

# **Integrated CNS Practical**

## **Biochemical & Microbiological**

### **Examination of CSF**

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CENTRAL NERVOUS SYSTEM BLOCK  
2017-2018



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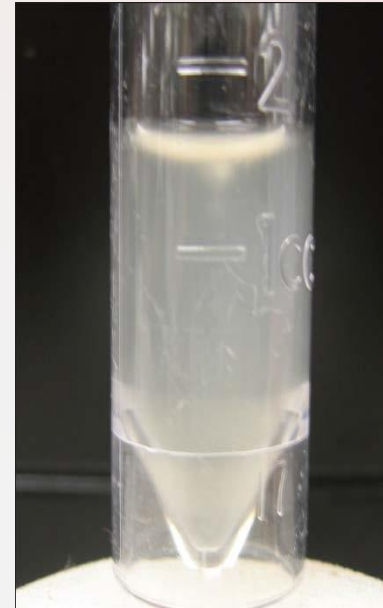
# CASE 1

A 15-year-old healthy male visited emergency room presenting with fever, headache, vomiting and drowsiness. Physical examination showed **decreased level of consciousness, neck stiffness, skin rash** and **high temperature (38°C)**. Cerebrospinal fluid (CSF) examination revealed opening pressure of 210 cm H<sub>2</sub>O.

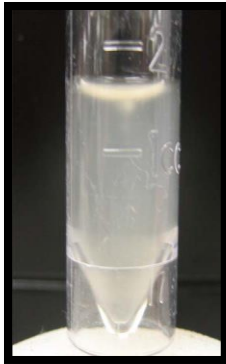

The doctor in the emergency department takes a detailed history and conducts a clinical examination. Because of clinical findings, he decides to do a lumbar puncture. The results of the lumbar puncture are shown below:



# Normal and turbid CSF



# **CASE 1: LUMBER PUNCTURE RESULTS**

<b>CSF</b>	<b>Patient's results</b>	<b>Normal range</b>
<b>Appearance</b>	<b>Turbid</b> 	<b>Clear</b> 
<b>WBCs and differential</b>	<b>8,320 per mm<sup>3</sup> Mainly polymorphonuclear leucocytes (84%)</b>	<b>Few (&lt;5 cells/mm<sup>3</sup>)</b>
<b>Protein</b>	<b>5.0</b>	<b>01-0.4 g/L</b>
<b>Glucose</b>	<b>1.3</b>	<b>3.0-4.5 mmol/L</b>
<b>Chloride</b>	<b>110</b>	<b>115-130 mmol/L</b>

## **QUESTION 1:**

What is your diagnosis?

.....  
.....

## **QUESTION 2:**

What is the most likely infection responsible?(Select only one)

- A. Mycobacterium Avium
- B. Fungal infection
- C. Parasitic infection
- D. Viral infection
- E. Bacterial infection
- F. Trepanoma pallidum (Neurosyphilis)
- G. Mycobacterium tuberculosis

**QUESTION 3:**

What is your justification for your answer to question two?

.....  
.....

**QUESTION 4:**

What further investigation would you like to do at this stage?

.....  
.....

**QUESTION 5:**

Mention two of the recommended antibiotics that can be used as empiric treatment in such a case?.....

.....

Microscopy of the cerebrospinal fluid •  
showed gram -ve cocci.

