



Disease Detectives

Core Concepts:

- Symptoms and laboratory tests can be used to diagnose diseases.
- Meningitis is a serious infection that can lead to permanent brain damage or death.
- A vaccine can prevent the most common forms of bacterial meningitis.

Class time required:

- Four forty minute class periods. Parts 1 and 4 could be assigned as homework but Parts 2 and 3 should be completed in class.

Teacher Provides:

NOTE: Since this is a “progressive disclosure” case, you may distribute as a single packet OR distribute each part as needed.

For Part 1 each student will need:

- Copy of **Part 1: What is wrong with Mike?**
- Copy of **Part 1: Possible Diseases** (page v). For reuse in multiple classes, place in a sheet protector.

For Part 2 each student will need:

- Copy of **Part 2: Is it Viral or Bacterial Meningitis?**
- Copy of **Fact Sheet—Meningitis** (pages ix and x, save for use with other parts). For reuse in multiple classes, place in a sheet protector.

For Part 2 each team of 2-3 students will need:

- COLOR copy of **CSF (cerebrospinal fluid) Testing Procedure** (page vii)
- COLOR copy of **Patient’s White Blood Cells in CSF** (page viii). For reuse in multiple classes, laminate or cover with clear packing tape.
- 2 plastic droppers labeled “Patient CSF” and “Protein Test Solution”
- Small tubes or cups labeled and filled as shown in the table below:

Label on tube/cup	Contents of tube/cup for ONE student group Use more of each solution if these will be used for multiple classes.
Patient CSF	At least 2 ml of 8% sodium bicarbonate (baking soda) solution (<i>8 grams baking soda + 100 ml water</i>)
Protein Test Solution	1 ml of 0.01 % Bromothymol blue solution (0.01 g bromothymol powder + 100 ml water)

- Small bag labeled “Glucose Test Paper” containing at least 1 strip of pH 1-12 or pH 1-14 test paper If preparing for multiple classes, put at least one strip in the bag per class.
- **Glucose and Protein Test Sheet** (page 6) printed on transparency or inserted into a sheet protector.

For Part 3 each student will need:

- Copy of **Part 3: Which Type of Bacteria?**
- Copy of **Fact Sheet—Meningitis** (saved from Part 2)

For Part 3 each team of 2-3 students will need:

- Droppers labeled: “Nm Antibody-Coated beads,” “Sp Antibody-Coated beads.” “Hi Antibody-Coated beads” and “Patient CSF” (may be reused from Part 2)
- Small tubes or cups labeled and filled as shown in the table below. If using for multiple classes increase amounts.

Label on tube/cup and dropper	Contents of tube/cup for ONE student group Use more of each solution if these will be used for multiple classes.
Nm Antibody-Coated beads	At least 1 ml 15% calcium chloride solution (15 grams calcium chloride + 100 ml water)
Sp Antibody-Coated beads	At least 1 ml water
Hi Antibody-Coated beads	At least 1 ml water
Patient CSF	At least 1 ml 8% sodium bicarbonate (baking soda) solution (8 grams baking soda + 100 ml water)

- **Instructions for Antibody-Coated Bead Agglutination Test**
- **Antibody-Coated Agglutination Test Sheet** printed on plastic transparency sheet or printed on paper that is inserted into a sheet protector.

For Part 4 each student will need:

- Copy of **Part 4: City High School**
- Copy of **Fact Sheet—Meningitis** (saved from Part 2)
- Copy of **Pre-writing Grid** (pages xii and xiii)

For Part 4 each team of 2-3 students will need:

- Internet access. If Internet access is not feasible, the teacher may print copies of information for distribution to the teams. Provide each team member with one copy of information from a different source. Suggested sources include:
 - CDC Meningitis <http://www.cdc.gov/meningitis/index.html>
 - Kids Health: Meningitis <http://kidshealth.org/parent/infections/lung/meningitis.html>
 - Medline Plus: Meningitis <http://www.nlm.nih.gov/medlineplus/meningitis.html>

Suggested Supplementary Resources

- The PBS series **The Vaccine War** examines the debate over medical risks vs. benefits and a parent's right to make choices about her child vs. a community's common good
<http://www.pbs.org/wgbh/pages/frontline/vaccines/>
- The book **In the Blink of an Eye: The Deadly Story of Epidemic Meningitis** by Andrew W. Artenstein, ISBN 978-1-4614-4844-0 provides further information on meningitis and the science involved in seeking ways to prevent meningitis.

