

Disease Detectives

Part I: What is wrong with Mike?

Yesterday, Mike Wright developed a severe headache, a high fever, and a stiff neck. Then, he became nauseated and began vomiting. He just wanted medicine to make him feel better and a dark quiet room so that he could sleep. Today, Mike's parents noticed that he was so sleepy that it was difficult to get him to wake up and he seemed confused. They took Mike to the hospital emergency room because they are worried that he is very sick.



1. Read the description of Mike's illness. Complete the "Mike's Symptoms" column in the chart below by putting an "X" in the appropriate boxes to indicate Mike's symptoms.

Symptoms	Mike's Symptoms	Viral Meningitis	Bacterial Meningitis	Influenza	West Nile Encephalitis
Fever					
Headache					
Cough					
Stiff neck					
Nausea and vomiting					
Light sensitivity					
Muscle aches					
Confusion					

2. Use the information on the **Possible Diseases** sheet on the last page of this lab to complete the other four columns in the chart. *Note: You may tear this page off to make it easier to complete the chart.*

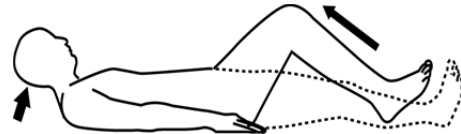
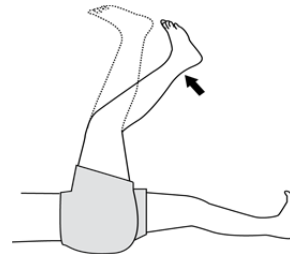
3. Why is it important that doctors determine which disease is causing Mike's symptoms?

4. Based on the information in the chart, what diseases are most likely to be causing Mike's symptoms?

Part 2: Is it Viral or Bacterial Meningitis?

The emergency room doctor found two worrisome symptoms that indicate Mike Wright may have meningitis.

- An inability to straighten his legs when his hips were flexed to 90 degrees.
- Severe neck stiffness that caused his hips and knees to flex when his neck was flexed.



Use the information in the **Fact Sheet: Meningitis** to answer questions 1 through 4.

1. What is meningitis?

2. Why is it important to determine if Mike has bacterial meningitis or viral meningitis?

3. Which type of meningitis (bacterial or viral) requires immediate treatment with antibiotics?

4. The doctor orders a lumbar puncture to collect the patient's cerebrospinal fluid (CSF).

- What is a lumbar puncture?

- What is cerebrospinal fluid (CSF)?

- You will test the patient's CSF to determine if Mike has bacterial or viral meningitis. Conduct the tests described on the **CSF Testing Procedures** sheet in your lab kit.
- Record the results of the CSF tests in the data table below

CSF Test Results for Mike Wright

	Glucose	Protein	Most Common White Blood Cells
Mike Wright (Patient)			
Bacterial meningitis	low	high	neutrophils
Viral meningitis	normal	normal or high	lymphocytes

- Based on the results of Mike Wright's CSF tests, what type of pathogen is causing his meningitis—a viral pathogen or a bacterial pathogen?

Part 3: Which Type of Bacteria?

There are three types of bacteria that commonly cause bacterial meningitis:

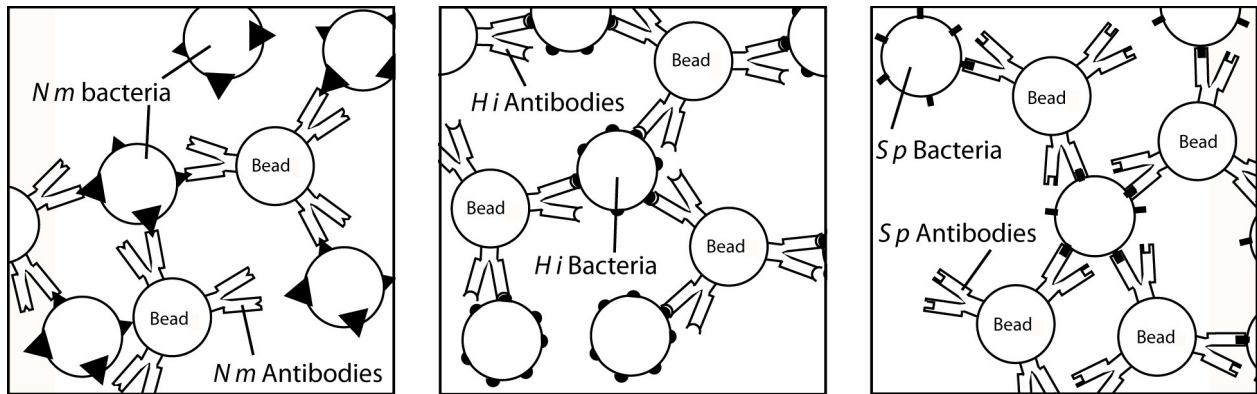
- *Streptococcus pneumonia* (*Sp*)
- *Neisseria meningitides* (*Nm*)
- *Haemophilus influenza* (*Hi*)

1. Use the information in the **Fact Sheet: Meningitis**. State two reasons why it is important to know which specific type of bacteria may be causing Mike's meningitis.