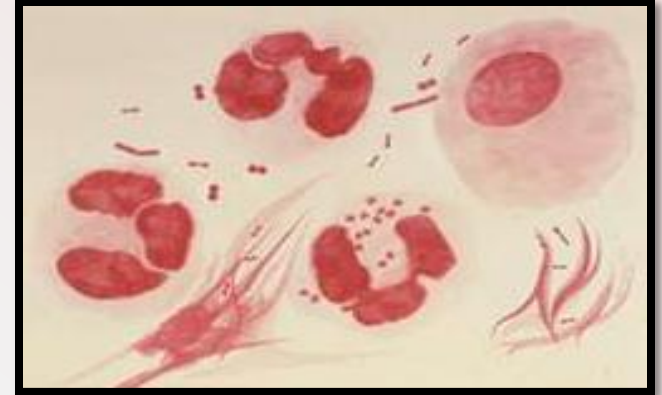
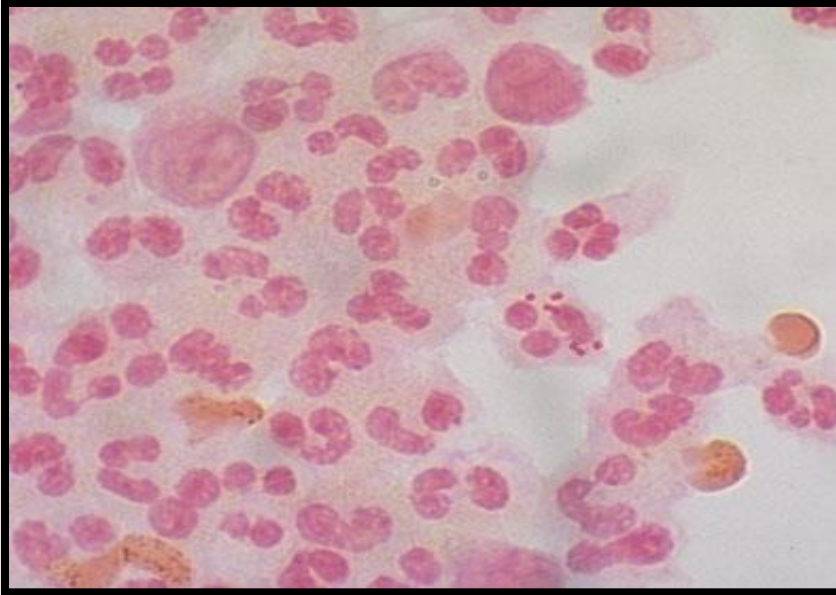
The patient showed complete recovery •  
after administration of ceftriaxone for 10  
days.

# The characteristic skin rash (purpura) of meningococcal septicemia, caused by *Neisseria meningitidis*





# **Bacterial meningitis:** ***Neisseria meningitidis***



## **Microscopic Appearance**

Gram stained smear from CSF deposit showing :  
gram negative intracellular diplococci + many pus cells

# **Bacterial meningitis:**

## ***Neisseria meningitidis***



**Culture on Thayer-Martin agar**

# Case Study

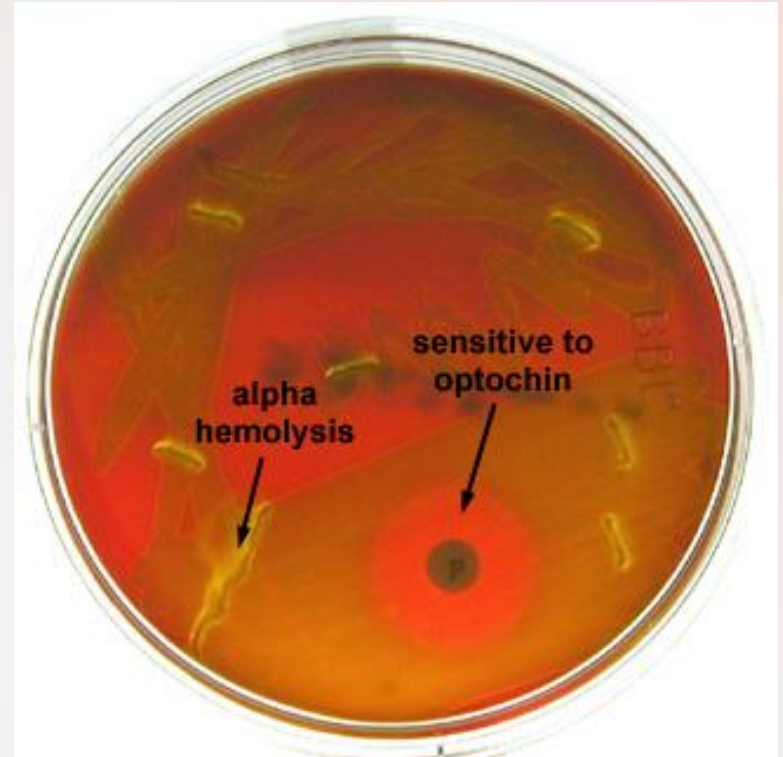
**A 59 y.o. male farmer with sudden onset of fever, headache, neck stiffness and confusion**

**Peripheral Blood count:**

**12,800 WBCs/mm<sup>3</sup> (73% neutrophils; 12% bands)**

**Cerebrospinal Fluid:**

- **3520 WBC/mm<sup>3</sup> (100% neutrophils)**
- **Glucose: <1 mg/deciliter**
- **Protein: 368 mg/deciliter**



**Gray white, alpha-hemolytic colonies recovered on sheep blood agar with increased CO<sub>2</sub> from spinal fluid sediment was Optochin sensitive**

# Questions

**What is your most likely diagnosis?**

.....  
.....  
.....

