

PASSION ACADEMIC TEAM *YU - MEDICINE*

Sheet# 1 - MICROBIOLOGY

Lec. Date : 16/02/2020 CE .

Lec. Title : Group A Streptococcus (S.pyogenes)

Written By : Sawsan Radi & Salam AbuShanab .



**If you come by any mistake , please
kindly report it to
shaghafbatch@gmail.com**

RESPIRATORY SYSTEM

Group A streptococcus (*S. pyogenes*)



Dr. Waleed Al
Momani Associate
professor Medical
microbiology Faculty
of medicine Yarmouk
university

introduction

** microbiology in respiratory system is so important because respiratory tract infection almost is a leading cause of death .

** high mortality rate caused by RTI .

** another system (too close to RS) gastrointestinal , they are cause a leading threat on human health .

** coronavirus is RTI , there is some evidence indicate that it might be related to gastrointestinal infection (gastroenteritis) .

** RTI are a priority , specially in children under 5 and elder age .

** most cause of death of children is pneumonia .

** the common thing in RTI is mode of transmission.

anyone with RTI can infect other people by coughing , sneezing through droplets or aerosoles .

**you can't prevent this mode of transmission .

- - the mode of transmission will be the same for all organism that we will study in this system - -

**RTI can caused by all microbes (virus , bacteria , fungus . parasites..and so on)

**by social distance we can reduce RTI(نبعء الناس عن بعض)

- Streptococci
 - facultative anaerobe
 - Gram-positive (anaerobe)
 - usually chains (sometimes pairs)
 - catalase negative

**the most important streptococcus organism causing infection in URT is group A streptococcus (streptococcus pyogen :this organism can form a copious amount of pus)

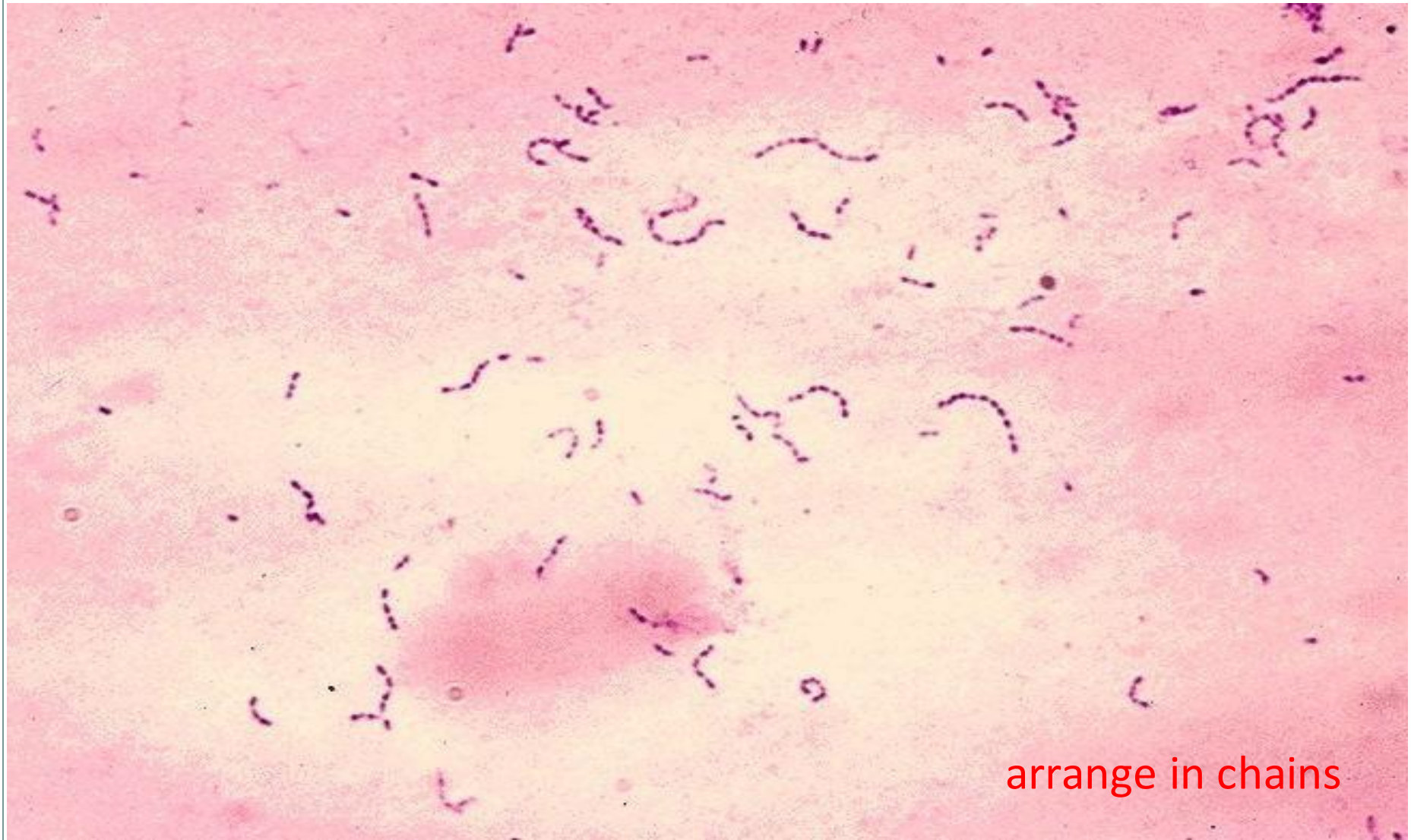
** facultative anaerobes is a virulence factor because it can cause a disease on either anaerobic and aerobic conditions .

