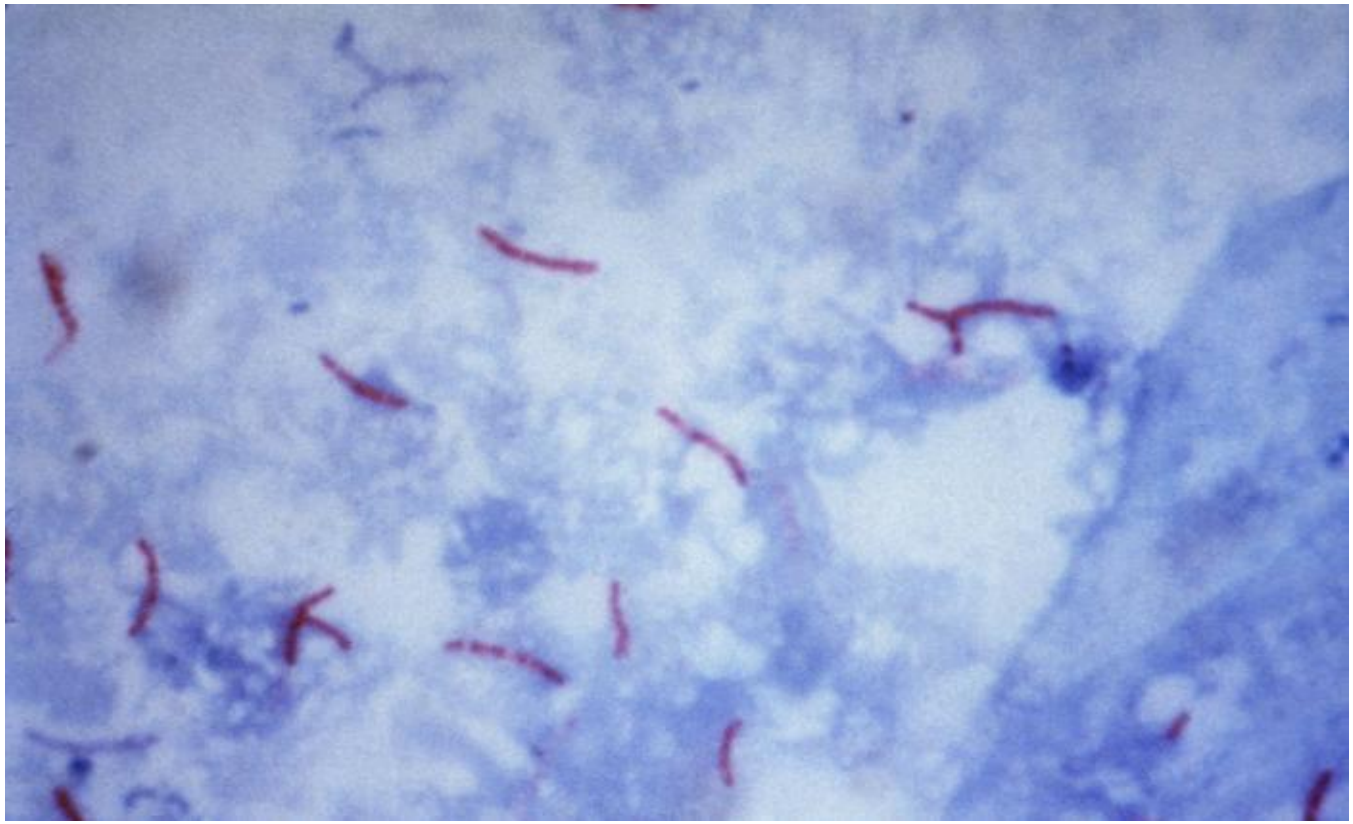
Name its most important ingredient (constituent)

Blood

Name its main use

Culture and isolate bacteria

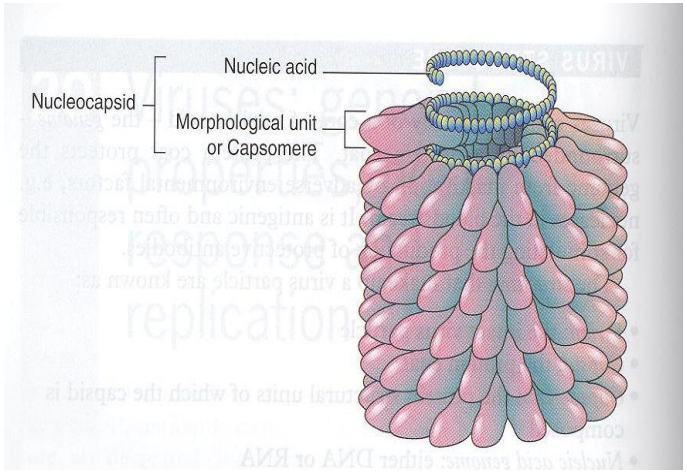
This is a special stain for a sputum of a patient complaining of chronic cough , fever loss of appetite and blood in coughed sputum.

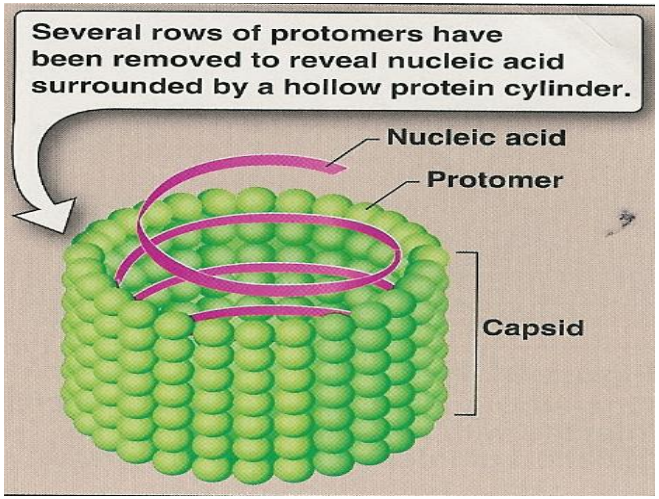


| | |
|---|---|
| A: Name the bacterium : | Mycobacterium tuberculosis |
| B: Name the disease | tuberculosis |

