

# Entomologists on Safari: On the Hunt for Mosquitoes

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## CDC's 2007 Science Ambassador Program

This lesson is designed for a middle school science course. West Nile virus is an infectious disease in the U.S. Although most people infected with the virus are asymptomatic, West Nile disease can be serious, particularly among older people. In this lesson, students will assume the role of entomologists in a case study to investigate increased mosquito activity and the possibility of West Nile virus transmission in the fictional community of Anywhereville. Students will then present the community with ways to prevent West Nile virus infection by creating a West Nile prevention poster.

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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## Summary

This lesson is designed for a middle school science course. West Nile virus is an infectious disease in the U.S. Although most people infected with the virus are asymptomatic, West Nile disease can be serious, particularly among older people. In this lesson, students will assume the role of entomologists in a case study to investigate increased mosquito activity and the possibility of West Nile virus transmission in the fictional community of Anywhereville. Students will then present the community with ways to prevent West Nile virus infection by creating a West Nile prevention poster.

## Learning Outcomes

- Students will be able to describe the symptoms and transmission of West Nile virus.
- Students will be able to describe parts of the mosquitoes.
- Students will be able to explain prevention strategies for West Nile virus.

## Materials

1. Computers with Internet access
2. Photocopies of the West Nile Pretest – one per student
3. Photocopy of the West Nile Virus Pretest Key – one copy for teacher’s reference
4. Photocopies of West Nile Virus Case Study – one per student
5. Photocopy of West Nile Virus Case Study Key – one copy for teacher’s reference
6. Photocopies of the Poster Rubric – one per student
7. Photocopies of the Presentation Rubric – one per student
8. Poster boards – one per group
9. Art supplies including markers, scissors, and glue

## Total Duration

2 hours and 25 minutes

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## Procedures

### Teacher Preparation

The teacher should provide each student with one copy of the following documents:

- Step 1 – Introduction (West Nile Pretest)
- Step 2 – West Nile Virus Case Study
- Step 3 – Poster Rubric, and Conclusion – Presentation Rubric

One copy of the handouts, West Nile Virus Pretest (Key) and West Nile Virus Case Study (Key) should be made for the teacher’s reference. Prior to the lesson, the teacher should show the Centers for Disease

Control and Prevention (CDC), Division of Vector-Borne Infection Disease's Protecting Yourself and Your Community from West Nile Virus video. For additional information, the teacher may also review the fact sheet, West Nile Virus: What You Need to Know. Teachers may also need to reserve time in a computer lab or media center where students will have access to computers to complete their research in Step 2.

#### **Web Resources**

Title: Protecting Yourself and Your Community from West Nile Virus

URL: [http://www.cdc.gov/ncidod/dvbid/westnile/wnv\\_communityVideo.htm](http://www.cdc.gov/ncidod/dvbid/westnile/wnv_communityVideo.htm)

Description: This is a video about West Nile virus and how individuals and communities can take action to prevent infection.

Title: West Nile Virus: What You Need to Know

URL: [http://www.cdc.gov/ncidod/dvbid/westnile/wnv\\_factsheet.htm](http://www.cdc.gov/ncidod/dvbid/westnile/wnv_factsheet.htm)

Description: This website contains information about the transmission, symptoms and prevention of West Nile virus.

## **Introduction**

### **Step 1 (Duration: 30 minutes)**

The West Nile Virus Pretest will be used to assess students' prior knowledge and introduce the topic of West Nile virus. The teacher should make sure to inform students that they will be answering these questions later in the lesson. Answers to the pretest can be found in the West Nile Virus Pretest – Key.

#### **Supplemental Documents**

Title: West Nile Virus Pretest

Description: This is a five question short answer test used to assess students' previous knowledge of West Nile virus.

Title: West Nile Virus Pretest - Key

Description: This is the pretest answer key and can be used to aid in the discussion of the students answers to the pretest.

### **Step 2 (Duration: 45 minutes)**

After completing the pretest, the teacher should provide each student with one copy of the West Nile Virus Case Study handout. The teacher then will inform students that they are entomologist and the community of Anywhereville has requested their assistance with a troubling situation. The residents of the community have reported a significantly higher than usual level of mosquito activity and have reported several cases of severe West Nile virus disease. Using the Web resources listed on the handout, students will research various aspects of West Nile virus transmission, disease, and prevention.