Suggested Class procedure:

NOTE: Since this is a “progressive disclosure” case, it is important to distribute each part as needed – NOT as a single packet.

1. Assign students to work in teams of two or three students.
2. Distribute **Part 1: What is wrong with Mike?** and **Part 1: Possible Diseases** to each student. Read the case aloud. Ask students to work with their team to answer the four questions.
3. Distribute **Part 2: Is it Viral or Bacterial Meningitis?** and **Fact Sheet - Meningitis** to each student. Ask students to complete Part 2. As they work, distribute the lab materials for Part 2 to each team:
 - CSF (cerebrospinal fluid) Testing Procedure sheet
 - Patient CSF (save extra for Part 3)
 - Small bag of Glucose Test Paper
 - Protein Test Solution
 - Glucose and Protein Test Sheet
 - Photo of Patient's White Blood Cells in CSF
 - Droppers labeled Patient CSF and Protein Test Solution
4. Distribute **Part 3: Which Type of Bacteria?** to each student. Read the first three paragraphs aloud.
5. Distribute lab materials for Part 3 to each team:
 - Antibody-Coated Bead Test Sheet
 - Tubes/cups of:
 - Patient CSF (new tube or saved from Part 2)
 - *Nm* Antibody-Coated Beads
 - *Sp* Antibody-Coated Beads
 - *Hi* Antibody-Coated Beads

- Droppers labeled:
 - Patient CSF
 - *Nm* Antibody-Coated Beads
 - *Sp* Antibody-Coated Beads
 - *Hi* Antibody-Coated Beads
6. Students work with their team to complete Part 3. They will need the **Fact Sheet—Meningitis** for Part 3.
 7. Distribute **Part 4: A Case of Meningitis** and **Pre-writing Grid** to each student. They will also need the **Fact Sheet—Meningitis** for Part 4.
 8. Students work with their team to answer the questions 1 through 5. Encourage team members to collaborate when completing the Pre-writing Grid by sharing the information they find with other team members. The use of a pre-writing grid is a way to encourage students to do research before they begin writing on a topic. If students are working in a team, each student can do research with one source and the team can share the information using the pre-writing guide.
 9. Students work individually and use the information from the Pre-writing Grid to write the letter to parents. Writing the parent letter may be done for homework.
 10. Be prepared to discuss the pros and cons of vaccinations (both for meningitis and for other diseases). It is important that students understand that the benefits from vaccinations far outweigh the risks from vaccinations. It has been shown that the scientist who claimed that vaccines caused autism falsified his data. For more information, see <http://www.cnn.com/2011/HEALTH/01/05/autism.vaccines/index.html>
 11. Also remind students that vaccinations are not just for babies. There are vaccines that teens should have, such as the vaccines to prevent meningitis, diphtheria, tetanus, and HPV. A potential resource for this discussion is CDC: Preteen and Teen Vaccines at <http://www.cdc.gov/vaccines/who/teens/index.html>

Part 1: Possible Diseases

Viral Meningitis

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.

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.

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.

Bacterial Meningitis

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.

There are several types of bacteria that can cause bacterial meningitis. Common causes of bacterial meningitis include *Streptococcus pneumoniae*, *Neisseria meningitidis*, and *Haemophilus influenza*.

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.

Influenza

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.

People who have the flu often have a fever, headache, cough, fatigue, and muscle or body aches. Some people also experience vomiting and diarrhea.