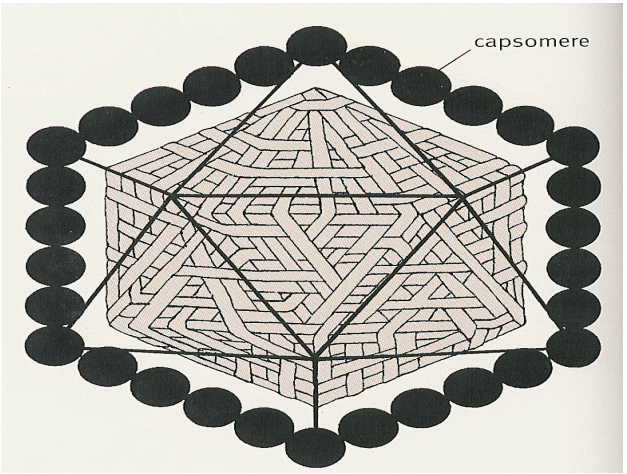
# VIRUSES

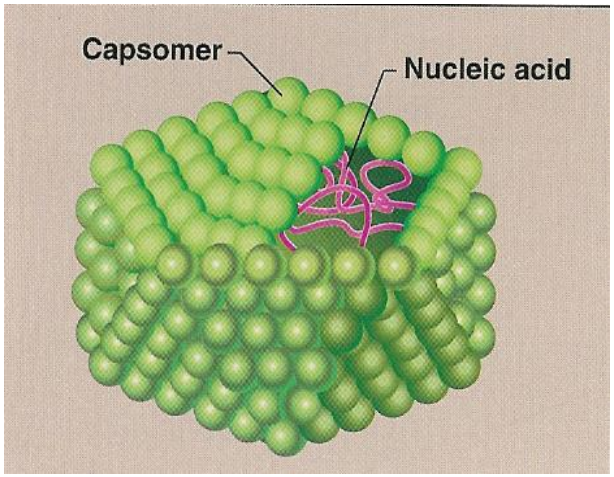
# Helical Virus



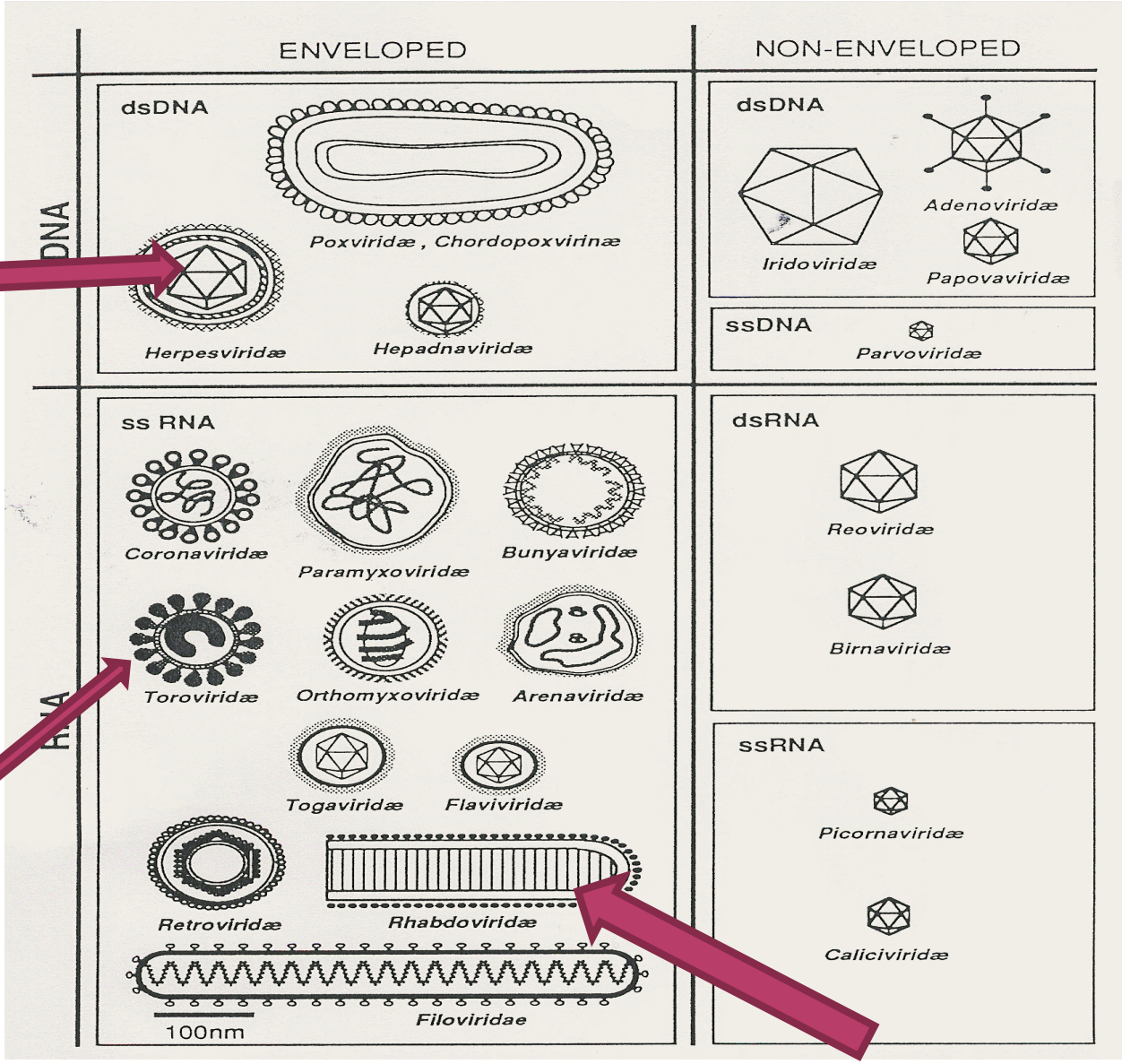




# Icosahedral Virus

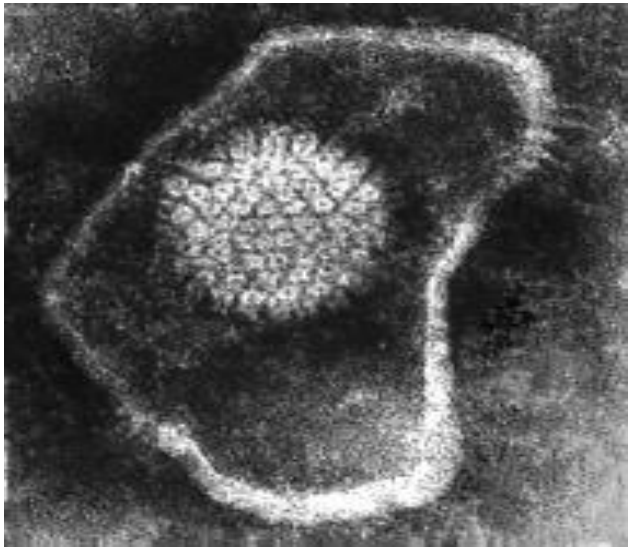


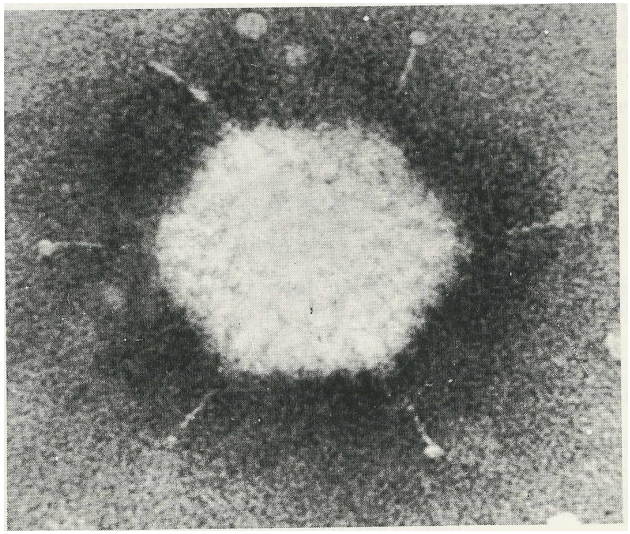
# Classification



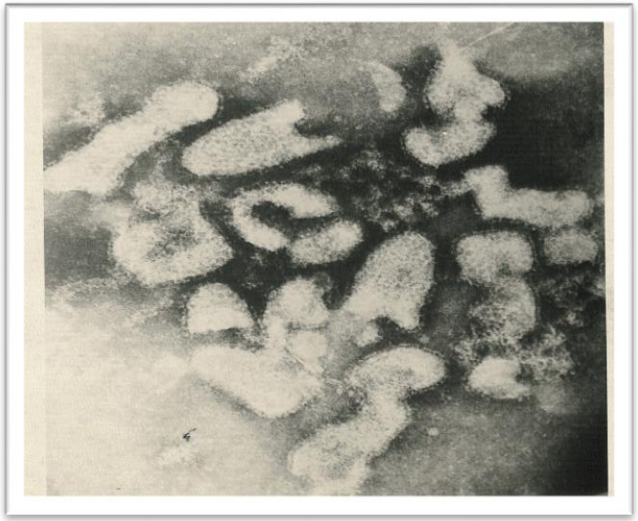
## Electron microscopy ; electron micrographs