#### **Supplemental Documents**

Title: West Nile Virus Case Study

Description: This document provides background for the outbreak in Anywhereville and lists the research questions students will answer.

Title: West Nile Virus Case Study – Key

Description: This document contains the answers to the West Nile Virus Case Study.

#### **Web Resources**

Title: West Nile Questions and Answers

URL: <http://www.cdc.gov/ncidod/dvbid/westnile/qa/transmission.htm>

Description: This CDC website contains information on various topics related to West Nile virus.

### **Step 3 (Duration: 30 minutes)**

Now that the students have completed the case study, they are ready to apply their knowledge to create a West Nile virus prevention poster. The teacher should place students in groups of four and have each group create a poster to be used in a neighborhood meeting of Anywhereville residents. Each student should be provided with the Presentation Rubric handout to ensure he or she is aware of the criteria on which their work will be assessed.

### **Conclusion (Duration: 40 minutes)**

After completing the poster, have each group create a 5-10 minute presentation for the Anywhereville residents. Classmates will serve as the audience of neighborhood residents. The group should incorporate in their presentation the prevention poster made in Step 3. Each student should be provided with the Presentation Rubric handout to ensure they are aware of the criteria on which their work will be assessed.

## **Assessment**

The students will be evaluated using the West Nile Virus Case Study – Key in Step 2, the Poster Rubric in Step 3 and the Presentation Rubric in the Conclusion.

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## **Modifications**

### **Extensions**

This lesson can be modified by having students research the mosquito species in their areas. Students can identify the breeding patterns and possible diseases these mosquitoes might carry.

Students can identify potential mosquito breeding areas near their school or homes and then discuss ways to eliminate these areas in their community.

Students can create a public service announcement about prevention of West Nile virus. Multiple media types can be used (e.g., radio, television, brochures).

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## Education Standards

### National Science Education Standards

#### SCIENCE AS INQUIRY, CONTENT STANDARD A

As a result of activities in grades 5-8, all students should develop

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

#### LIFE SCIENCE, CONTENT STANDARD C

As a result of their activities in grades 5-8, all students should develop understanding of

- Structure and function in living systems
- Reproduction and heredity
- Regulation and behavior
- Populations and ecosystems
- Diversity and adaptations of organisms

## West Nile Virus Pretest

Entomologists on Safari: On the Hunt for Mosquitoes  
Lyn Countryman and Mable Hurtault, CDC's 2007 Science Ambassador Program

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Directions: Answer each question using complete sentences.

1. What are the symptoms of West Nile virus?
2. How does West Nile virus spread?
3. How soon do infected persons get sick?
4. What is the treatment for West Nile virus?
5. How can West Nile virus be prevented?

## West Nile Virus Pretest – Key

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Directions: Answer each question using complete sentences.

1. What are the symptoms of West Nile virus?

ANSWER: Most people who are infected will not develop any symptoms. Severe symptoms can include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness, and paralysis. These symptoms may last several weeks, and neurological effects may be permanent. Up to 20 percent of the people who become infected have symptoms such as fever, headache, and body aches, nausea, vomiting, and sometimes swollen lymph glands or a skin rash on the chest, stomach and back. Symptoms can be as short as a few days, though even healthy people have become sick for several weeks.

2. How does West Nile virus spread?

ANSWER: Most often, WNV is spread by the bite of an infected mosquito. Mosquitoes become infected when they feed on infected birds. Infected mosquitoes then can spread WNV to humans and other animals when they bite. In a very small number of cases, WNV also has been spread through blood transfusions, organ transplants, breastfeeding (probable) and even during pregnancy from mother to baby.

3. How soon do infected persons get sick?

ANSWER: People typically develop symptoms between 3 and 14 days after they are bitten by an infected mosquito.

4. What is the treatment for West Nile virus?

ANSWER: There is no specific treatment for WNV infection. In milder cases, people might experience symptoms such as fever and aches that pass on their own, although even healthy people have become sick for several weeks. In more severe cases, people usually need to go to the hospital where they can receive treatment including intravenous fluids, help with breathing, and nursing care. (1)

5. How can West Nile virus be prevented?

ANSWER: The easiest and best way to avoid WNV is to prevent mosquito bites. When you are outdoors, use insect repellent. Many mosquitoes are most active at dusk and dawn. Be sure to use insect repellent and wear long sleeves and pants at these times, or consider staying indoors during these hours. Make sure you have good screens on your windows and doors to keep mosquitoes out. Get rid of mosquito breeding sites by removing standing water from flower pots, buckets and barrels. Change the water in pet dishes and replace the water in bird baths weekly. Drill holes in tire swings so water drains out. Children's wading pools should be kept empty and on their sides when they are not being used.