** percentage of infection caused by G+ anaerob around 30% because it facultative anaerobes (not only reason , but most important)

-pyogen : pus-producing organism

-pyrogen : substance, typically produced by bacteria, which produce fever .

Streptococcus in chains (Gram stain)



arrange in chains

Identification :

1. Lancefield groups


- carbohydrate antigens on the surface of bacteria cell

** streptococci is classified into groups (A,B,C,D...), we have 80 different group according lancefield grouping system .

** every single bacteria cell has carbohydrate Ab different from the other .

**** all what we need to do , just we run distance the known Ab (A,B ,C,D ...)

if there is agglutination with group A ,that means , this bacteria group A

if with C  this bacteria group C

... and so on .

Groupable streptococci



□ A, B and D the most important because it is pathogen.

○ frequent

□ C, G, F this group either opportunistic or non-pathogen .

○ less frequent

** group A can cause RTI

كل جروب متخصص بسيسنم

Non-groupable



□ *S. pneumoniae*

○ pneumonia

□ Viridans streptococci : they are found in oral cavity and they cause dental caries and oral cavity infection and may cause problems in subclinical endocarditis starting from the oral .

○ e.g. *S. mutans*

* dental caries

note :

groupable : bacteria has antigen .

non groupable : bacteria doesn't have antigen .

2. Hemolysis reaction - sheep blood agar

**there are 3 major types of hemolysis :

1-alpha

2-beta

3-gama

**and another

type of
hemolysis

is alpha

prime

that

showing

beta in

first circle

and alpha in

other one .

streptococcus A is beta hemolytic



Epidemiology

- *S. pyogenes* can transiently colonize the oropharynx
- *S. pyogenes* causes pharyngitis mainly in children of 5 to 15 years old.
- The pathogen is spread mainly by respiratory droplets.
- Crowding increases the opportunity for the pathogen to spread, particularly during the winter months.

Clinical Diseases

1. Local infection with *S. pyogenes*

Streptococcal (group A) sore throat (pharyngitis)

some time this bacteria is the only cause of tonsillitis .

The illness is characterized by:

Acute sore throat, malaise, fever, and headache.

Infection typically involves the tonsillar pillars, uvula, and soft palate, which become red, swollen, and covered with a yellow-white exudate

2. Invasion by *S. pyogenes*

Invasion from respiratory tract: otitis media, sinusitis, pneumonia, meningitis, osteomyelitis, and arthritis.

وجود ال tonsils من حيث ال location يكون قريب من المناطق الحيوية , قريب من ال , sinus , brain , ears , bone ..

- *sinus -- sinusitis
- *lung -- pneumonia
- *brain -- meningitis
- *ear -- otitis media