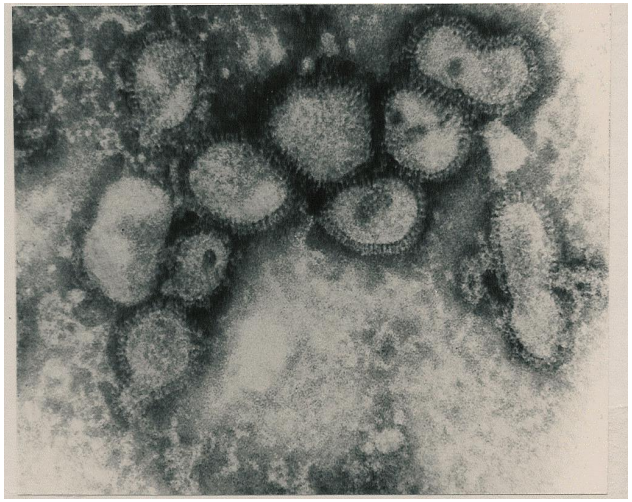
*Herpes virus*



*Adenovirus*

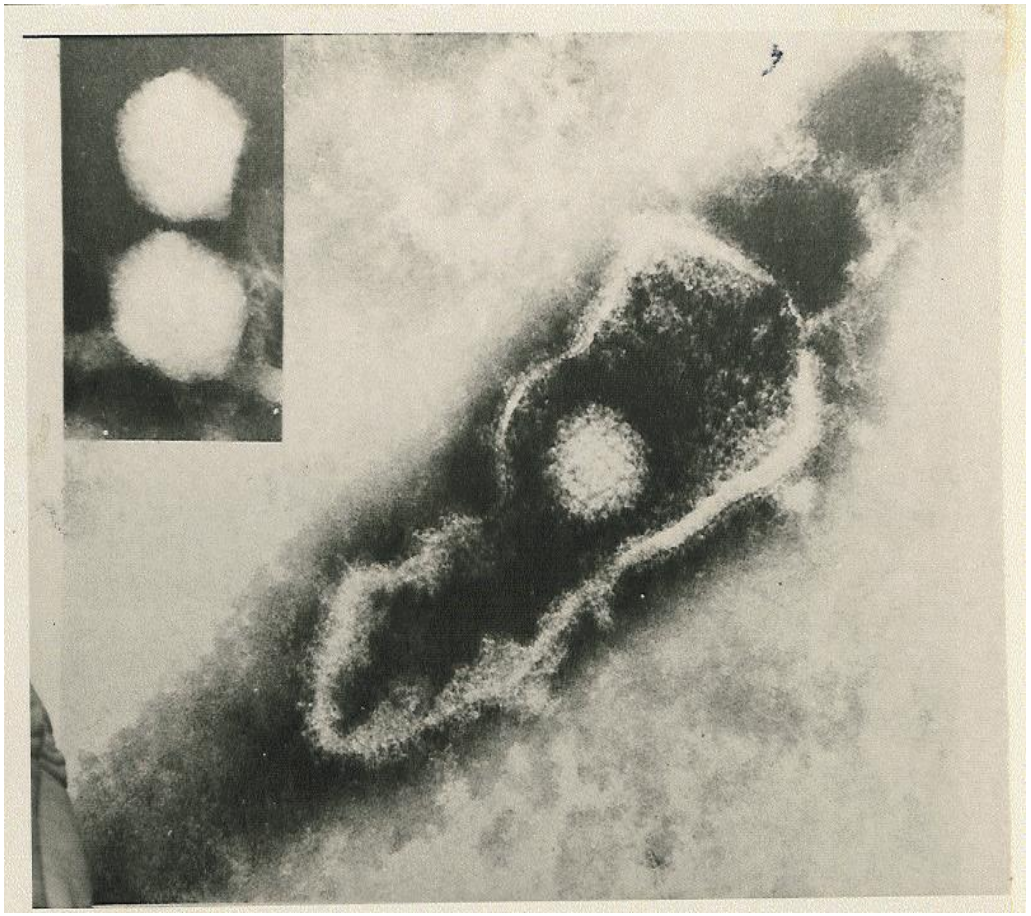


*Rabies virus*



*Influenza Viruses*

# *Herpes simplex virus -1 : Herpesviridae*



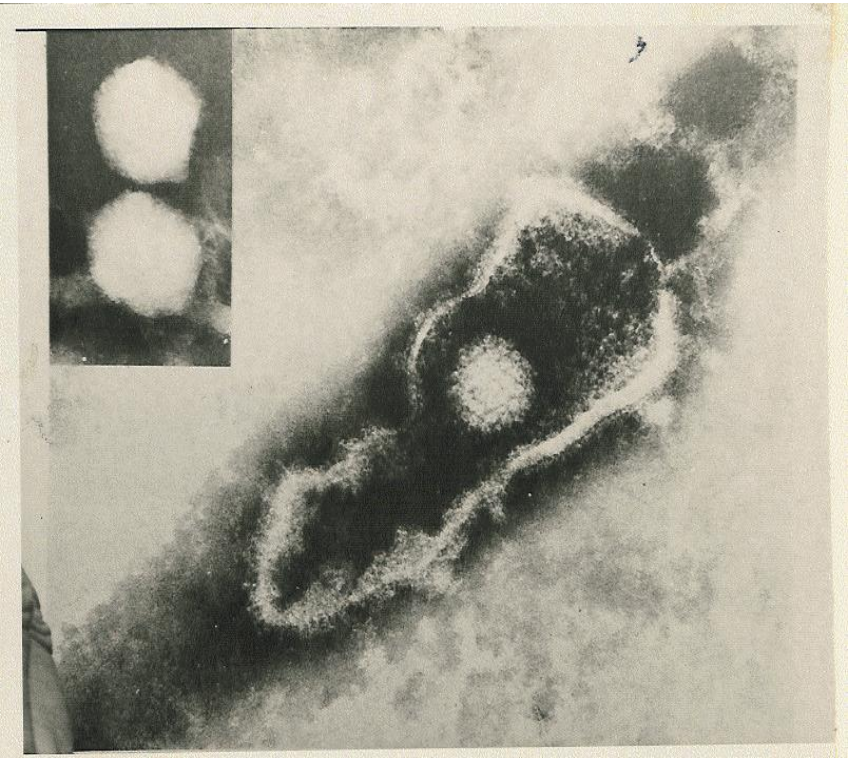
