

## Activity 3: Vector Villains

The students will learn how some insects act as vectors that carry a disease. They will then create a "Wanted Poster", complete with a rap sheet of details for their fictitious insect vector. Will it be one of the "baddest" of the bad and make the list of the "Ten Most Wanted?"

### Background

Vectors are organisms that transmit diseases. The vectors are not affected negatively by the disease. Examples of vectors are flies, mites, fleas, ticks, rats, and dogs. The most common vector for disease is the mosquito. Mosquitoes transfer disease through the saliva which comes in contact with people or animals when they are withdrawing blood. Mosquitoes are vectors for infectious disease like malaria, West Nile virus, dengue fever, and yellow fever.

Vectors add an extra dimension to disease transmission. Since vectors are mobile, they increase the transmission range of a disease. Changes in vector behavior will affect the transmission pattern of a disease. It is important to study the behavior of the vector as well as the disease-causing microorganism in order to establish a proper method of disease prevention. In the case of malaria, insecticides are sprayed and breeding grounds for mosquitoes are eliminated in an attempt to control the spread of malaria.

Biting is not the only way vectors can transmit diseases. Diseases may be spread through the feces of a vector. Microorganisms could also be located on the outside surface of a vector (such as a fly) and spread through physical contact with food, a common touch surface, or a susceptible individual (mechanical transmission).

### Learning Objectives

The student will:

1. increase their awareness of insect vectors and the methods these insects use to transmit disease by researching different vector-borne diseases
2. demonstrate his/her understanding of insects as vectors and insect adaptations by creating a fictitious insect with characteristics similar to actual insect vectors.

### Materials

1. Copies of Student Activity Guides: Vector Villains: "The Ten Most Wanted" for each student
2. Colored Pencils or Markers

### Procedure

## ***MISSION DEBRIEFING:*** Teacher Guide

1. **Before class time:** Copy the student guide, Vector Villains: “The Ten Most Wanted” for each student. If the assignment value is NOT 100 points, make sure you fill in your own chosen “point value” in the rubric before making copies. If your copy machine will copy 11 x 17 sized papers, it is very effective to copy the Mug Sheet and Rap Sheet side-by-side on the front of a page, and then copy the Student Activity pages called Vector Villains: “The Ten Most Wanted” side-by-side on the back. The directions and grading rubric are accessible to students and the picture and rap sheet can be hung up and displayed easily.
2. **During class:** Introduce the concept of vector borne diseases and ask each student or a small group of students to select a vector-borne disease to research and report back to the class on key facts about that disease and mode of transmission. The chart below is a good start.

[Note: Many other animals, such as spiders and some mammals, can be vectors for diseases, but the following chart focuses only on insect vectors. You may want to check out insect books from the library or show them pictures from the web (go to Yahoo.com and click on Images, type in the names of the insects listed below and there are images of each available) so students can see some of the many adaptations of insects before they create a composite, fictitious drawing of their own.]

Insect Vector	Disease it transmits	More details
Mosquito ( <i>Anopheles</i> )	Malaria	All human malaria is spread by a female <i>Anopheles</i> mosquito that needs a supply of blood in order to produce and lay eggs. This mosquito becomes infected by taking blood from infected individuals. The malaria parasite reproduces inside the infected mosquito forming a sac with thousands of new malaria parasites. As a mosquito bites, it injects infected saliva into a person who will then develop malaria.
Mosquito ( <i>Aedes</i> )	Dengue ( <b>deng</b> -gey or gee) fever	The mosquito is a carrier of the virus from one person to another. This disease is found in tropical or subtropical areas predominately. There are over 100 million cases each year.
Mosquito ( <i>Aedes</i> )	Heartworm disease	Heartworm is a <a href="#">parasitic roundworm</a> that is spread from <a href="#">host</a> to host through the bites of <a href="#">mosquitoes</a> . The heartworm affects <a href="#">dogs</a> , <a href="#">cats</a> , <a href="#">wolves</a> , <a href="#">coyotes</a> , <a href="#">foxes</a> , and some other animals, such as <a href="#">ferrets</a> , <a href="#">sea lions</a> , and even <a href="#">humans</a> . The parasitic worm is called a "heartworm" because the parasite, in the final reproductive stage of its <a href="#">life cycle</a> , resides in the <a href="#">heart</a> of its host where it can stay for many years and may even kill its host through <a href="#">congestive failure of the heart</a> .
Flea ( <i>Xenopsylla</i> )	Bubonic plague	Plague is an infectious disease that is caused by bacteria. It is carried from animals to humans by a flea that bites an infected animal and then bites a human. Outbreaks of plague occur both in rural areas and in cities worldwide. In the U.S., a few cases occur in rural areas. It can be treated with antibiotics.
Mosquitoes	West Nile Virus	The West Nile virus is transmitted between animal and human hosts via blood-feeding vectors such as ticks and