Disease Associated with Streptococcal Superantigen Toxins

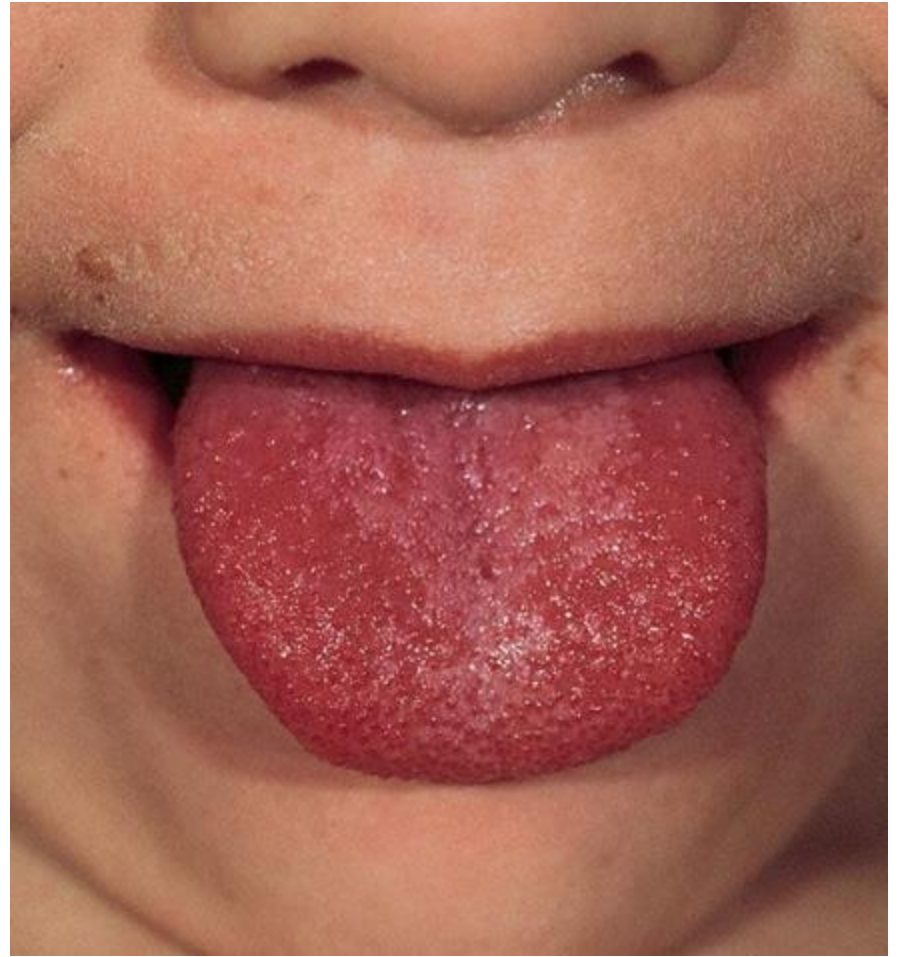
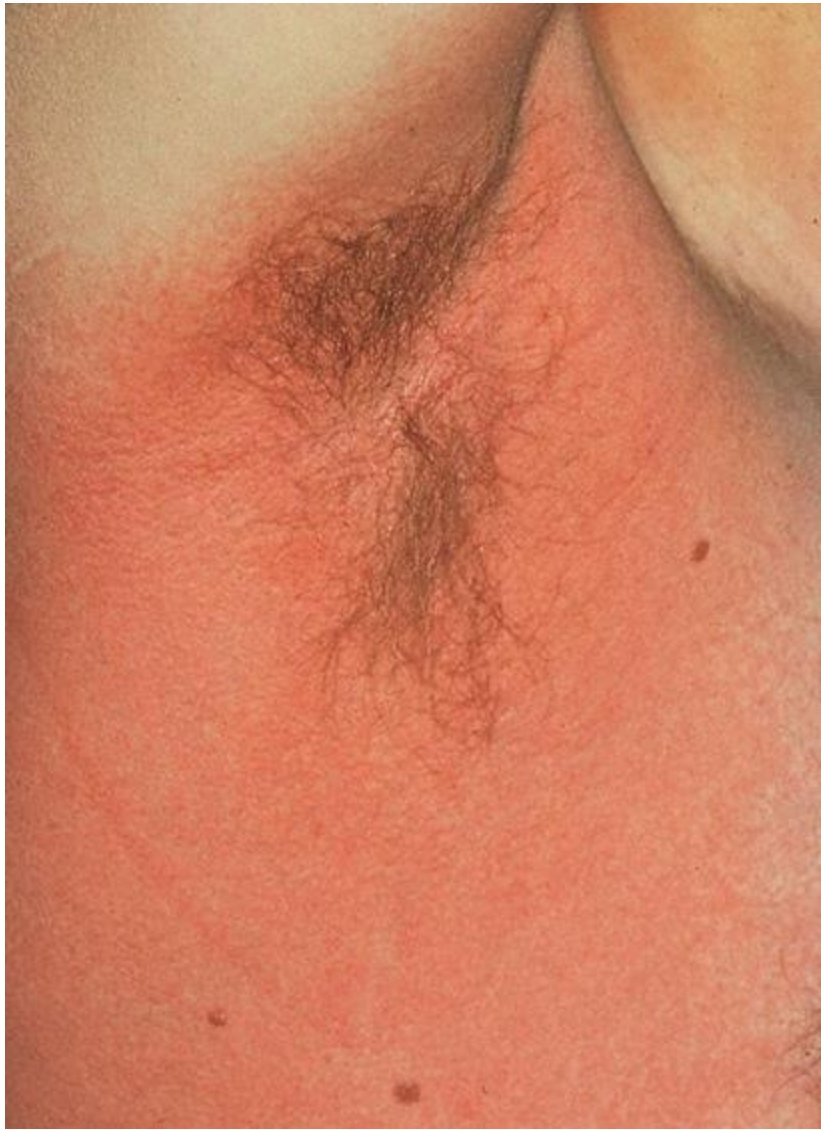
Scarlet Fever Related to toxins that released by bacteria
الحمى القرمزية

Characterized by

1. The buccal mucosa, temples, and cheeks are deep red

1. Strawberry tongue

1. A diffuse red “sandpaper” rash spreading from the upper chest to the trunk and extremities



3. Poststreptococcal diseases

Acute Rheumatic Fever: most commonly preceded by infection of the respiratory tract.