**What is the most probable pathogen isolated?**

.....  
.....  
.....  
.....

# Questions

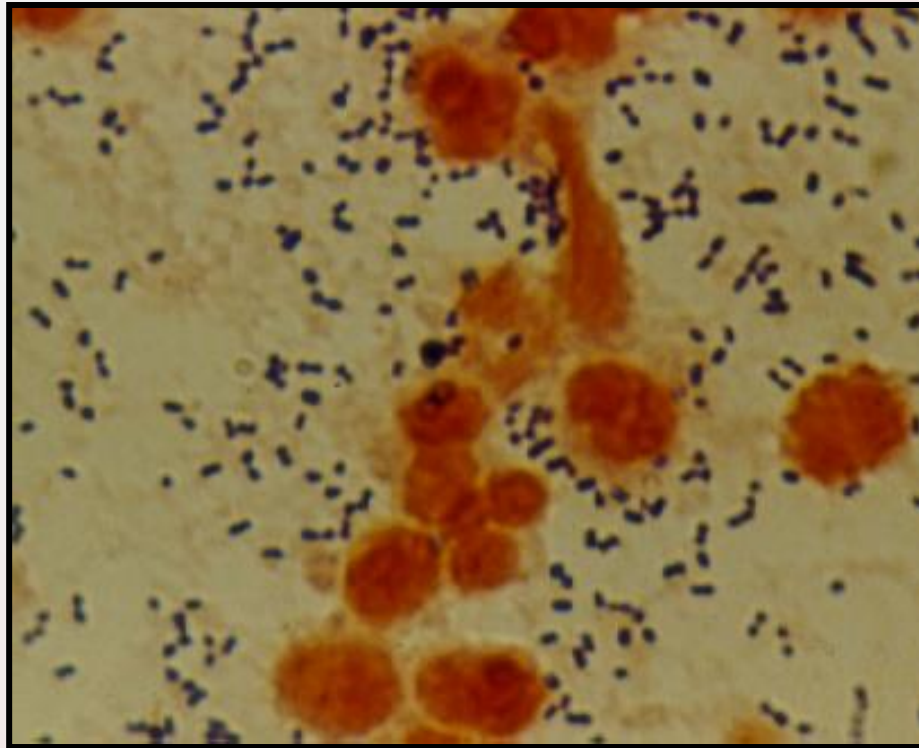
Mention two of the recommended antibiotics that can be used as empiric treatment in such a case?

.....

.....

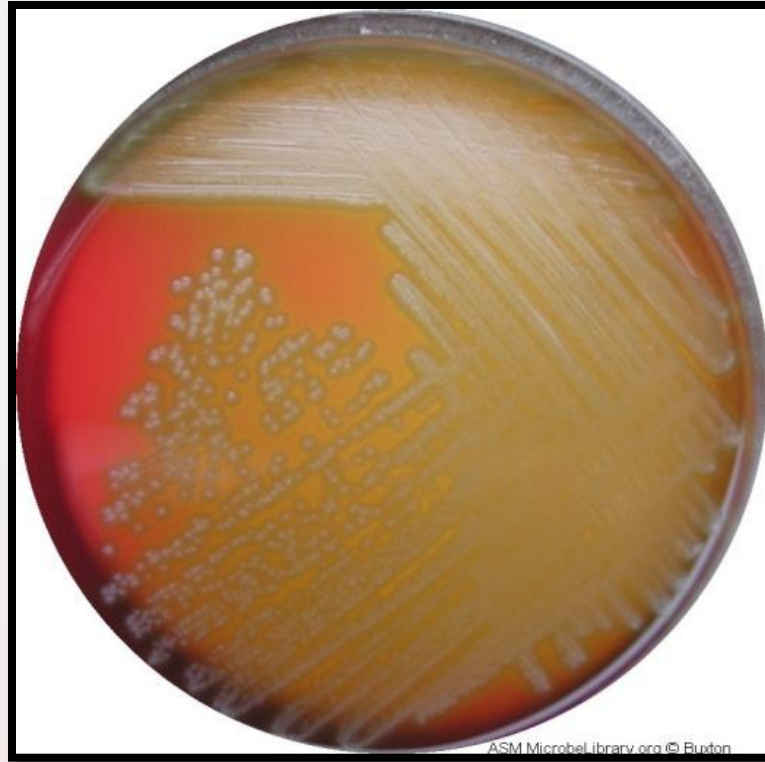
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# Bacterial meningitis: Pneumococcal Meningitis