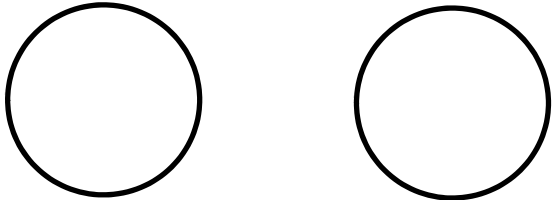
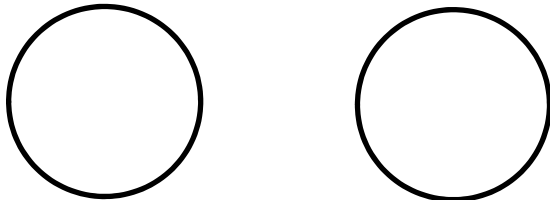
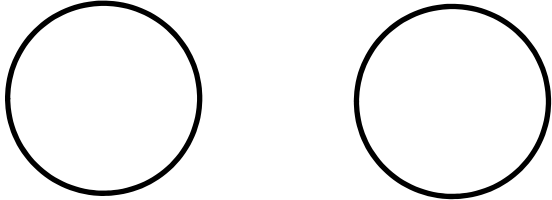
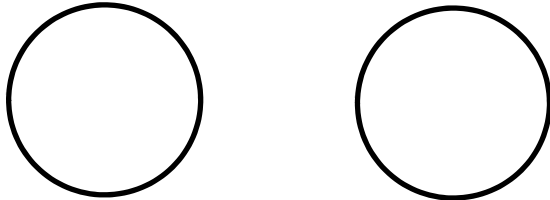
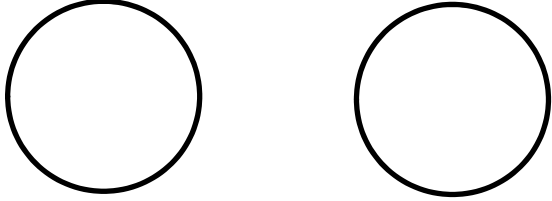
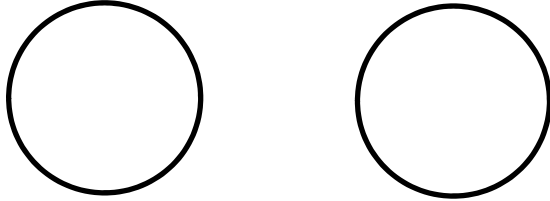
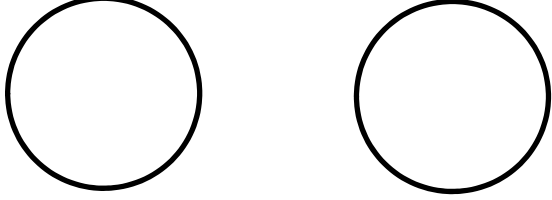
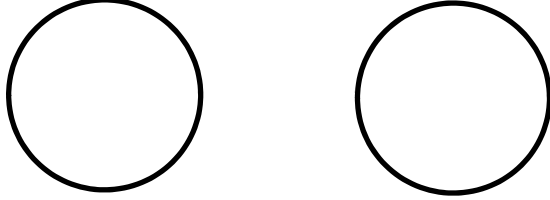
Flu is unpredictable, and how severe it is can vary widely depending on the type of virus causing it. Older people, young children, pregnant women and people with certain health conditions (such as asthma, diabetes, or heart disease), and persons who live in facilities like nursing homes may be more at risk for severe flu symptoms.

West Nile Encephalitis

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.

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.

For Part 2: Print on transparency sheet




<p>Glucose and Protein Test Sheet</p>  <p>Use for Glucose Test Use for Protein Test</p>	<p>Glucose and Protein Test Sheet</p>  <p>Use for Glucose Test Use for Protein Test</p>
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For Part 2

CSF (cerebrospinal fluid) Testing Procedures




Test for glucose levels - Use the plastic **Glucose and Protein Test Sheet**:

- Place 2 drops of the patient's CSF sample in the circle labeled "Use for Glucose Test."
- Dip the Glucose Test Paper into the CSF sample in the circle.
- Use the Glucose Test Color Chart to determine whether the patient's CSF glucose level is low, normal, or high.