Characterized by:

1. Fever, subcutaneous nodules, chorea, and migratory polyarthrititis

1. Cardiac enlargement, valvular murmurs, and effusions are seen clinically and reflect endocardial, myocardial, and epicardial damage, which can lead to heart failure

3. Acute glomerulonephritis: preceded by infection of the respiratory tract.

Characterized by

1. Clinically by edema, hypertension, hematuria, proteinuria, and decreased serum complement levels

1. Renal failure

what dr said about the previous two slides

- ** poststreptococcal infection is a immune complex related to chronic infection cause by streptococcus A .
- **immune complex disease manifested as either Rheumatic carditis or glomerulonephritis or arthritis .
- ** if tonsillitis not treated properly , this disease will turn chronic ...
(يعني البكتيريا حتستقر بال (tonsils)
- **stimulation for production excessive amount of Ab (foreign body provoke immune system to produce Ab) , this Ab will go to heart , joints , kidney and cause rheumatic fever .
- ** most danger manifestation for chronic tonsillitis or rheumatic fever is glomerulonephritis because it with renal failure .

Laboratory Diagnosis



1. Culture: Specimens are cultured on blood agar plates in air.

The best way to diagnose a disease is culturing

2. Antigen detection tests: commercial kits for rapid detection of group A streptococcal antigen from throat swabs.

بعد ما ناخذ عينة بنضيف عليها ال anti body و بقدر أحدد نوعها من الاستجابة حصلت أو لأ

3. Detection of group A streptococci by molecular methods: PCR assay for pharyngeal specimens.

Very specific , no missed diagnose

But we will always need th antigen dtction test

الدليل إنه مشاكل ال chronic tonsillitis بالعادة بتكون بسبب استخدام خاطئ للمضاد الحيوي

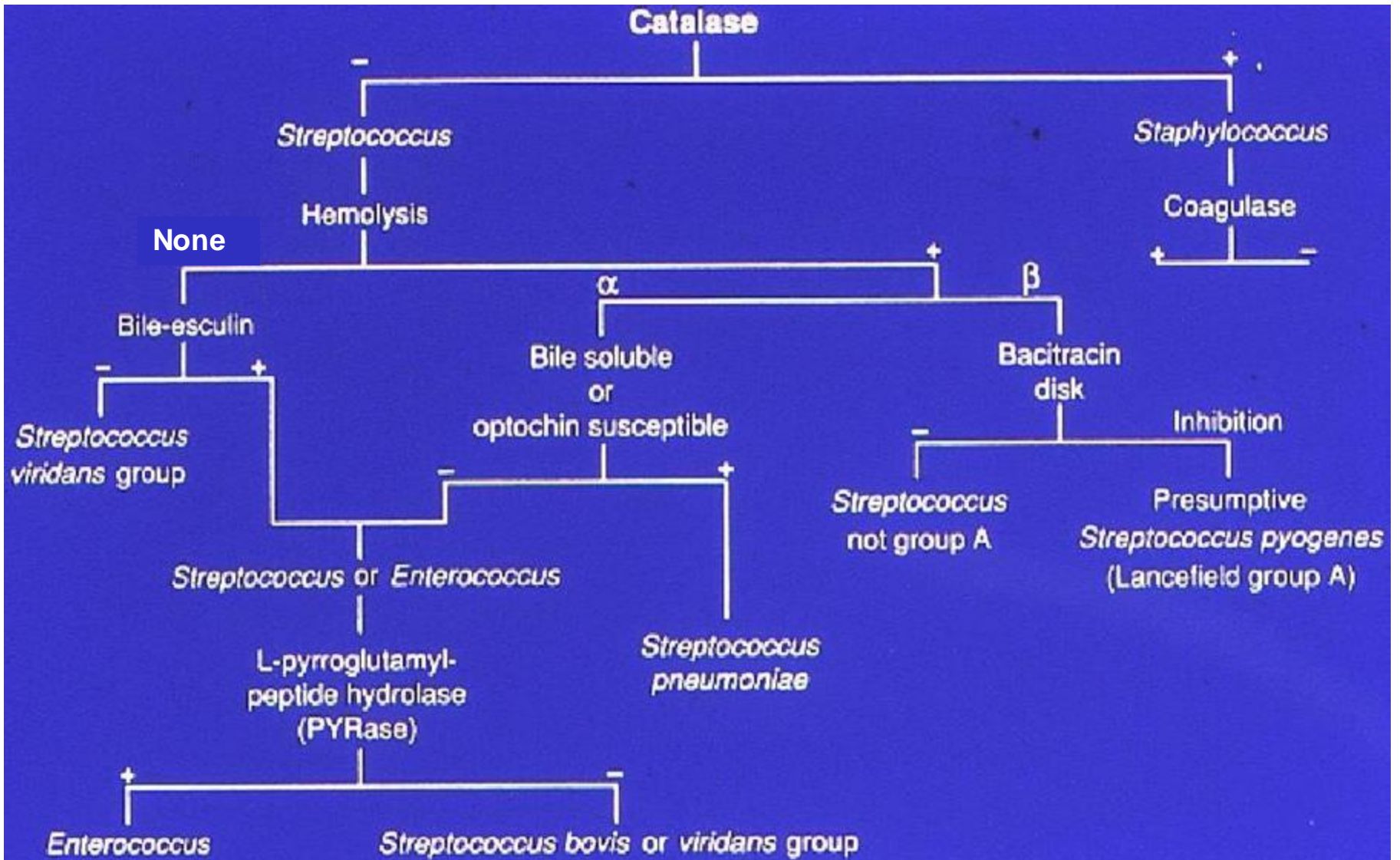
لهيك مهم نعمل isolation ونعمل للعينة antimicrobial susceptibletest وأعطي مضاد حيوي The drug of choice with the true