***Enveloped virus***

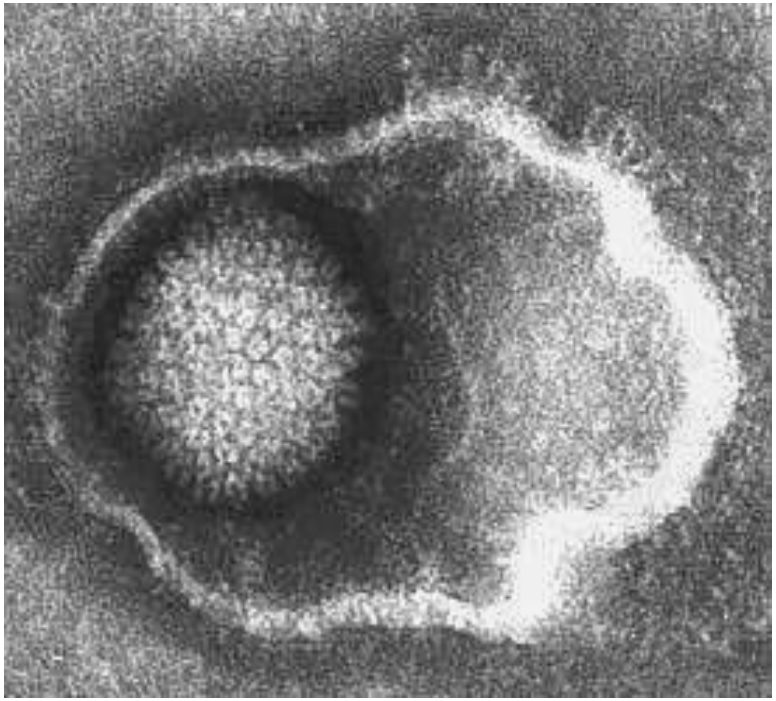
***Icosahedral capsid***

***d.s DNA genome***

***Loose envelope***

# These are electron micrographs of a virus





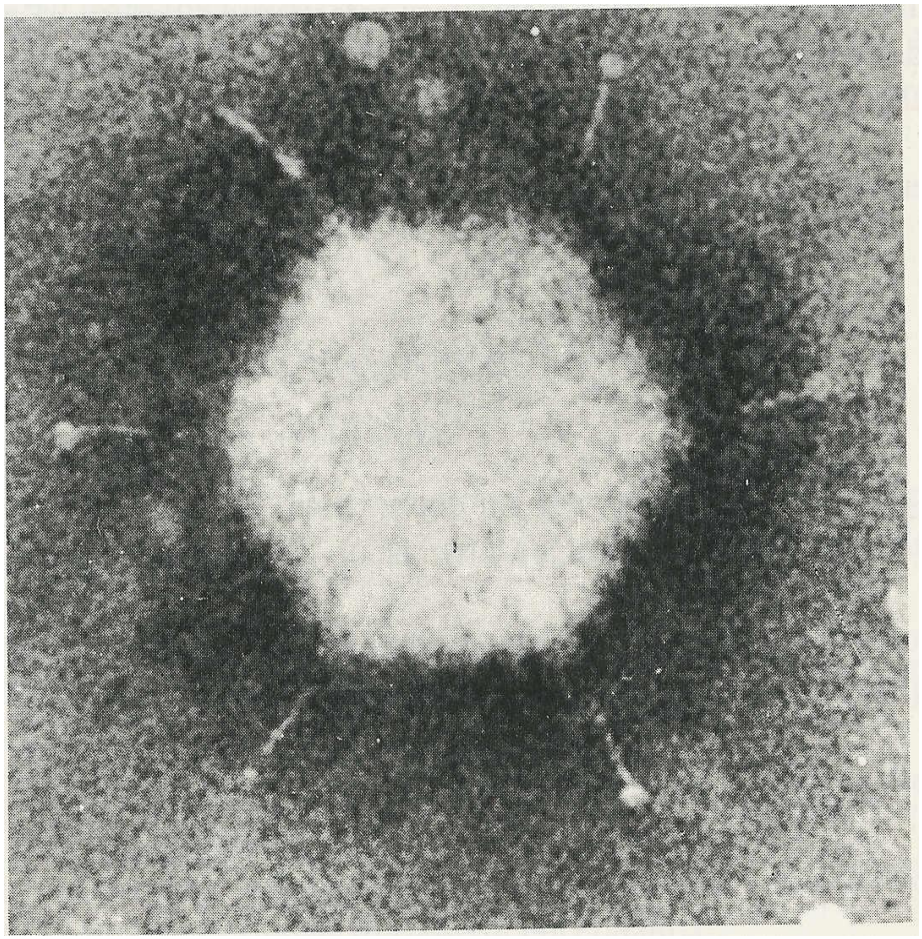
Q1: Name this virus

Herpes virus

Q2: Describe its structure.