### References

Centers for Disease Control and Prevention. West Nile Virus: What You Need To Know - CDC Fact Sheet. [cited 2007 June 8]. 2006. Available from URL:

[http://www.cdc.gov/ncidod/dvbid/westnile/wnv\\_factsheet.htm](http://www.cdc.gov/ncidod/dvbid/westnile/wnv_factsheet.htm)





10. List three ways residents can prevent mosquito bites.

11. What percentage of infected individuals develops severe illness?

## West Nile Virus Case Study – Key

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### Group Members

Student's Name \_\_\_\_\_

Student's Name \_\_\_\_\_

Student's Name \_\_\_\_\_

Student's Name \_\_\_\_\_

### Directions

Your group will read the following description of a West Nile encephalitis outbreak in the town of Anywhereville. After reading the description, answer the questions below using the web resources and the associated links provided.

Centers for Disease Control and Prevention  
West Nile Virus: Questions and Answers  
<http://www.cdc.gov/ncidod/dvbid/westnile/q&a.htm>

Centers for Disease Control and Prevention  
West Nile Virus: Entomology  
<http://www.cdc.gov/ncidod/dvbid/westnile/insects.htm>

### West Nile in Anywhereville, U.S.

The local department of health has received several reports from the Anywhereville hospital of West Nile encephalitis. The residents know very little about West Nile virus and are concerned that more cases of the illness will occur. The mayor has asked you, as an entomologist, to provide residents with information about the virus and prevention of disease.

From speaking with residents, you learn that this summer has been unusually wet. As you walk around the town, you notice pools of standing water and water-filled containers such as bird baths, potted plants, and rain gutters. Residents have commented on increased mosquito activity. Dead birds also have been found in the area.

### Questions

1. What specific type of virus is West Nile?

ANSWER: Flavivirus (7)

2. What is the main way West Nile virus is transmitted to humans?

ANSWER: Most often, WNV is spread by the bite of an infected mosquito. (1)

3. Name three other ways West Nile virus has been found to be transmitted to humans.

ANSWER: In a very small number of cases, WNV also has been spread through blood transfusions, organ transplants, breastfeeding (probable), and even during pregnancy from mother to baby. (1)

4. How are mosquitoes infected with the virus?

ANSWER: Mosquitoes become infected when they feed on infected birds. (1)

5. Which of the following age groups is most likely to develop severe West Nile virus disease (i.e. encephalitis and West Nile fever)?

ANSWER:

- A. Young children
- B. Young and middle aged adults
- C. Older adults [adults over 50 (2)]

6. Which species of mosquito is the most common vector (carrier) of West Nile virus in the U.S.?

ANSWER: Culex spp. (3)

7. What should residents do when a dead bird is found in their neighborhood?

ANSWER: If a dead bird is found, residents should not touch it with their bare hands. They should contact the local health department for instructions on reporting and disposing of the bird. (4)

8. Do most people infected with West Nile virus become ill?

ANSWER: No. Approximately 80 percent of people who are infected with WNV will not show any symptoms. (5)

9. What are the symptoms for mild and severe West Nile disease?

ANSWER:

Mild West Nile fever: Fever, Headache, Body aches, Nausea, Vomiting, Occasional swollen lymph, Occasional skin rash on chest, stomach and back (5).

Severe West Nile fever (also known as neuroinvasive disease such as West Nile encephalitis, West Nile meningitis or West Nile poliomyelitis) : High fever, Headaches, Neck stiffness, Stupor, Disorientation, Coma, Tremors, Convulsions, Muscle weakness, Vision Loss, Numbness, Paralysis (5).