		
Low Glucose	Normal Glucose	High Glucose

Test for protein levels - Use the plastic **Glucose and Protein Test Sheet**:

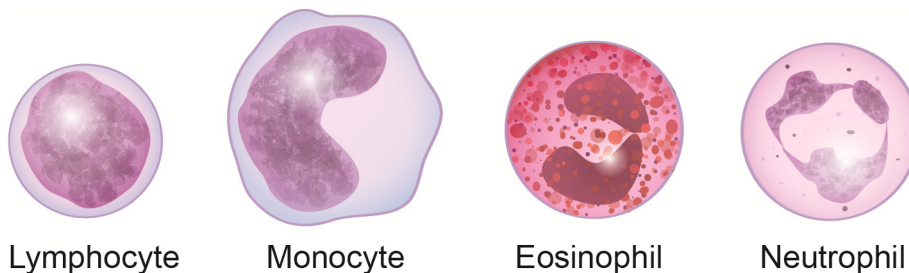
- Place two drops of the patient's CSF sample in the circle labeled "Use for Protein Test."
- Add two drops of Protein Test Solution to the CSF sample in the circle.
- Use the Protein Test Color Chart to determine whether the patient's CSF protein level is low, normal, or high.

		
Low Protein	Normal Protein	High Protein

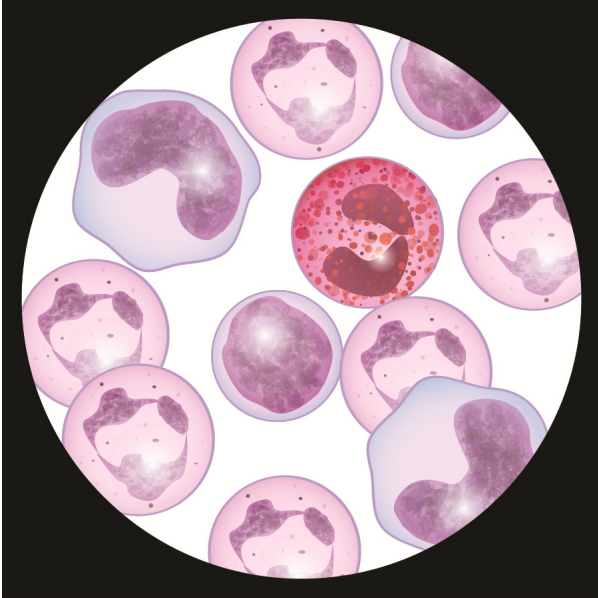
White Blood Cell Count:

- Observe the pictures of stained white blood cells in the patient's CSF sample.
- Refer to the diagrams below that show different types of white blood cells. Identify which type of white blood cell is most common in the patient's CSF.