Enveloped virus ,
Icosahedral capsid,
d.s DNA genome

# *Adenovirus : Adenoviridae*



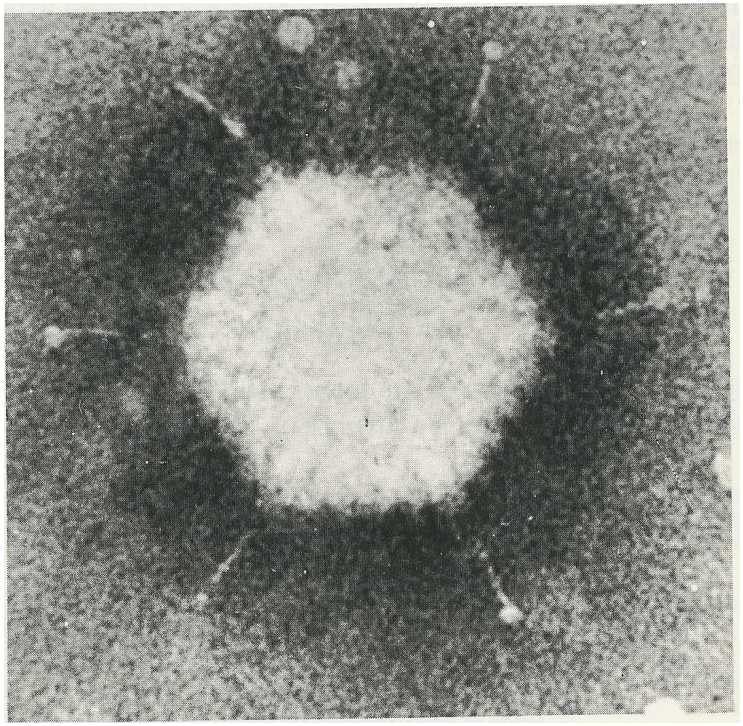
***Only V with fiber***

***Nonenveloped virus***

***Icosahedral capsid***

***d.s DNA genome***

# This is an electron micrograph of a virus



Q1: Name this virus

***Adenovirus***

Q2: Describe its structure.