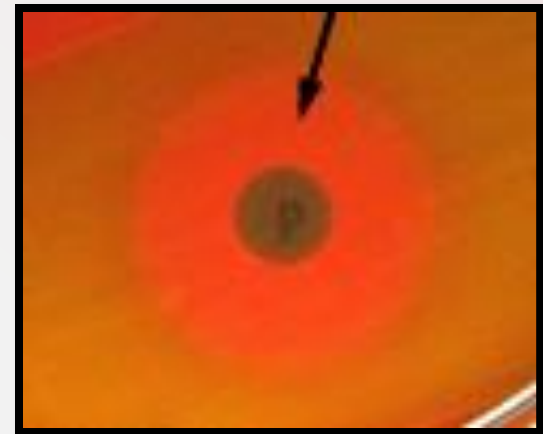
Direct gram stain of a CSF deposit shows gram-positive diplococci with lanceolate shape and polymorphnuclear leucocytes

# **Bacterial meningitis:** **Pneumococcal Meningitis**



**Culture on blood agar showing alpha-hemolytic colonies**

***Bacterial meningitis:***  
**Pneumococcal Meningitis**



**OPTOCHIN SENSITIVE ALPHA-HAEMOLYTIC STREPTOCOCCI**



***Bacterial meningitis:***  
***H. influenzae* Meningitis**

Mainly caused by *Hemophilus influenzae*  
type b

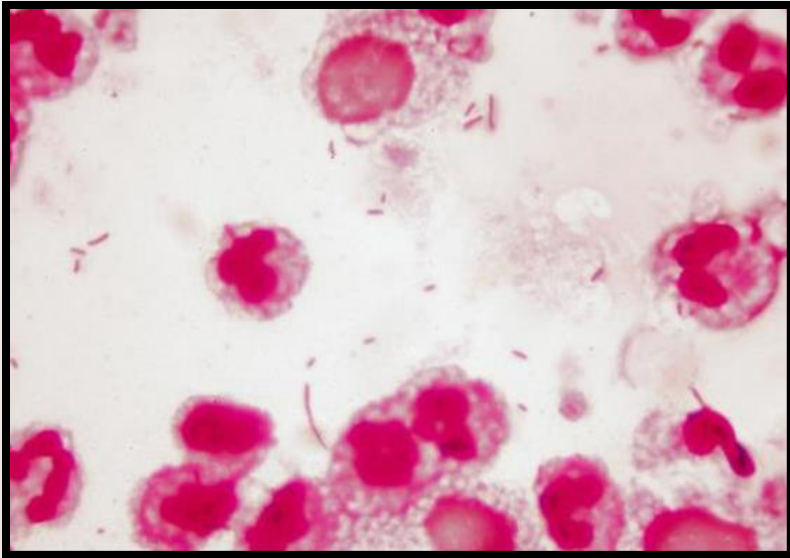
Gram negative coccobacilli

Requires X & V growth factors for growth

The optimum growth temperature is 35°C -  
37°C in 5% CO<sub>2</sub>

# Bacterial meningitis:

## *H. influenzae*

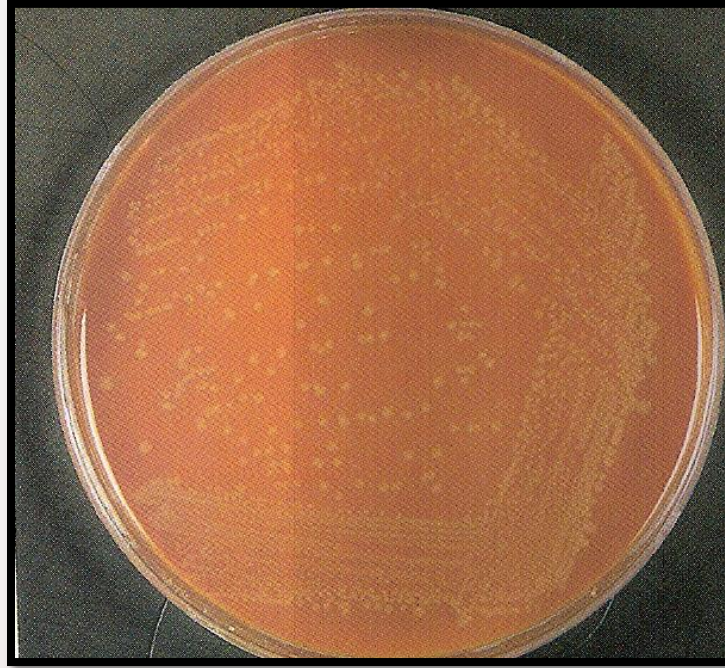


## Microscopic Appearance

Direct gram stain of a CSF deposit shows Gram-Negative **pleomorphic coccobacilli** with many polymorphnuclear leucocyte

# Bacterial meningitis:

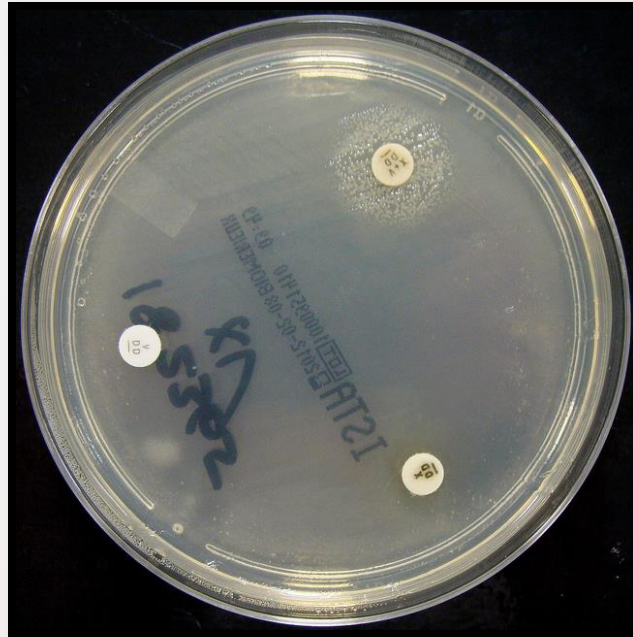
*H. influenzae*