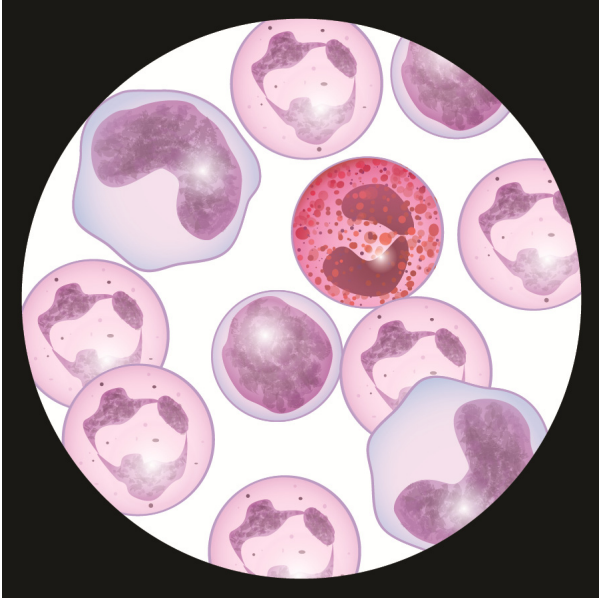
White Blood Cells



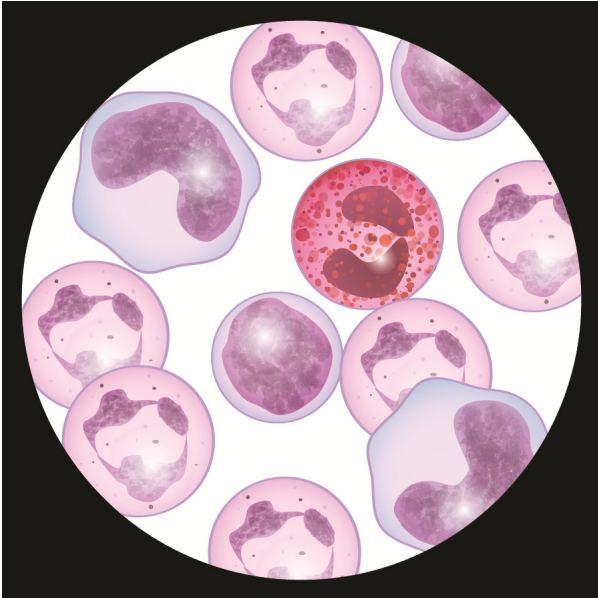
For Part 2



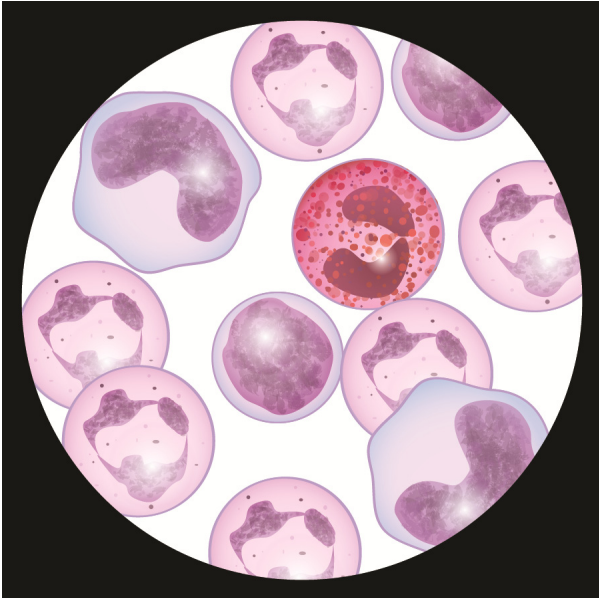
Patient's White Blood Cells in CSF



Patient's White Blood Cells in CSF



Patient's White Blood Cells in CSF



Patient's White Blood Cells in CSF

Fact Sheet: Meningitis

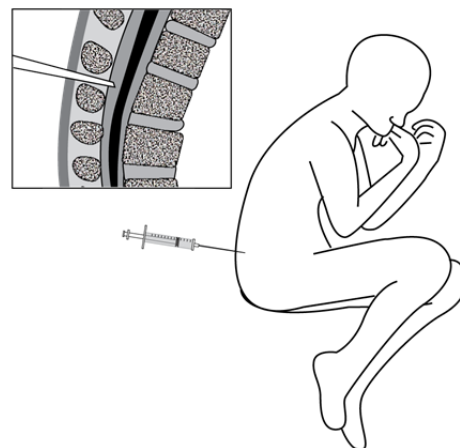
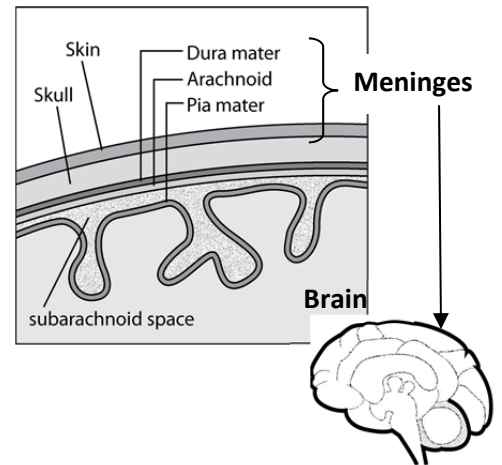
Meningitis is an inflammation of the meninges (the thin membranes surrounding the brain and spinal cord). It is usually caused by a viral or bacterial infection.

Viral meningitis is more common than bacterial meningitis, but it is less serious. Viral meningitis usually clears up on its own and does not cause any permanent harm. It can be caused by several types of viruses, including enteroviruses (which cause the stomach flu), the human immunodeficiency virus (HIV), and the virus that causes mumps.

Bacterial meningitis is not as common as viral meningitis, but it is much more serious and requires emergency treatment. Bacterial meningitis can cause brain damage, learning disabilities, hearing loss, or even death.