## ***MISSION DEBRIEFING:*** Teacher Guide

		mosquitoes.
Flies	Cholera	Flies can transmit food-borne diseases such as cholera and typhoid. They breed in organic wastes, refuse, and animal excrement. They carry disease agents from feces to our food. This vector uses mechanical transmission rather than a bite.
Tsetse fly ( <i>Glossin</i> )	Trypanosomiasis (sleeping sickness)	Sleeping sickness is an infectious parasitic disease carried by tsetse flies and characterized by inflammation of the brain and the covering of the brain (meninges).
Triatomine bugs (kissing bugs)	Chagas' disease	Chagas disease is an insect transmitted disease caused by a protozoan parasite. It is spread by reduvid (kissing or triatomine bugs) and is one of the major health problems in South America. Due to immigration, approximately 500,000 people in the United States are believed to be infected.
Mosquitoes	Filariasis	A parasitic worm causes this disease. The female worm lays eggs in the person's bloodstream. A mosquito ingests the larvae when it bites and then passes the parasite to an uninfected person. 120 million people worldwide are affected. The disease causes severe disfigurement (such as elephantiasis) more often than death.

3. Explain to the students that they will be creating a fictitious insect vector with characteristics based on actual insect vectors. Show the model "Rap Sheet" and "Mug Sheet" for a real vector—the mosquito—that is included at the end of the Teacher Guide pages. This model is based on an actual vector so the rap sheet does not model highly creative responses. You may want to have students use their textbook or another source (have them cite their source for a bibliography) for additional information on actual insects and their characteristics so they can base their drawings on composite characteristics of these. See the Book section or the Web Sites listed at the end of the Teacher Guide for additional references.
4. Distribute the Student Activity Sheet called "The Rap." Explain that a Rap Sheet is a list of information about a criminal. They will develop both the "Rap Sheet" information and draw the "Mug Shot" picture of the insect. Creativity is encouraged but they must also meet the criterion that has been listed in the directions on "The Rap" page of the Student Activity Sheet. If you would like for them to use a Latin Etymology (word origin) sheet to create their scientific name, you may print a list of science related word meanings from the following link:  
[http://en.wikipedia.org/wiki/Latin\\_and\\_Greek\\_roots\\_in\\_English](http://en.wikipedia.org/wiki/Latin_and_Greek_roots_in_English)
5. Make sure the students are familiar with the concept of binomial nomenclature (two-word Latin or Greek origin names) in science.

6. Optional: The focus of this activity is for students to learn about insect vectors that carry disease. Many insects are important in positive ways, too. If you would like to emphasize that aspect of insects, you could offer an extension activity where students design nominees for Time Magazine Entomology Issue: “Bug of the Year” award. These could be based on actual insects they research, or you could introduce actual insects and let the students design fictitious “Bug of the Year” entries as modeled in the previously described activity. Benefits of insects are outlined at this web site: <http://www.si.edu/RESOURCE/FAQ/nmnh/buginfo/benefits.htm>

### Extension Activities

- *Science/Art:* Create “Wanted Posters” or “Bug of the Year” posters for actual insects.
- *Health:* Research the effectiveness of prevention measures used to combat the vector borne diseases listed.
- *Social Studies:* Research information about some of the vector borne diseases listed. Create a spreadsheet that shows geographical occurrences, number of cases, mortality rate, and other interesting facts about the diseases.
- *Language Arts:* Using the Latin word meaning list, create a story about a vector borne disease occurrence. Within your story, use “mystery words” you create from a combination of Latin prefixes, root words, and suffixes.