dose مناسب يقتل البكتيريا بالكامل بحيث لا يتضاعف الالتهاب



ما حكى كثير عنه لأنه أخذناه
باللاب الفصل الماضي

Identification of Gram-positive cocci Flowchart



Isolation and identification

بِسْ مِثَالِ عَلِيٍّ الِ antigen detection test

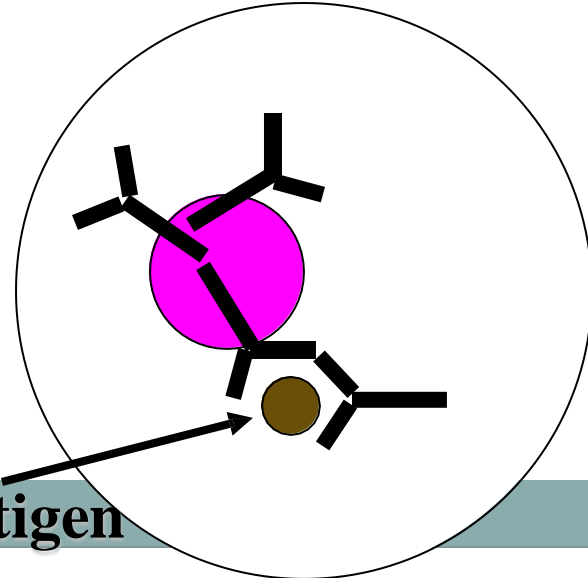
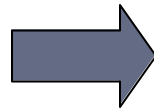
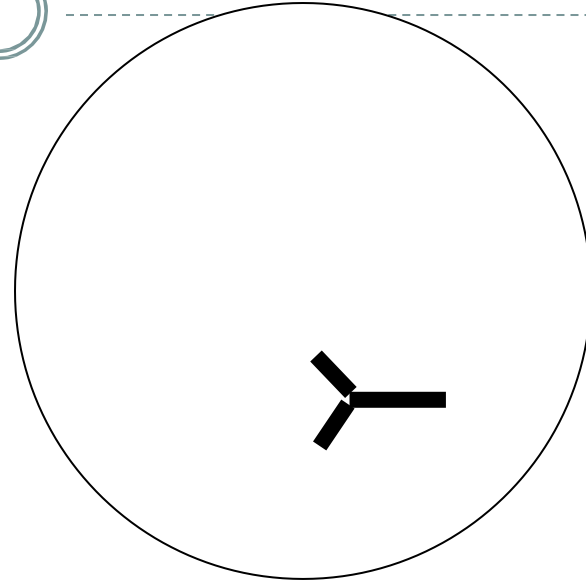
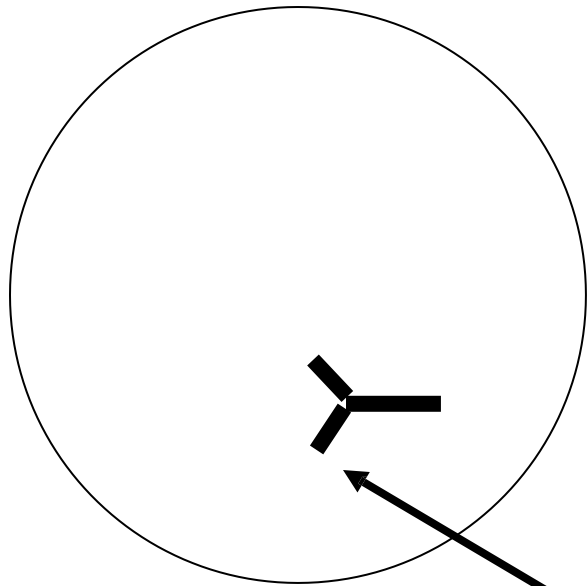


- ❑ β hemolytic colonies
 - bacitracin inhibits growth

- ❑ β hemolytic colonies
 - group A antigen

Modern Rapid “Strep” Test

Throat swab extract
(+/- streptococcal antigen)



Antibody

Liposome

Streptococcal antigen

Post-infectious diagnosis (serology)



- antibodies to streptolysin O (ASO) Titer (an immune test)
وهو يقيس شدة المرض
- important if delayed clinical sequelae occur

Treatment

- All *S. pyogenes* are sensitive to penicillin G.
- Effective doses of penicillin or erythromycin for 10 days can prevent poststreptococcal diseases.