To diagnose meningitis, doctors will do a lumbar puncture (spinal tap). A lumbar puncture allows the doctor to collect some of the cerebrospinal fluid (CSF) that surrounds the brain and spinal cord. During a spinal tap, patients usually lie on their side curled into a ball. First, the doctor will numb the skin with medication. Patients need to lie very still while the doctor inserts a very thin needle into the spinal column. Fluid is removed and collected in tubes.

After the cerebrospinal fluid is collected, it will be examined under a microscope to see if it contains bacteria, white blood cells, or other substances that indicate inflammation or infection. Usually, by looking at the spinal fluid, a doctor will be able to tell if someone has meningitis. The fluid will also be sent to a laboratory to be tested for bacteria and viruses. Once the doctors know what pathogen is causing the meningitis, they can choose the best medication to treat the infection.



The bacteria that cause bacterial meningitis colonize in the nose and throat. From there they get into the bloodstream and enter the cerebrospinal fluid (CSF) that bathes the brain and spinal cord. This fluid is an ideal medium for the bacteria because it provides nutrients for their multiplication. When the bacteria die, toxins are released. These toxins can damage brain blood vessels and lead to shock or swelling of the brain. White blood cells circulating in the CSF are attracted to the bacteria. These white blood cells may release powerful enzymes that damage brain tissue.

There are several types of bacteria that may cause bacterial meningitis. Therefore, it is important that doctors conduct tests to determine which type of bacteria is causing a patient's meningitis, so they can select the proper treatment.

One type of bacteria, *Neisseria meningitides*, causes a dangerously contagious and life-threatening type of meningitis. This type of bacterial meningitis is more common in people who are living in a crowded setting, such as a dormitory, school, or child care facility.

Bacterial meningitis caused by *Neisseria meningitides* is very serious and prompt treatment is essential if the patient is to survive. Patients need to be in the hospital during treatment. Strong antibiotic medicine will be given intravenously (through an IV— a thin tube that goes into a vein to give medicine) to get rid of the bacteria. Fluids containing glucose (sugar) and minerals may also be given through the IV to help patients recover.

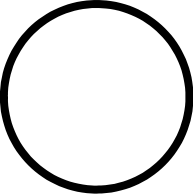
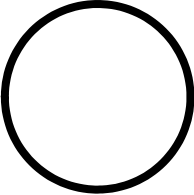
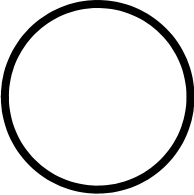
About 25–30% of people with bacterial meningitis die from it. People who survive bacterial meningitis may have complications including: hearing loss, seizures, cerebral edema (brain swelling), weakness on one side of the body, speech problems, visual impairment or blindness, difficulty coordinating movements, trouble breathing, respiratory arrest, and recurring meningitis.

The Centers for Disease Control (CDC) recommends that children age 11 or older receive the meningococcal vaccine (MCV4) that prevents bacterial meningitis.

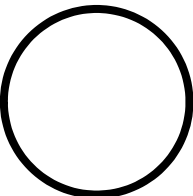
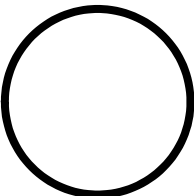
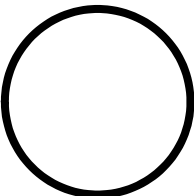
Doctors will want to know who was in close contact with a person who has bacterial meningitis. Close contact means living with or spending a lot of time with the person, or sharing the same utensils or cups. This is important because people who have not been vaccinated for bacterial meningitis may need antibiotics for a few days, just in case they were infected with the bacteria.

For Part 3 – Print on plastic transparency sheet OR print on paper that you insert into a sheet protector.