### Standards

National Science Education Standards, Grades 5-8

- Science Content Standard C: All students should develop understanding of structure and function in living systems.
- Science Content Standard C: All students should develop understanding of diversity and adaptation of organisms.
- Science Content Standard F: All students should develop understanding of personal health.

### Books:

Nuridsany, Claude, and Marie Perennon. Microcosmos: the Invisible World of Insects. New York: Stewart, Tabori and Change, 1996.

McGavin, George C. Bugs of the World. New York: Facts on File, 1993.

Wyborny, Sheila. Parasites!--the Malaria Parasite. San Diego: Kidhaven, 2005.

## **Web Sites:**

- Vector-borne diseases

<http://www.cdc.gov/ncidod/dvbid/>

- Diseases caused by insects

<http://www.si.edu/resource/faq/nmnh/buginfo/diseases.htm>

- Facts about insects

<http://content.scholastic.com/browse/article.jsp?id=4628>

- Incredible insects

<http://www.si.edu/RESOURCE/FAQ/nmnh/buginfo/incredbugs.htm>

- Mosquito information

<http://www.mosquito.org/mosquito-information/index.aspx>

- Arthropod borne diseases in the United States

<http://www.kcom.edu/faculty/chamberlain/arthro.htm>

## The Rap Sheet

<b>Common name:</b>	Mosquito
<b>AKA :</b>	“Mo Skeeto”
<b>Scientific name and its meaning:</b>	<u>Anopheles quadrimaculatus</u> which means “hurtful with four dark spots on the wings”
<b>Description:</b>	Mosquitoes are insects belonging to the order Diptera, the True Flies. Like all True Flies, they have two wings, but unlike other flies, mosquito wings have scales. Female mosquitoes' mouthparts form a long piercing-sucking proboscis. Males differ from females by having feathery antennae and mouthparts not suitable for piercing skin.
<b>Diet:</b>	A mosquito's principal food is nectar or a similar sugar source. The female requires a blood meal before laying eggs.
<b>Habitat:</b>	These pesky villains must have water as part of their life cycle habitat but they also live on land as adults. The reason they have various habitats is because mosquitoes go through four separate and distinct stages in their life cycle: Egg, Larva, Pupa, and Adult. Eggs are laid one at a time on the water surface. They hatch to form larva which live and feed in the water and come to the surface for oxygen. The pupa stage is in a water habitat and this is where they develop into an adult which hatches and can live on land.
<b>Wanted for:</b>	Spreading diseases such as malaria that cause the death of one person every 40 seconds worldwide; other species spread dengue, yellow fever, filariasis, and encephalitis diseases such as West Nile Virus.
<b>Usual victim</b>	Mosquitoes prey on humans and animals who might be near mosquito habitat in the evenings
<b>Expected punishment:</b>	The danger of these villains is hopefully being reduced by sentencing them to death by spraying insecticide, treating water habitat areas with larvicide, and reducing their feeding options by using bed nets over sleeping people in the countries at risk.
<b>Reward:</b>	This villain is tricky because it spreads so many diseases worldwide yet it is important as part of the food chain for many species. The reward for learning to control this villain and its spread of disease would be a payoff worth MILLIONS OF DOLLARS and lives saved worldwide each year.