***Nonenveloped virus,***

***Icosahedral capsid & d.s DNA genome***

# *Rabies virus: Rhabdoviridae*

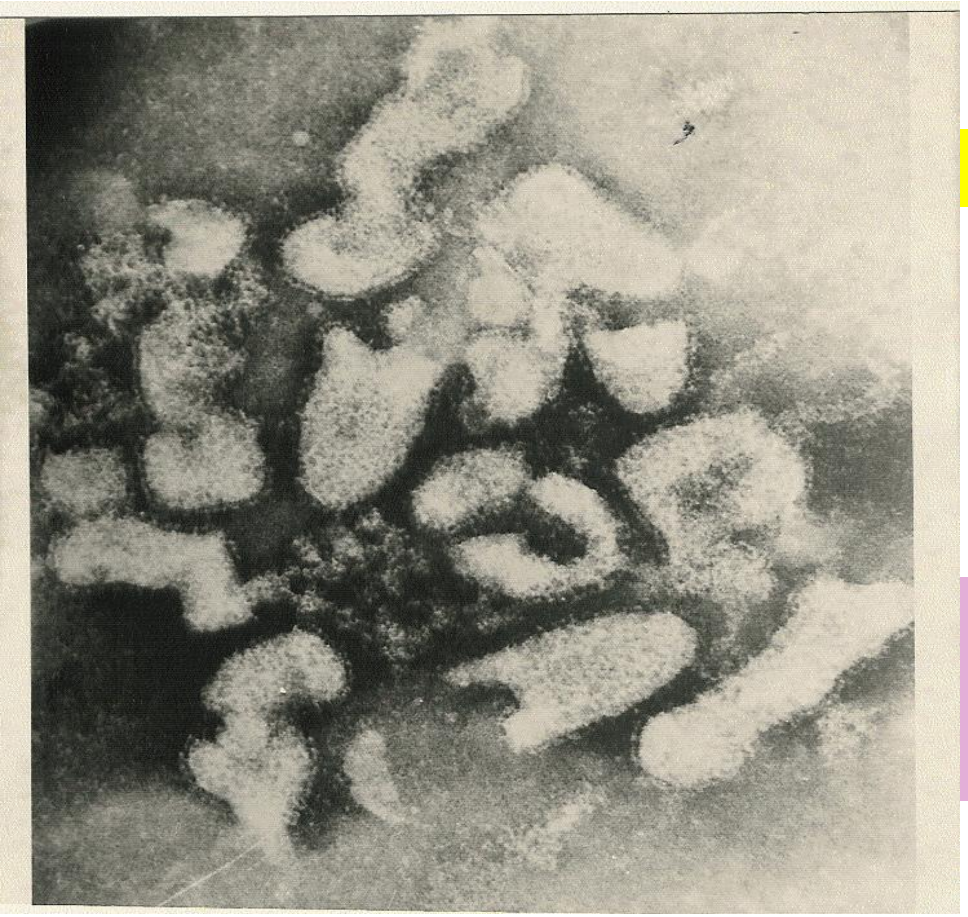
***Bullet shape***

***Enveloped virus***

***Helical capsid***

***s.s RNA genome***

# This is an electron micrograph of a virus



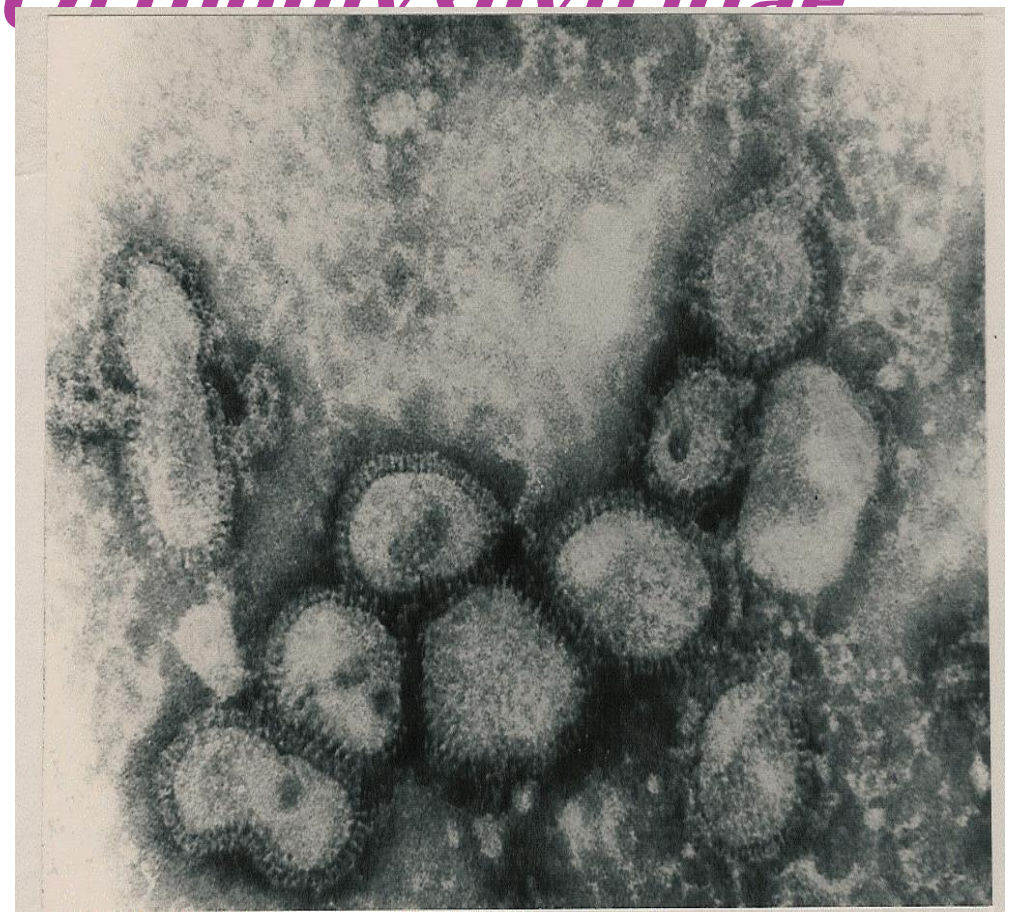
Q1: Name this virus

***Rabies virus***

Q2: Describe its structure.

***Enveloped virus , Helical capsid & s.s RNA genome***

# *Influenza Viruses : Orthomyxoviridae*



***Enveloped V & spikes***

***Helical capsid***

***Segmented s.s RNA***

***Pleomorphic shape***

# This is an electron micrograph of a virus

Q1: Name this virus

Influenza Viruses

Q2: Describe its structure

Enveloped Virus with spikes ,
Helical capsid ,Segmented s.s RNA

Some web sites with virus images

http://www.virology.net/

http://www.virology.net/Big_Virology/BVDNAherpes.html

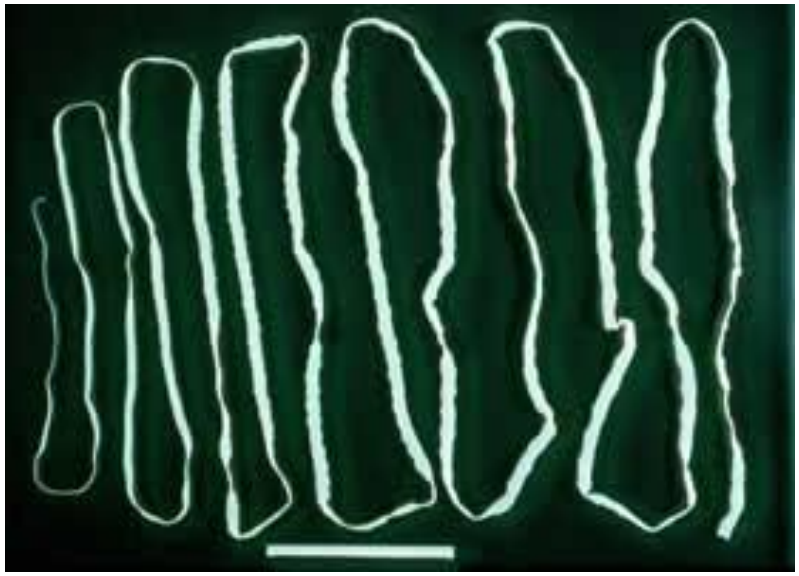
http://web.uct.ac.za/depts/mmi/stannard/herpes.htm

# Classification of Parasites

| Protozoa | Helminths |
| --- | --- |
| Unicellular<br>Single cell for all function | Mulicellular<br>Specialized cells |
| Amoebae:<br>move by psudobodia.<br>Flagellates:<br>move by flagella.<br>Ciliates :<br>move by cilia<br>Apicomplexa<br>(sporozoa) Tissue parasites | Round worms<br>(Nematodes) cylindrical, unsegmented<br>Flat worms<br>1-Trematodes:<br>leaf-like, unsegmented.<br>2-Cestodes:<br>tape-like, segmented |