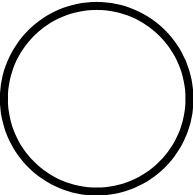
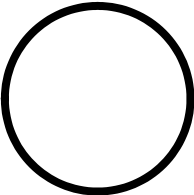
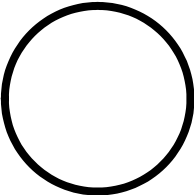
Antibody-Coated Bead Agglutination Test Sheet

<i>Neisseria meningitides</i> (Nm)	<i>Streptococcus pneumoniae</i> (Sp)	<i>Haemophilus influenzae</i> (Hi)
		

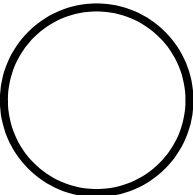
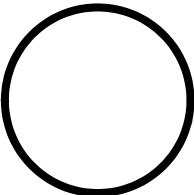
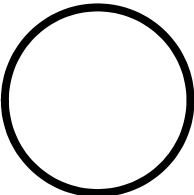
Antibody-Coated Bead Agglutination Test Sheet

<i>Neisseria meningitides</i> (Nm)	<i>Streptococcus pneumoniae</i> (Sp)	<i>Haemophilus influenzae</i> (Hi)
		

Antibody-Coated Bead Agglutination Test Sheet

<i>Neisseria meningitides</i> (Nm)	<i>Streptococcus pneumoniae</i> (Sp)	<i>Haemophilus influenzae</i> (Hi)
		

Antibody-Coated Bead Agglutination Test Sheet

<i>Neisseria meningitides</i> (Nm)	<i>Streptococcus pneumoniae</i> (Sp)	<i>Haemophilus influenzae</i> (Hi)
		

Pre-writing Grid

	Source 1	Source 2	Source 3
What substance in a meningitis vaccine makes it effective?			
How does the meningitis vaccine work to prevent meningitis?			
Does the meningitis vaccine prevent all types of meningitis?			
What are the advantages of the use of vaccinations to prevent meningitis?			

<p>What are the disadvantages of using antibiotics to prevent meningitis?</p>			
<p>Why are other vaccines, such as those for influenza and tetanus, not effective in preventing meningitis?</p>			
<p>Is the meningitis vaccine safe and effective?</p>			
<p>What other information might be helpful in convincing parents that it is important that people be vaccinated to prevent meningitis?</p>			

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	X	X	X	X	X
Headache	X	X	X	X	X
Cough				X	
Stiff neck	X	X	X		
Nausea and vomiting	X	X	X	X	X
Light sensitivity	X	X	X	X	
Muscle aches				X	X
Confusion	X	X	X	X	

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?

These diseases may all lead to serious problems and even death.

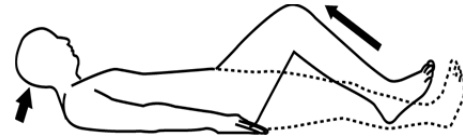
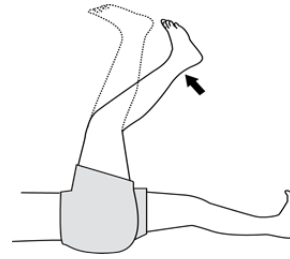
4. Based on the information in the chart, what diseases are most likely to be causing Mike's symptoms?

Viral meningitis or bacterial meningitis

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?

Meningitis is an inflammation of the meninges (the thin membranes surrounding the brain and spinal cord).

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

Bacterial meningitis can result in serious brain damage or death. Viral meningitis is less serious and usually does not require treatment.

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

Bacterial meningitis

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

- What is a lumbar puncture?

During a lumbar puncture, the doctor inserts a fine needle into the spinal column and collects the cerebrospinal fluid.

- What is cerebrospinal fluid (CSF)?

The fluid that surrounds the brain and spinal cord

- 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)	<i>low</i>	<i>high</i>	<i>neutrophils</i>
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?

Bacterial pathogen

Part 3: Which Type of Bacteria?