**Culture on chocolate agar**

# Bacterial meningitis:

## H. influenzae



### **Culture on Nutrient agar**

H. influenzae :Growth arround XV factors( requires both factors XV)

no growth arround X or V alone

# Bacterial meningitis: *H. influenzae*

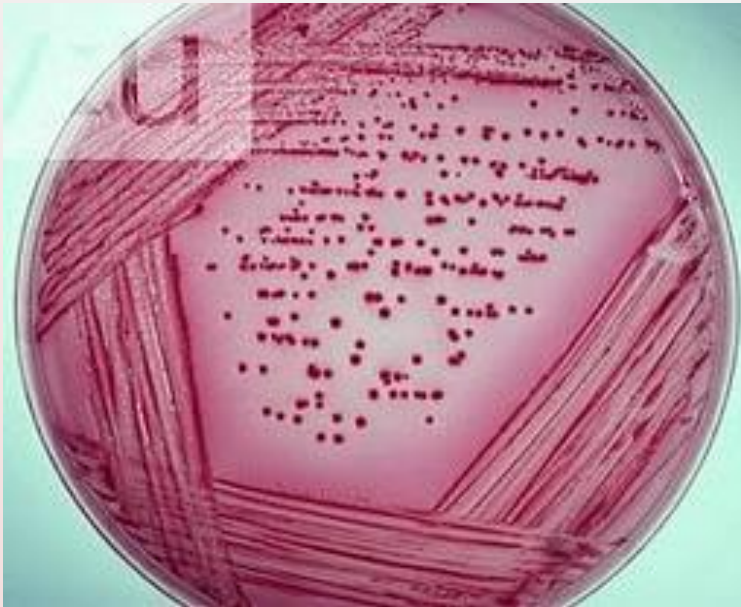


## Culture on Blood agar

Growth on blood agar showing **satellitism** adjacent to a streak of *S. aureus*. *S. aureus* producing surplus factor increasing growth of adjacent *H. influenzae*

# Bacterial meningitis: *E. coli*

Neonatal meningitis is most common due to  
Colonization of infants with *E. coli* at delivery is



*Escherichia coli* on MacConkey  
agar plate: appear pink as  
they ferment lactose



**gram negative bacilli**

# CASE 2

A 10-year old boy is brought to the emergency department (A&E) at King Khalid Hospital accompanied by his mother. He has fever, headache, and vomiting for the last 2 days. Clinical examination confirmed that he has meningeal irritation. The doctor decided to do a lumbar puncture.