المشكلة إنه الآن عالأغلب صار عندها

resistance to penicillin G, which was the drug of choice

Prevention and Control

- Most streptococci are normal flora of the human body.
- Source of *S. pyogenes* is a person harboring these organisms (carrier).

Control:

1. Prompt eradication of streptococci from early infections.

□ ☺ □ خَلِّ مسافة أمان

2. Prophylactic antibiotic treatment for rheumatic fever patients. **They are susceptible to disease**

3. Eradication of *S. pyogenes* from carriers.

4. Dust control, ventilation, air filtration, UV irradiation and aerosol mists are of doubtful efficacy.

بيجي مع إنه نخلص من ال crowd
كل ما كنت بمكان أبعد عن الاكتظاظ السكاني كنت بعيد عن الإصابة بالعدوى أكثر

Haemophilus

Overview- Haemophilus



- Small
- Non-motile
- Gram-negative rods
- Transmitted via respiratory droplets, or direct contact with contaminated secretions
- Normal flora of the human respiratory tract and oral cavity.

It appears in the Gram stain as polymorphic As coccipacillus or as rods...and many other shaps



Haemophilus Species



- Haemophilus = “blood loving”
 - Require either heme (X factor) or NAD (V factor)
- Haemophilus is facultative and can grow anaerobically
- Organism is sensitive to drying and extremes in temperature
- Distinctive “mousy” or “bleach-like” odor
- Groupable

The best Media for this bacteria is the blood agar, we can know that from its name, which is treated by heat...so we use chocolate agar

□ ☺ □ (منطقي جداً) بصفتي بالآخر إنه أفضل ميديا هي التشوكليت

ريحتها سيئة بس أكيد ما حكيها
ماوسي لأنه في حدا قارن بين
القصد إنه..ريحتها وريحة الفأر
سيئة

Haemophilus Influenzae



- Misnamed – originally thought to cause the “flu”
- Now we know that flu is caused by viruses
- In some cases of flu, *H. influenzae* is secondary infection

أعطيناها اسم الانفلونزا لأنه كان يُعتَقَد إنها يتسبب الانفلونزا
لكن تبين لاحقاً إنه الحَبّ عالفايروس مش عليها وليست
الاسم بعدها لأنها ممكن تيجي بشكل ثانوي بعد الفايروس..

Haemophilus species of clinical importance



1. *H. influenzae* type b is an important human pathogen
2. *H. ducreyi*
3. Other *Haemophilus* are normal flora
 - *H. parainfluenzae* – pneumonia & endocarditis
 - *H. aphrophilus* – pneumonia & endocarditis
 - *H. aegyptius* – pink eye (purulent conjunctivitis)

Differentiation of Species



الجدول بيّين حاجة أفراد
العائلة البكتيريّة العوامل
الموجودة في الدّم

Hemolysis

Growth Factor

X V V

<i>H. influenzae</i>	-	+	+
<i>H. aegyptius</i>	-	+	+
<i>H. ducreyi</i>	-	+	-
<i>H. parainfluenzae</i>	+	-	+
<i>H. aphrophilus</i>	-	-	-

Haemophilus Influenzae: Clinical Infections: Typable strains



- Acute epiglottitis or laryngotracheal infection in small children
 - Can cause airway obstruction
- Cherry-red, swollen epiglottitis, and stridor are hallmarks
 - Swollen epiglottis close the air passage, specially during sleeping
- Fever, sore throat, hoarseness, an often muffled cough

نسبة وفاة الأطفال عالية بال *epiglottitis* لأنهم مش حيقدروا ياخدوا القرار
بأنهم يقوموا وينتفضوا إذا اختنقوا فيصير عندهم *asphyxia*



The swollen epiglottis characteristic of
Haemophilus influenzae acute epiglottitis

Pneumonia/septicemia

In children

Conjunctivitis “pink eye”

very contagious

نحكي عنهم بمزّات
قادمة لما نحكي عن ال
LRT

Haemophilus Influenzae: Clinical Infections: nontypable strains

□ Otitis media

○ Children 6 months- 2 years

It can extend to ear and cause otitis media and to the brain causing meningitis

□ Sinusitis

□ Pneumonia, bronchitis

○ In adults

□ These sites are all in proximity to respiratory tract

Haemophilus Species



□ *Haemophilus* species require growth factors:

○ X-factor (hemin)

الدكتور أشار إلى إنه جسمنا
بحاجة هـول ال factors

□ Heat-stable substance

□ Present in RBC and released with degradation of hemoglobin

○ V-factor (NAD: nicotinamide adenine dinucleotide)

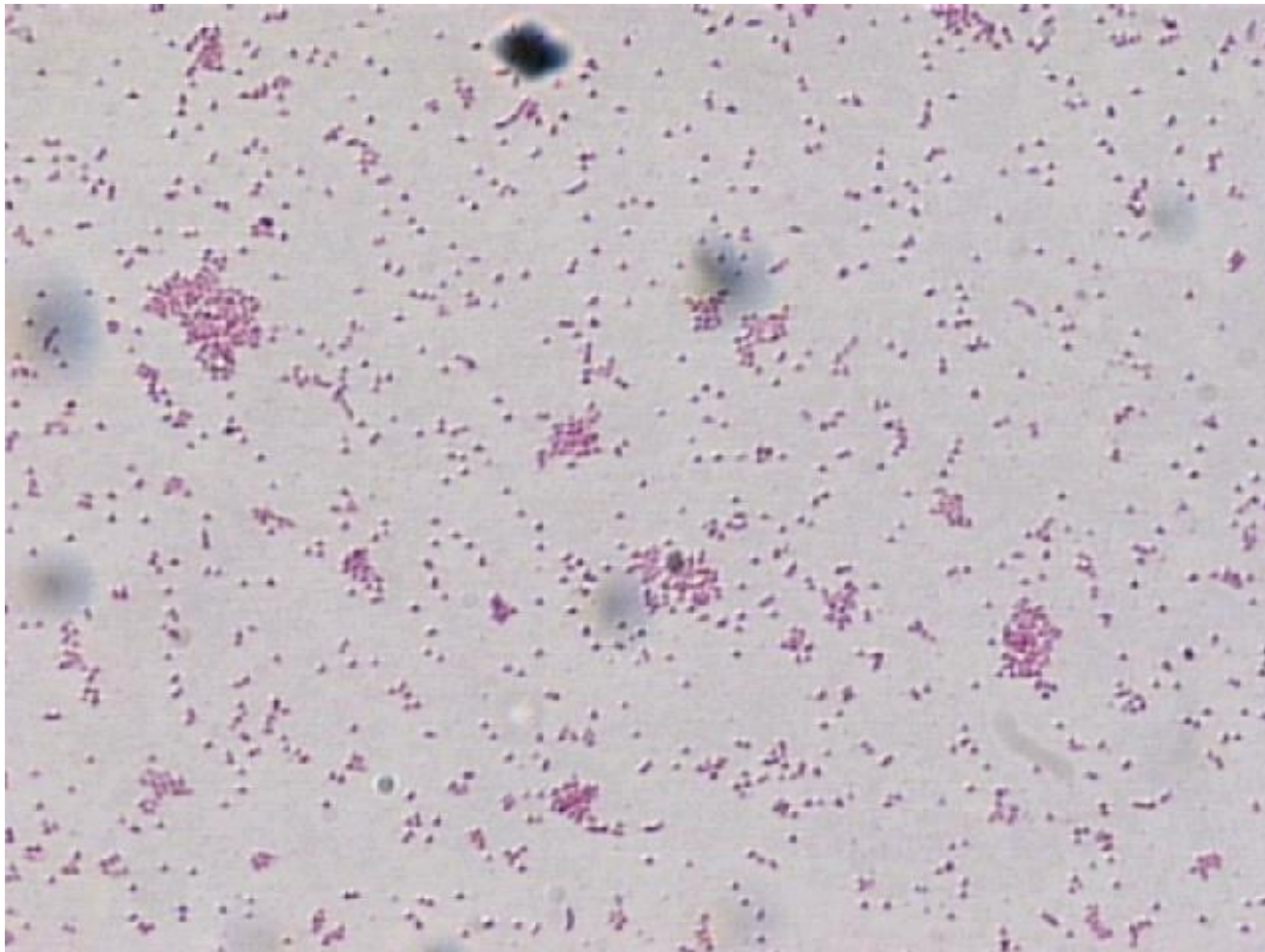
□ Heat-labile

□ Found in blood or secreted by certain organisms

Laboratory Diagnosis

Specimen collection

- Can be isolated from most clinical specimens
 - relatively high bacterial load in blood of children with bacteremia
 - Susceptible to drying and temperature extremes
- Present in blood in high amount..so we use the blood culture instead of throat swap ,why?
You may cause closing upper air passage
- Gram stain: most are small, faintly staining, gram-negative coccobacilli