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

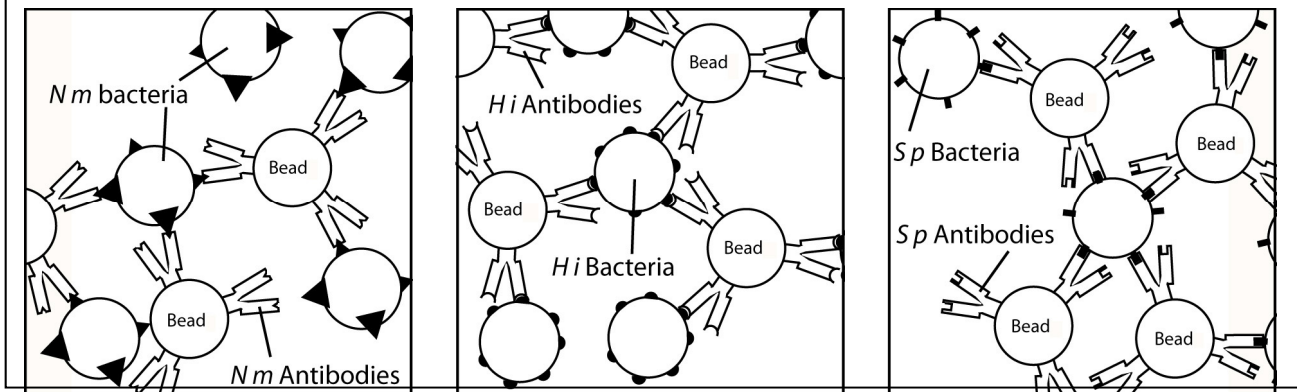
- *Streptococcus pneumonia* (**Sp**)
- *Neisseria meningitides* (**Nm**)
- *Haemophilus influenza* (**Hi**)

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.

- **To determine if the meningitis might be caused by *Neisseria meningitides*, a highly contagious pathogen that can be lethal within hours if not diagnosed and treated promptly.**
- **To select the appropriate antibiotic used to treat the patient.**

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.

They have different shapes.

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

They have antigens with different shapes on their surface.

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.

The antigens on the Nm bacteria have the right shape to attach to the Nm antibodies on the Antibody-Coated beads.

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.

The Nm antibodies do not have the correct shape to attach to the antigens on Hi bacteria.

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?

The Nm beads

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.

The antigens on the bacteria only had the correct shape to attach to the antibodies on the Nm beads. These caused the antibody-coated beads to stick together.

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

Neisseria meningitides because only the Nm antibody-coated beads turned cloudy when mixed with the patient's CSF.

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.

It is dangerously contagious.

It is a serious disease that often results in brain damage or death.

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

Bacteria multiply in the CSF. When the bacteria die, toxins are released. These toxins can damage brain blood vessels and lead to shock or swelling of the brain. White blood cells circulating in the CSF are attracted to the bacteria. These white blood cells may release powerful enzymes that damage brain tissue.

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

About 25 - 30% of people with bacterial meningitis die from it. People who survive bacterial meningitis may have complications including: hearing loss, seizures, cerebral edema (brain swelling), weakness on one side of the body, speech problems, visual impairment or blindness, difficulty coordinating movements, trouble breathing, respiratory arrest, and recurring meningitis.

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

Patients need to be in the hospital during treatment. Strong antibiotic medicine will be given intravenously (through an IV- a thin tube that goes into a vein to give medicine) to get rid of the bacteria. Fluids containing glucose (sugar) and minerals may also be given through the IV to help patients recover.

14. How could this type of meningitis be prevented?

The Centers for Disease Control (CDC) recommends that children age 11 or older receive the meningococcal vaccine (MCV4) that prevents bacterial meningitis.

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

People who have not been vaccinated will need antibiotics for a few days.

Part 4: A Case of Meningitis

<h1>City High School</h1>	
Home	<h3>Important Notice for All Students and Parents!</h3>
About City High	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.
Activities	For further information on bacterial meningitis, please see the US Centers for Disease Control and Prevention (CDC) website:
Administration	www.cdc.gov/meningitis/about/index.html
Athletics	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 <u>not</u> already received the meningococcal vaccine (MCV4) may receive this vaccination through their physician or at free clinics set up in all district schools.
Departments	For further information on the meningococcal vaccine (MCV4) , visit the Centers for Disease Control website at www.cdc.gov/meningitis/vaccine-info.html
Parents/PTA	

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

Student answers will vary.

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

It prevents bacterial meningitis.

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

They may be concerned that the vaccine may have side effects.

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

Student answers will vary but may include:

- **Concern over vaccine safety.**
- **Not aware that vaccine was available.**
- **Too busy to get vaccine**
- **Has not seen a doctor recently**
- **Afraid of shots**

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,