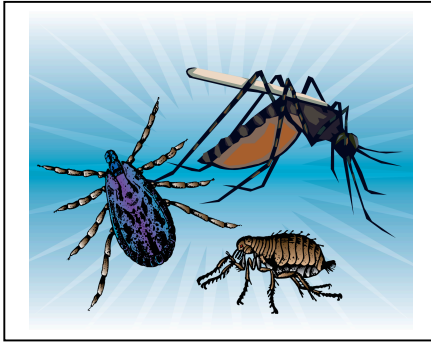
# The Mug Shot of Mo Skeeto

Created by: Student's name

The Mug Shot of Mo Skeeto



Created by: student's name



### Activity 3: Vector Villains

Insects can be heroes or villains. In this activity you will learn about some of the troublemakers who act as vectors and transmit diseases. Then, you will design your entry. Will it be one of the "baddest" of the bad and make the list of the "Ten Most Wanted?"

#### Background Information

What is a vector borne disease? Vectors are animals that are capable of transmitting diseases without the disease affecting them. Examples of vectors are flies, mites, fleas, ticks, rats, and dogs. The most common vector for disease is the mosquito. Mosquitoes transfer disease through the saliva which comes in contact with their hosts when they are withdrawing blood. Mosquitoes are vectors for malaria, [West Nile virus](#), dengue fever, and yellow fever. Because insects fly, they can spread diseases much farther.

Biting is not the only way vectors can transmit diseases. Diseases may be spread through the feces of a vector. Microorganisms could also be located on the outside surface of a vector (such as a fly's feet) and then spread through physical contact with food or a surface that is touched.

#### Materials

- Mug sheet, Rap sheet, colored pencils or markers

#### Procedure

1. You will create a "Rap Sheet" (information about your fictitious insect vector) and draw a "Mug Shot" (picture of your fictitious insect vector).
2. Use the following rubric to make sure you include all of the requirements:



## ***MISSION DEBRIEFING* Student Activity Guide**

### **For the Rap Sheet:**

Requirement	More details	Point Value 50 points	Your score
Common name:	What name do the guys on the street call this villain?	5	
AKA :	This means “also known as” in criminal science circles; it is the alias name.	5	
Scientific name and meaning:	The correct form will include a two-word name created from Latin or Greek root words. The first word of the name is capitalized, the second word is not, and both words are underlined. Explain the meaning of the words you have chosen.	5	
Description:	Use your best language arts skills to describe the appearance of your insect.	5	
Diet:	Consider the mouth parts and other adaptations of your insect when describing its diet.	5	
Habitat:	The hideout...where does your insect live?	5	
Wanted for:	It is wanted for transmitting a disease, of course—it’s a vector. Describe the disease it transmits <u>AND explain how it is passed from one species to another.</u>	5	
Usual victim	The insect vector passes the disease from victim to victim. Who are these victims?	5	
Expected punishment:	Explain how this crime can be stopped. How will you suggest getting this insect vector out of circulation?	5	
Reward:	What do you suggest the reward should be to encourage others to help catch this villain?	5	