The results of the lumbar puncture are shown below:

# **CASE 2: LUMBER PUNCTURE RESULTS**

<b>CSF</b>	<b>Patient's results</b>	<b>Normal range</b>
<b>Appearance</b>	Clear 	Clear 
<b>WBCs and differential</b>	100 per mm <sup>3</sup> Mainly lymphocytes (80%)	Few (<5 cells/mm <sup>3</sup> )
<b>Protein</b>	0.5	0.1-0.4 g/L
<b>Glucose</b>	3.7	3.0-4.5 mmol/L
<b>Chloride</b>	100	115-130 mmol/L



## **QUESTION 1:**

What is your most likely diagnosis?

.....  
.....

## **QUESTION 2:**

What is the most likely infection responsible?(Select only one)

- A. Mycobacterium Avium
- B. Fungal infection
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- D. Viral infection
- E. Bacterial infection
- F. Trepanoma pallidum (Neurosyphilis)
- G. Mycobacterium tuberculosis

### **Question 3:**

Justify your answer to question two?

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.....

.....

### **QUESTION 4:**

What further investigation would you like to do at this stage?

.....

.....

.....

# Microbiological Finding


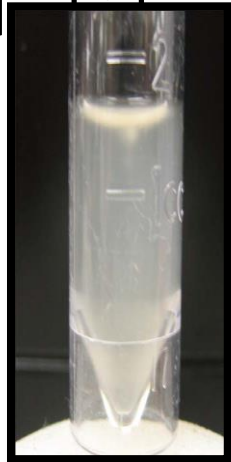
CSF Molecular testing is positive for  
Enterovirus •

# CASE 3

A **65-year-old** is referred from a general practitioner because of **headache, fever, excessive sweating at night,** and **weight loss over the last 4-5 months.** He has **lost his appetite for food.** On examination, there is neck rigidity. Laboratory tests including blood count, serum and electrolytes, blood urea, creatinine and blood culture are all normal. The doctors decides to do a lumber puncture.

The results of the lumber puncture are shown in the next slide:

# **CASE 3: LUMBER PUNCTURE RESULTS**

CSF	Patient's results	Normal range
Appearance		
WBCs and differential	300 per mm <sup>3</sup> Mainly lymphocytes	Few (<5 cells/mm <sup>3</sup> )
Protein	0.8	0.1-0.4 g/L
Glucose	2.0	3.0-4.5 mmol/L
Chloride	115	115-130 mmol/L

## **QUESTION 1:**

What is your most likely diagnosis?

.....  
.....  
.....

## **QUESTION 2:**

What is the most likely infection responsible?(Select only one)

- A. Fungal infection
- B. Parasitic infection
- C. Viral infection
- D. Bacterial infection
- E. Trepanoma pallidum (Neurosyphilis)
- F. Mycobacterium tuberculosis

**QUESTION 3:**

What is your justification for your answer to question two?

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.....

