Disease Detectives

Part 1: 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 to complete the other four columns in the chart.

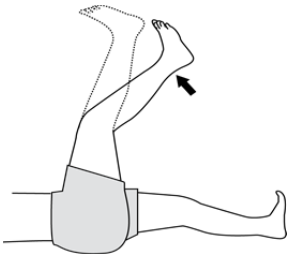
3. Why is it important that doctors determine which disease is causing Mike's symptoms?

   _____

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

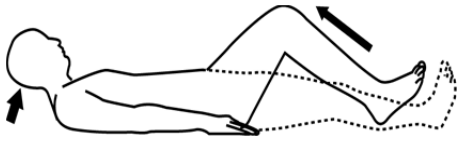
   _____

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)?

     _____

5. 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.

6. 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

7. 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?

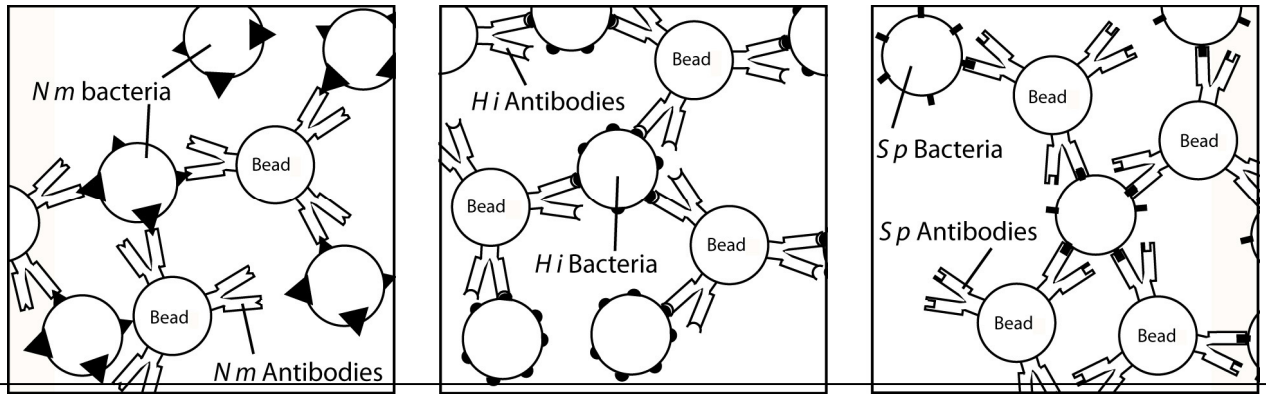
There are three types of bacteria that commonly cause bacterial meningitis:

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

1. Use the information in the **Fact Sheet: Meningitis**. State <u>two</u> 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 <u>specific kinds of antibodies</u> (*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 <u>two</u> reasons why meningitis caused by this type of bacteria is considered serious.

- _____
- _____

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?

_____

_____

Part 4: A Case of Meningitis

City High School

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Important Notice for All Students and Parents!

Students and parents should be aware that a student at City High School has been diagnosed with **bacterial meningitis**. Bacterial meningitis is especially dangerous because it is contagious and can cause serious illness or death. Signs and symptoms of meningitis include: high fever, headache, stiff neck, and vomiting.

For further information on bacterial meningitis, please see the US Centers for Disease Control and Prevention (CDC) website: www.cdc.gov/meningitis/about/index.html

The school board has established a new requirement that all students **age 11 or older** provide evidence that they have received the meningococcal vaccine (MCV4) that prevents bacterial meningitis. Students who have not already received the meningococcal vaccine (MCV4) may receive this vaccination through their physician or at free clinics set up in all district schools.

For further information on the **meningococcal vaccine (MCV4)**, visit the Centers for Disease Control website at www.cdc.gov/meningitis/vaccine-info.html

1. Have you been vaccinated for bacterial meningitis? (Ask your parents if you are not sure.)

   _____

2. Why do you think some parents support the requirement that all students be vaccinated for bacterial meningitis?

   _____

   _____

3. Why do you think some parents oppose the requirement that all students be vaccinated for bacterial meningitis?

   _____

   _____

4. Approximately 80% of teens have received the bacterial meningitis vaccine. List two possible reasons why 20% of teens have not been vaccinated?

   - _____
   - _____

5. Visit the CDC website and two additional websites to learn more about the meningococcal vaccine (MCV4). Use the information from these websites to complete the **Pre-writing Grid.** A pre-writing grid can help you organize information to be used in writing.
   - Write the title and Internet address for your three sources at the top of each column.
   - Write information related to each of the questions in the appropriate columns.

6. Write a letter to encourage all parents to have their children vaccinated with the meningitis vaccine. Your letter should include the answers to all of the questions in the Pre-writing Grid.

Dear Parents,

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