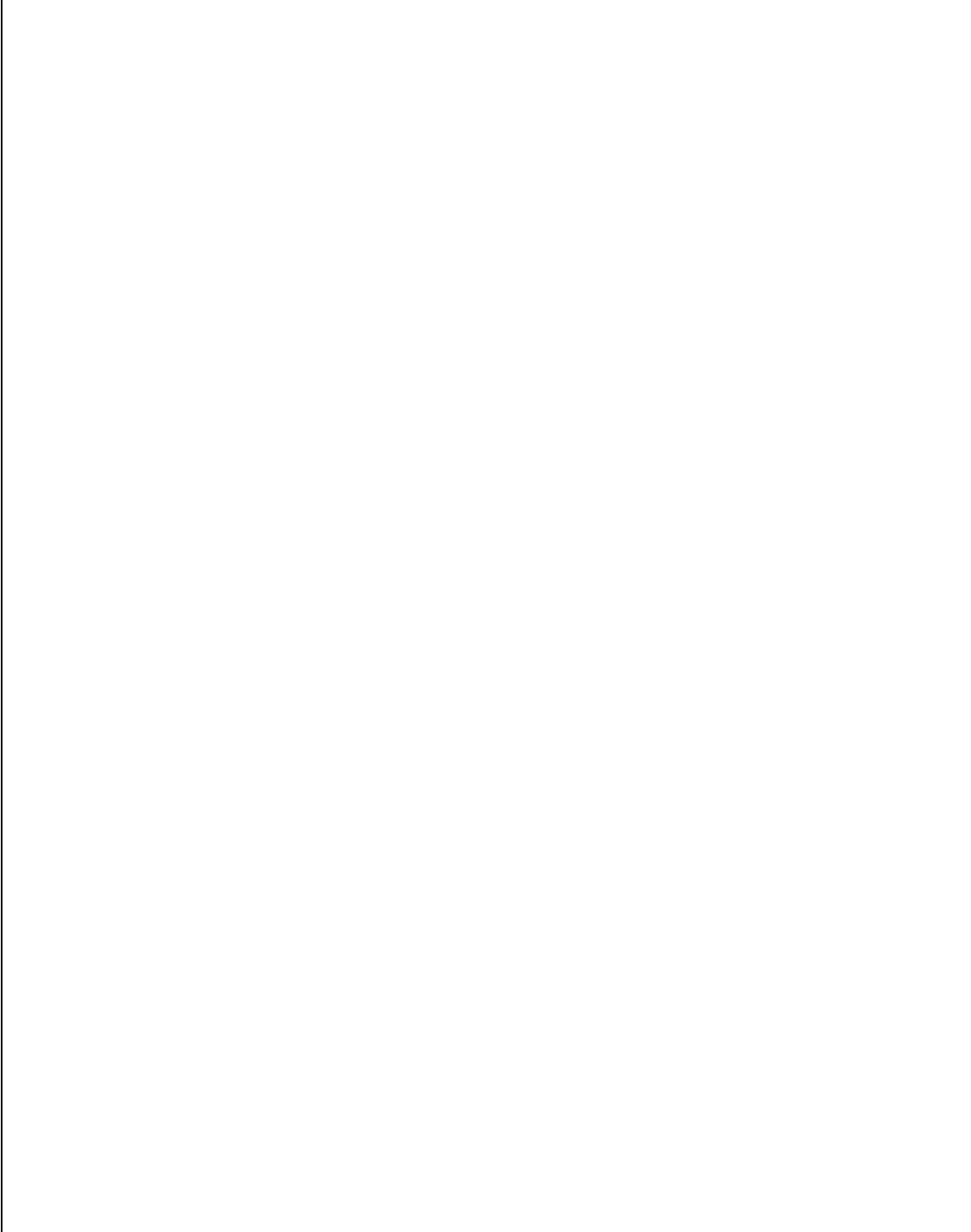
## ***MISSION DEBRIEFING* Student Activity Guide**

### **For the *Mug Shot*:**

Requirement	More details	Point Value 50 points	Your score
Mug shot (head) plus body is drawn.	You may draw a side view or front view of your insect but do a full length body drawing.	10	
Correct insect anatomy shown:	Insects have a head, thorax, and abdomen. Your villain is an adult so it will have wings (usually) coming from the thorax segment. Antennae are on the head.	20	
Creativity	Details of actual insect anatomy have been combined in your fictitious insect. You have added adaptations that will help it “commit the crime” as a vector for the disease.	10	
Neatness and color	A quality effort is shown in your drawing. Color is used to improve the appearance. Your villain fills the space allowed for the mug shot drawing.	10	

Requirement	More details	Point value	Your score
Bibliography	Cite your sources correctly. A sample is shown at this link: <i>I am still searching for the link we used at my school. I will let you know it soon.</i>	10	

## The Mug Shot



Created by: \_\_\_\_\_

## The Rap Sheet

<b>Common name:</b>	
<b>AKA :</b>	
<b>Scientific name and its meaning:</b>	
<b>Description:</b>	
<b>Diet:</b>	
<b>Habitat:</b>	
<b>Wanted for:</b>	
<b>Usual victim</b>	
<b>Expected punishment:</b>	
<b>Reward:</b>	