10. What percentage of infected individuals develops severe illness?

ANSWER: Approximately 1% (6)

11. List three ways residents can prevent mosquito bites.

ANSWER:

- Apply insect repellent to exposed skin.
- Spray clothing with repellents containing permethrin or another EPA-registered repellent, because mosquitoes might bite through thin clothing.
- Wear long-sleeved shirts and long pants whenever you are outdoors when weather permits.
- Place mosquito netting over infant carriers when you are outdoors with infants.
- Consider staying indoors at dawn, dusk, and in the early evening, which are peak mosquito biting times.
- Install or repair window and door screens so that mosquitoes cannot get indoors. (6)

**References:**

1. Centers for Disease Control and Prevention. Questions and Answers – Transmission. 2006. [cited 2007 June 8]. Available at URL: <http://www.cdc.gov/ncidod/dvbid/westnile/qa/transmission.htm>
2. Centers for Disease Control and Prevention. Questions and Answers – Who’s at Risk for West Nile. 2006. [cited 2007 June 8]. Available at URL: [http://www.cdc.gov/ncidod/dvbid/westnile/qa/who\\_risk.htm](http://www.cdc.gov/ncidod/dvbid/westnile/qa/who_risk.htm)
3. Centers for Disease Control and Prevention. Entomology 2006. [cited 2007 June 8]. Available at URL: <http://www.cdc.gov/ncidod/dvbid/westnile/insects.htm>
4. Centers for Disease Control and Prevention. Questions and Answers – West Nile Virus and Birds. 2006. [cited 2007 June 8]. Available at URL: [http://www.cdc.gov/ncidod/dvbid/westnile/qa/wnv\\_birds.htm](http://www.cdc.gov/ncidod/dvbid/westnile/qa/wnv_birds.htm)
5. Centers for Disease Control and Prevention. Questions and Answers – Symptoms. 2006. [cited 2007 June 8]. Available at URL: <http://www.cdc.gov/ncidod/dvbid/westnile/qa/symptoms.htm>
6. Centers for Disease Control and Prevention. Questions and Answers – Prevention. 2006. [cited 2007 June 8]. Available at URL: <http://www.cdc.gov/ncidod/dvbid/westnile/qa/prevention.htm>
7. Centers for Disease Control and Prevention. Virology – Classification of West Nile Virus. 2003. [cited 2008 September 26]. Available at URL: <http://www.cdc.gov/ncidod/dvbid/westnile/virus.htm>

## West Nile Virus Poster Rubric

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Total Points Awarded \_\_\_\_\_

Category	4 points	3 points	2 points	1 point
<b>Graphics - Originality</b>	Several of the graphics used on the poster reflect an exceptional degree of group creativity in their display.	One or two of the graphics used on the poster reflect group creativity in their display.	The graphics are made by the group, but are based on the designs or ideas of others.	No graphics made by the group are included.
<b>Knowledge Gained</b>	Group can accurately answer all questions related to facts in the poster and processes used to create the poster.	Group can accurately answer 75% of questions related to facts in the poster and processes used to create the poster.	Group can accurately answer about 50% of questions related to facts in the poster and processes used to create the poster.	Group appears to have insufficient knowledge about the facts or processes used in the poster.
<b>Content and Accuracy</b>	At least 7 accurate facts are displayed on the poster.	5-6 accurate facts are displayed on the poster.	3-4 accurate facts are displayed on the poster.	Less than 3 accurate facts are displayed on the poster.
<b>Attractiveness</b>	The poster is exceptionally attractive in terms of design, layout and neatness.	The poster is attractive in terms of design, layout and neatness.	The poster is attractive, though it may be a bit messy.	The poster is distractingly messy or very poorly designed. It is not attractive.

## West Nile Virus Presentation Rubric

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Total Points Awarded \_\_\_\_\_

Category	4 points	3 points	2 points	1 point
<b>Comprehension</b>	Group is able to accurately answer almost all questions posed by classmates about the topic	Group is able to accurately answer most questions posed by classmates about the topic	Group is able to accurately answer a few questions posed by classmates about the topic	Group is unable to accurately answer questions posed by classmates about the topic
<b>Preparedness</b>	Group is completely prepared and has obviously rehearsed	Group seems largely prepared but might have needed more rehearsals	Group is somewhat prepared, but it is clear that rehearsal was lacking	Group does not seem at all prepared to present
<b>Content</b>	Shows a full understanding of the topic	Shows a good understanding of the topic	Shows a good understanding of parts of the topic	Does not seem to understand the topic very well
<b>Speaks Clearly</b>	Speaks clearly and distinctly all (100-95%) of the time	Speaks clearly and distinctly the majority (95-90%) of the time	Speaks clearly and distinctly most (89-70%) of the time	Does not speak clearly or cannot be understood