- _____
- _____

Base your answers to questions 2 through 5 on the information in the box below.

An **antibody-coated bead test** can be used to identify the type of bacteria that are causing the patient's meningitis. This test uses microscopic beads coated with specific kinds of **antibodies** that can combine with specific **antigens** (proteins) on the surface of bacteria. When antigens on the bacteria attach to the antibodies on the beads, the beads will clump together and appear as a white cloudy substance.



2. Explain how the three specific kinds of antibodies (*Nm* antibodies, *Hi* antibodies, and *Sp* antibodies) attached to the beads are different.

3. Explain how the three specific kinds of bacteria (*Nm* bacteria, *Hi* bacteria, and *Sp* bacteria) are different.

4. Explain why *Nm* bacteria clump together when mixed with beads that are coated with *Nm* antibodies. Use the words antigen and antibody in your answer.

5. Explain why *Hi* bacteria do **not** clump together when mixed with beads that are coated with *Nm* antibodies. Use the words antigen and antibody in your answer.

6. Follow the instructions below to test the Patient CSF to determine which type of bacteria is causing Mike's meningitis. Use the **Antibody-Coated Bead Test Strip** and three tubes of beads (*Nm*, *Sp*, and *Hi*) provided in your kit.

- a. Place two drops of antibody-coated beads (*Nm* beads, *Sp* beads, or *Hi* beads) in the appropriate circles on the Antibody-Coated Bead Test Sheet.
- b. Place two drops of the Patient CSF into each of the circles on the Antibody-Coated Bead Test Sheet.
- c. A cloudy appearance indicates that Patient CSF contains that specific type of bacteria. It is easier to see the cloudy appearance if the test sheet is placed on a dark surface.

7. Which antibody-coated beads turned cloudy when mixed with the Patient CSF?

8. Explain what caused these antibody-coated beads, and not the other antibody-coated beads, to turn cloudy. Use the words antigens and antibodies in your answer.

9. What type of bacteria is causing the patient's meningitis? Support your answer with evidence from the Antibody-Coated Bead Test.

Use the information in the Fact Sheet: Meningitis to answer questions 10 through 15.

10. State two reasons why meningitis caused by this type of bacteria is considered serious.

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11. Explain how meningitis bacteria damage the brain. Be specific!

12. What health problems might result from this brain damage? Be specific!

13. What treatments can be used for a patient with this type of meningitis?

14. How could this type of meningitis be prevented?

15. What action should be taken by unvaccinated people who may have been exposed to the bacteria that cause this type of meningitis?

Possible Diseases

<p style="text-align: center;">Viral Meningitis</p> <p>Viral meningitis is an infection of the meninges (the covering of the brain and spinal cord) that is caused by a virus. People with viral meningitis usually recover completely without specific treatment.</p> <p>There are several viruses that can cause viral meningitis. Most viral meningitis cases are caused by enteroviruses that infect the digestive tract. Other viruses that can cause meningitis include the viruses that cause mumps, chicken pox, influenza, and measles.</p> <p>Viral meningitis infection is characterized by a sudden onset of fever, headache, and stiff neck. It is often accompanied by other symptoms, such as nausea, vomiting, sensitivity to light, and confusion.</p>	<p style="text-align: center;">Bacterial Meningitis</p> <p>Bacterial meningitis is a serious and sometimes fatal infection of the meninges (the covering of the brain and spinal cord) that is caused by bacteria. While most people with bacterial meningitis recover, the disease can cause serious complications, such as brain damage, hearing loss, learning disabilities, or even death.</p> <p>There are several types of bacteria that can cause bacterial meningitis. Common causes of bacterial meningitis include <i>Streptococcus pneumoniae</i>, <i>Neisseria meningitidis</i>, and <i>Haemophilus influenzae</i>.</p> <p>Early symptoms of meningitis infection include a sudden onset of fever, headache, and stiff neck. Other symptoms may include nausea, vomiting, increased sensitivity to light, and confusion. Later symptoms of bacterial meningitis include seizures and coma.</p>
<p style="text-align: center;">Influenza</p> <p>Influenza (the flu) is a contagious respiratory illness caused by influenza viruses that infect the nose, throat, and lungs. It can cause mild to severe illness, and at times can lead to death.</p> <p>People who have the flu often have a fever, headache, cough, fatigue, and muscle or body aches. Some people also experience vomiting and diarrhea.</p> <p>Flu is unpredictable, and how severe it is can vary widely depending on the type of virus causing it. Older people, young children, pregnant women and people with certain health conditions (such as asthma, diabetes, or heart disease), and persons who live in facilities like nursing homes may be more at risk for severe flu symptoms.</p>	<p style="text-align: center;">West Nile Encephalitis</p> <p>West Nile encephalitis is a potentially serious disease caused by the West Nile virus. This virus is often transmitted by the bite of an infected mosquito. Mosquitoes become infected when they feed on infected birds.</p> <p>Most people who become infected with the virus will not show any symptoms. However, some people have symptoms such as fever, headache, body aches, nausea, and vomiting. Rarely, infected people experience confusion, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis.</p>