**QUESTION 4:**

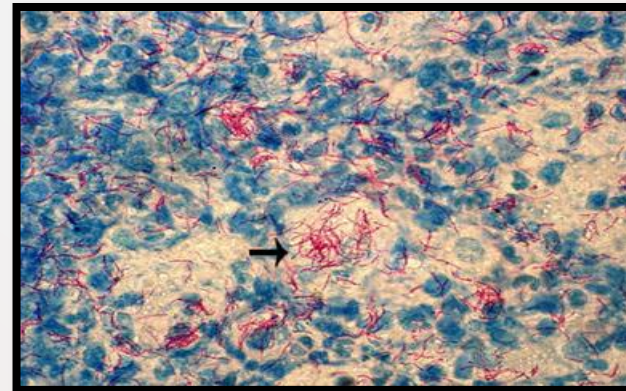
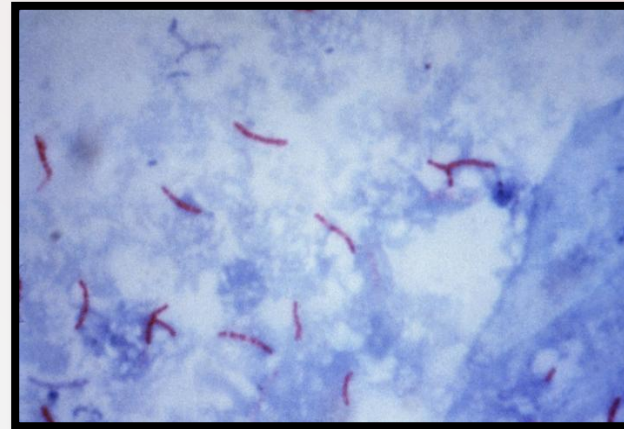
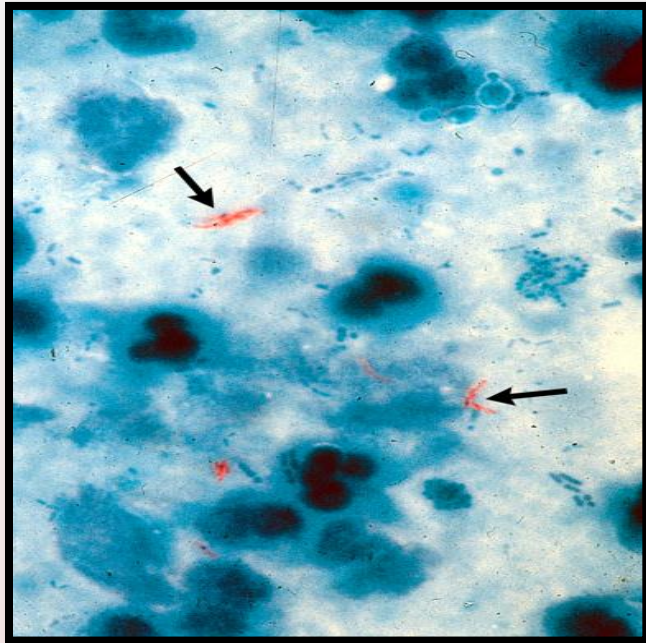
What further investigation would you like to do at this stage?

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# **Bacterial meningitis:** **Mycobacterium tuberculosis**

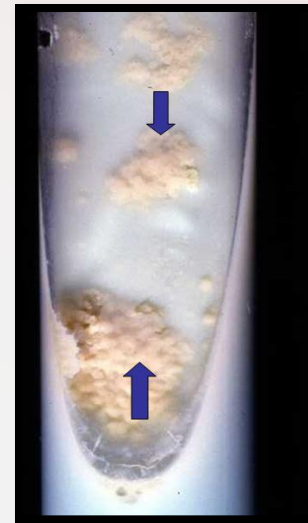
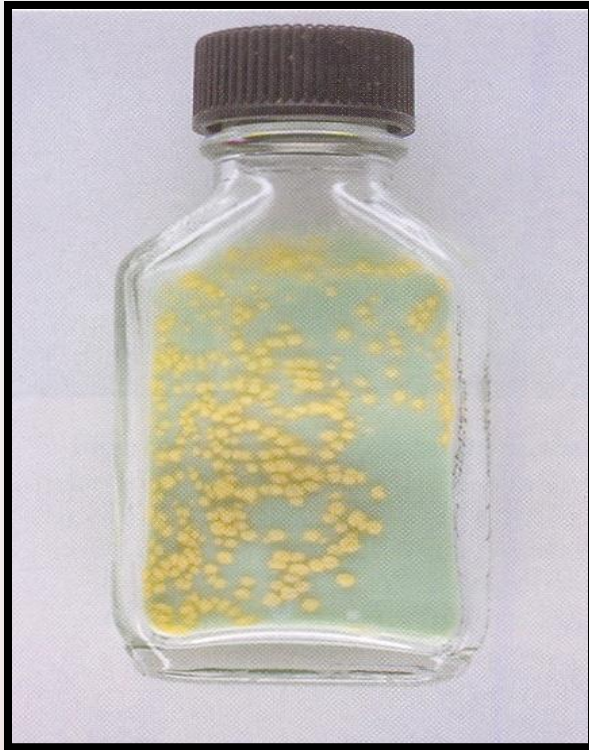


## **Microscopic Appearance**

Direct Ziel – Neelsen Stained Smear of a CSF deposit shows  
Acid – Fast Bacilli AFB



# **Bacterial meningitis:** ***Mycobacterium tuberculosis***



**Culture on Lowenstein – Jensen medium**

Colonies or growth is Rough, Tough and Buff