# *Ascaris lumbricoides* (roundworm)


**Ascaris adult**



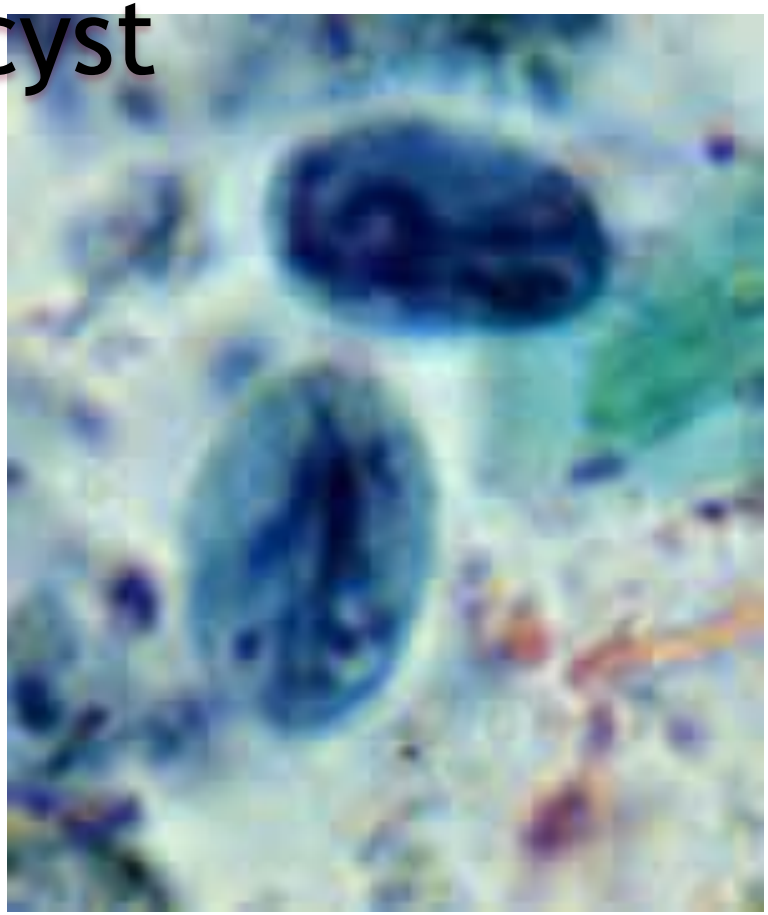

*Taenia saginata*

# The Trematodes

# Giardia lamblia trophozoite

Two nuclei, each with central karyosome Four pairs of flagella

# Giardia lamblia cyst



- Mature, infective cyst, containing 4 nuclei

# ARTHROPODS OF MEDICAL IMPORTANCE

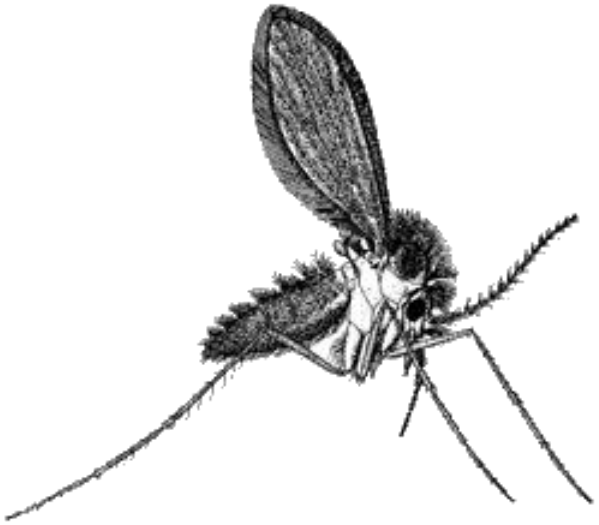
| Class *Insecta* الحشرات | Class *Arachnida* العناكب | Class القشريات *Crustacea* |
|---|---|---|
| • Muscid flies:housefly,Tsetse fly<br>• Myiasis-producing flies .<br>• Mosquitoes البعوض: *Anopheles*, *Aedes* *Culex*<br>• Sandfly ذباب الرمل (*Phlebotomus)*<br>• Black fly*(Simulium)*<br>• Fleas البراغيث<br>• Lice(*Pediculus*,*Phthirus)* القمل<br>• Bugs:*Cimex*,*Triatoma* البق<br>• Bees النحل | • Scorpions العقارب<br>• Spiders العناكب<br>• Ticks: القراد hard, soft<br>• Mites السوس<br>-*Sarcoptes scabiei*,<br>-dust mites | • Water flea *(Cyclops)* |

# LICE

Louse(singular) , Lice (pleural)

## *Pediculus humanus*

# *Phlebotomus* ( sand fly



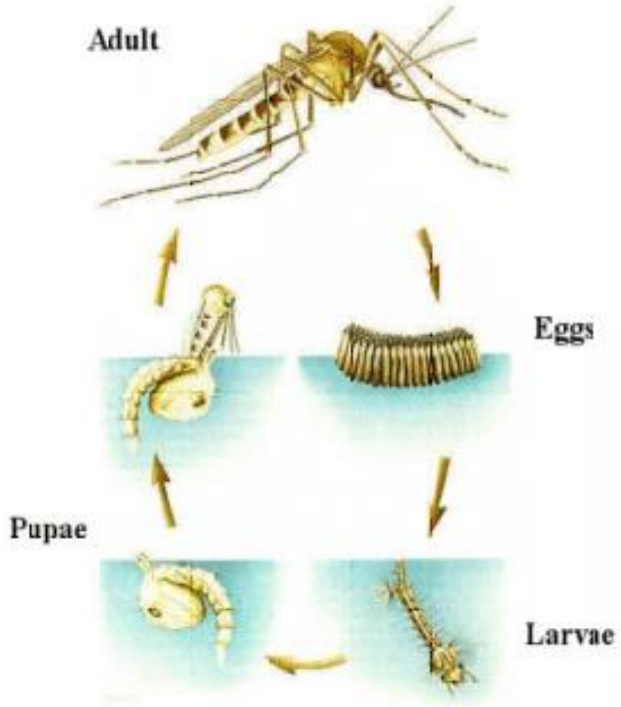
# Mosquitoes :

Cosmopolitan , more than 3000 species.

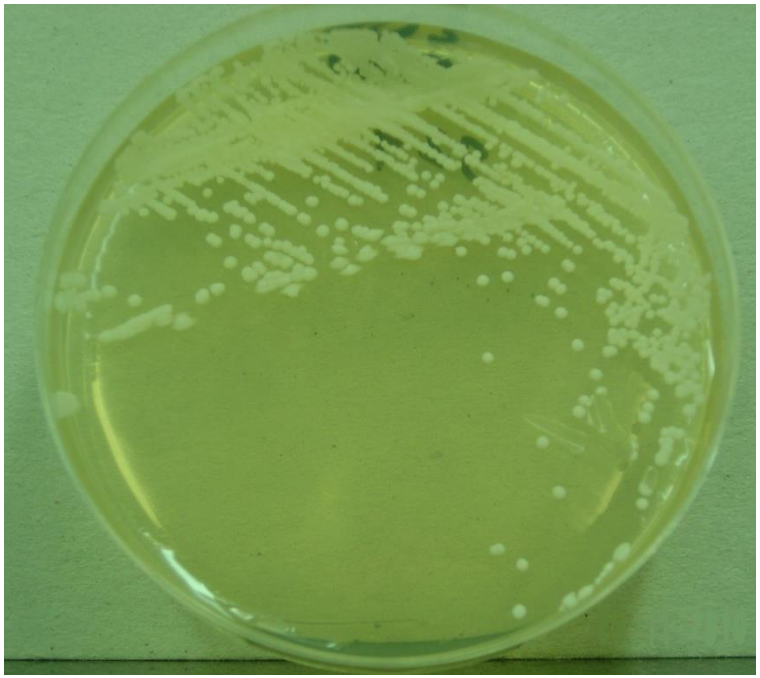
Larval and pupal stages always aquatic

Mouth parts in female adapted to piercing and sucking blood.