Laboratory Diagnosis

Direct detection

خصوصي اللي بصير عنده
meningitis

- Latex agglutination can be performed on CSF or urine
 - can be falsely-positive for recent vaccinees
 - sensitivity is equivalent to Gram stain

Laboratory Diagnosis

Culture

- *Haemophilus* require hemin (X factor) and NAD (V factor)

Chocolate agar contains both

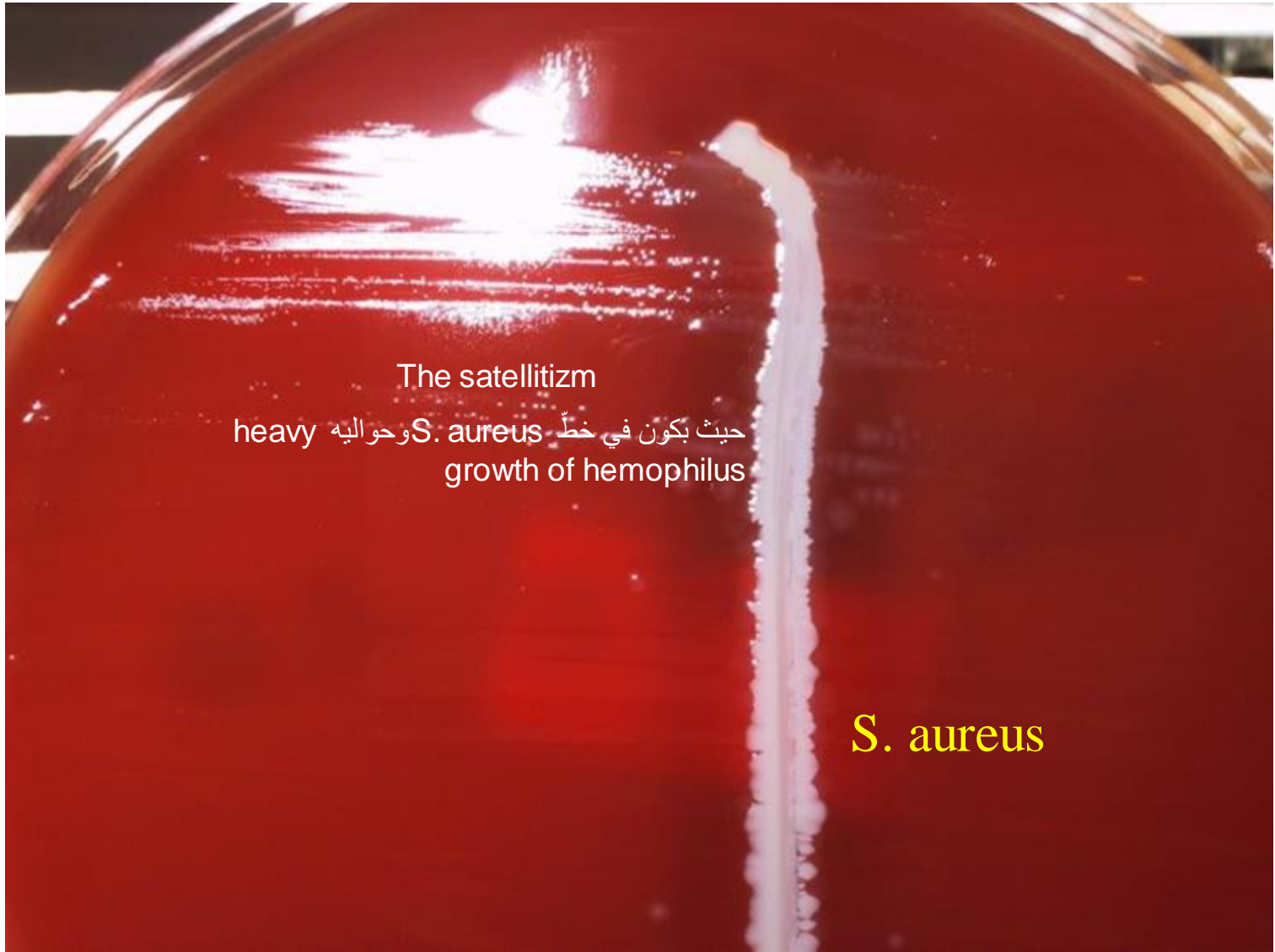
5% Sheep blood agar only contains hemin

Laboratory Diagnosis

Culture

مهمّ كثير بس ما حكي شي
بِزّ السلايد

- *S. aureus* produces NAD as a metabolic product
 - *Haemophilus* will satellite around colonies of *S. aureus* when growing on BAP



The satellitism

حيث يكون في خطّ *S. aureus* وحواليه heavy growth of hemophilus

S. aureus

Laboratory Diagnosis

Culture

- Growth conditions:

Haemophilus spp.: 35 – 37°C, 5-10% CO₂, 3 days

- Colony morphology:

Small and translucent

Exude a “mouse nest” odor

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