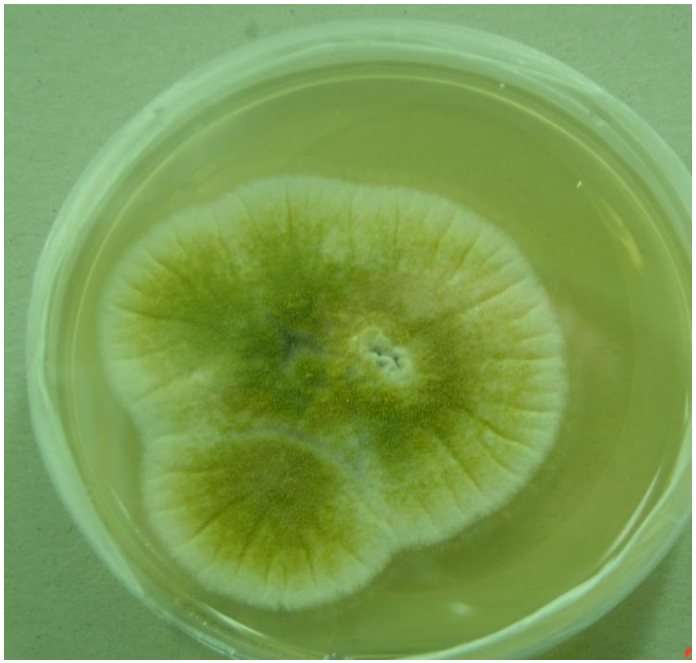
Genus and species distinguished by morphology of adult and deveopmetal stages.



Fungi can be divided to two types based on morphology



A



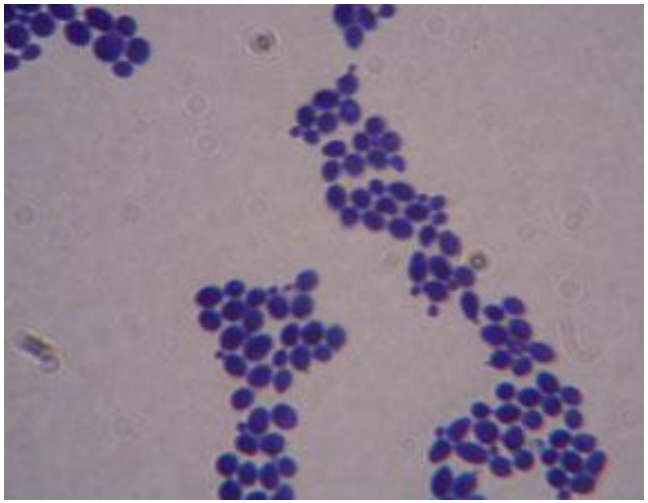
B

Based on morphology, name the two fungal structures in A and B?

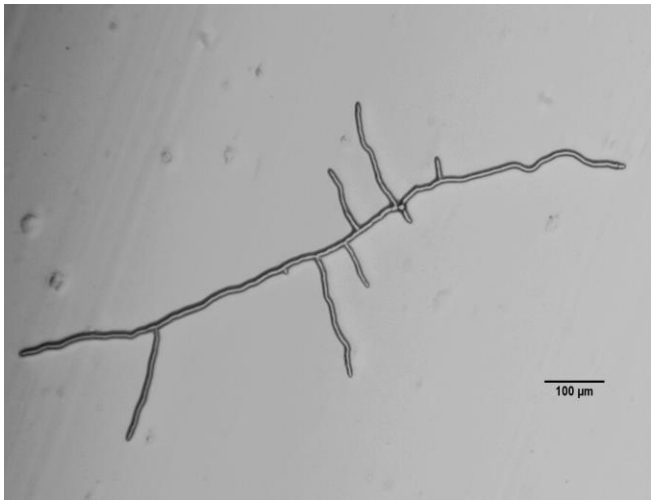
A: Yeast
e.g. *Candida*

B: Mould fungi
e.g. *Aspergillus*

Microscopic appearance of  yeast and mould fungi



A




B

Name the two fungal structures in A and B?

A: Budding yeast cells
e.g. *Candida*

B: Branching Fungal hyphae
e.g. *Aspergillus*

**Following is the microphotograph of an organism found in the upper part of the small intestine .**

Name the Organism

Giardia lamblia

What is the Stage?

Trophozoite stage

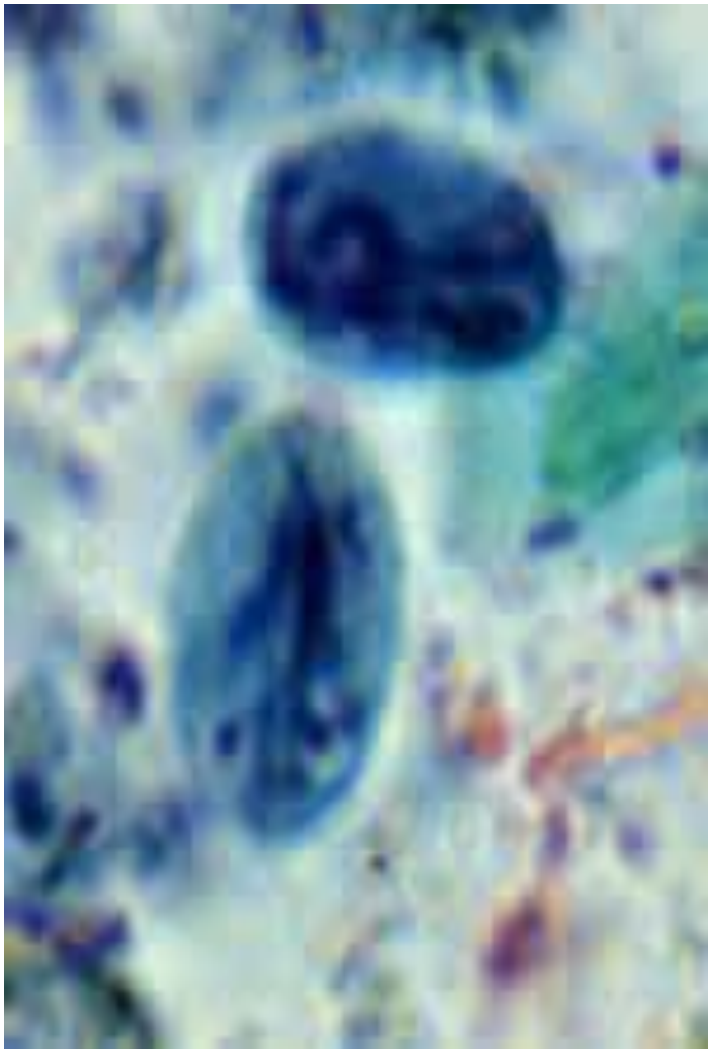
**Following is the microphotograph of an organism found in stools**

Name the Organism

Giardia lamblia

What is the Stage?

Cyst stage



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