

Teacher Guide: Malaria Under the Microscope

Class time: 30-50 minutes

Purpose: Students will observe prepared microscope slides of mosquitoes, human blood, malaria-infected blood and other available samples and describe the differences between healthy and infected cells. Students will communicate their findings by answering guided questions.

Notes to the teacher: This activity can be adapted to incorporate any available blood cell sample slides. If alternative slides are used, adjust the discussion questions accordingly. You will need microscopes for this activity. There should be at least one microscope for every four students, and preferably one microscope for every two students. If you have just a few microscopes or if students are unfamiliar with microscopy, have them use this [simulation offered by the University of Delaware](#) (requires Flash) before they begin. Another option is to have half the students read "[Malaria molecule lures mosquitoes](#)" and complete another section of this guide while the other half of the class uses the microscopes. Then switch.

Ideally, each microscope station should have one copy of every slide that the students will examine for this lab. If you do not have that many slides, you can distribute slides among the microscope stations and let students rotate slides.

Materials:

- **Microscopes with multiple objectives giving total magnifications between 40x and 400x**
 - [Home Advanced LED microscope from Home Science Tools provides a cost-efficient, high-quality option.](#)
- **Bolded prepared microscope slides are needed for the lab activity (ideally one copy of each slide per microscope station)**
 - [B&H Photography, Human Pathological Tissues Slide Set 1](#) contains **one slide of spleen tissue with malaria, one slide of spleen tissue with leukemia, one slide of blood with sleeping sickness** and seven other slides that could be useful for other lab activities.
 - [B&H Photography, Human Pathological Tissues Slide Set 2](#) contains **one slide of blood with malaria** and nine other slides that could be useful for other lab activities.
 - [B&H Photography, Normal Human Tissues Slide Set 1](#) contains **one human blood slide, one slide of red bone marrow, one tonsil slide** (the best available healthy comparison for the diseased spleen slides) and seven other slides that could be useful for other lab activities.
 - [Home Science Tools, Complete Elementary Set of 25 slides](#) contains **one normal human blood slide, one frog blood slide, one mosquito slide** and 22 other slides that could be useful for oth-

er lab activities. Or, buy slides separately: [Home Science Tools, Human Blood Slide](#) and [Home Science Tools, Frog Blood Slide](#). There are also sets that contain human and frog blood slides: [Home Science Tools, Human Anatomy Slide Set](#) and [Home Science Tools, Biology Slide Set](#).

- [Home Science Tools, Human Blood Slide, Sickle Cell Anemia](#) contains **one slide with sickle-shaped blood cells**. Or, buy this slide as part of a set: [Home Science Tools, Human Pathology Slide Set](#).
- (Optional) [B&H Photography, Normal Human Tissues Slide Set 2](#) does not contain any slides essential for this lab activity, but it complements Normal Set 1 and contains 10 slides that could be useful for other lab activities.
- (Optional) [B&H Photography, Parasites Slide Set, 10 slides](#) contains one blood slide with sleeping sickness, one blood slide with malaria and eight other slides that could be useful for other lab activities.

Directions:

1. Have students observe the microscope slides listed below and on the chart on [Blackline Master 3](#). If you would like students to try to photograph slides, suggest that they capture two slides for comparison. The notes below should help you guide your students in analyzing the slides.
2. When students are finished taking initial observations, have them identify at least six pairs of related slides and create a comparison diagram to compare and contrast the pairs.
3. Students should use their observations and comparisons to answer the accompanying comprehension questions.

Slide Notes:

- Healthy human blood. [*The slide will be dominated by red blood cells, and only a few white blood cells with nuclei that are stained blue or purple will be seen.*]
- Frog blood. [*The red blood cells have nuclei, unlike in human blood. Human red blood cells lose their nuclei when they leave the bone marrow and thus don't possess any genetic material that might mutate and make the cells cancerous.*]
- Sickle cell anemia. [*There are noticeably fewer red blood cells, many have a deformed shape and they tend to clump together. Unhealthy sickle cells cannot transport oxygen throughout your body, which can lead to fatigue. Because of their shape, sickle cells can also get stuck and prevent blood flow, resulting in pain or painful swelling.*]
- Human blood with trypanosomes. [*Some eel-like single-celled parasites can be spotted between the red blood cells.*]
- Human blood with *Plasmodium*. [*Some red blood cells have one or more stained blue or purple dots inside. These are the malaria parasites that are eating the hemoglobin in the cells. Students may also see red blood cells that have been ruptured by multiplying malaria parasites.*]
- Healthy human tonsil. [*A number of white blood cells will be seen, as well as red blood cells and other*

cell types. This makes a good healthy tissue slide for comparison with the diseased spleen slide.]

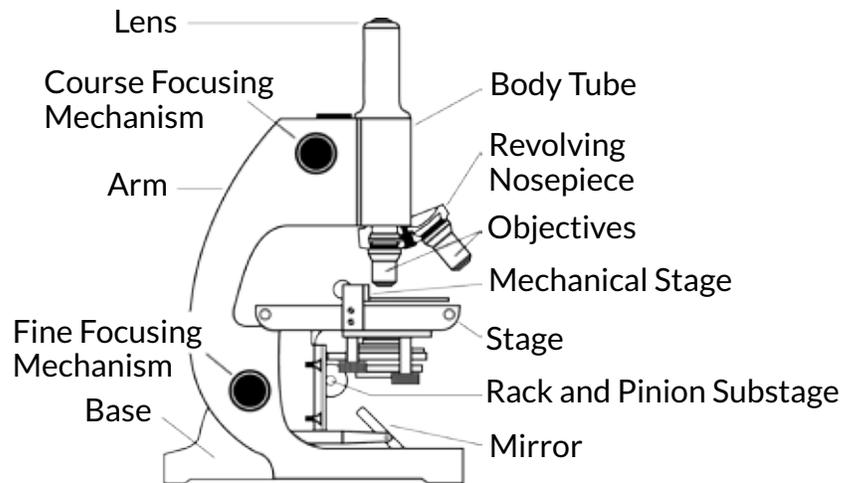
- *Human spleen with leukemia. [The slide will be dominated by white blood cells, which have multiplied and run amok.]*
- *Human spleen with Plasmodium. [There will be more cells with stained blue or purple dots inside than in other slides. These are the malaria parasites that are consuming the healthy cells. Students may also see cells that have been ruptured by multiplying malaria parasites.]*
- *Red bone marrow. [Developing red blood cells will be dominant.]*
- *Mosquito. [Students should note the proboscis. You could also give students a swatter and tell them to collect and mount their own mosquitoes on slides.]*

Student Guide: Malaria Under the Microscope

Purpose: To observe prepared microscope slides of mosquitoes, human blood, malaria-infected blood and other available samples of related diseases and to describe the differences between healthy and infected cells.

Directions:

1. Using your microscope, observe each of the following microscope slides (see generic diagram below for names of microscope parts).
 - a. Turn on the microscope and align a slide on the stage, the flat platform of the microscope.
 - b. Start with the lowest power (4x objective, or 40x total magnification).
 - c. Adjust the focus making sure you focus on the blood layer. (You should see red, blue and/or purple stains that were used to make the samples more visible. If you see only black and white spots and lines, you are probably focused on dust or scratches on the top or bottom of the slide.) Please note: Do NOT run the objective into the microscope slide.
 - d. Adjust the objective to a higher power and refocus.



2. Using the table provided on the next page, write down a description and provide a sketch of what you see for each slide. For blood slides, note the following:
 - a. What do red blood cells, called erythrocytes, look like?
 - b. What do while blood cells, called leukocytes, look like?
 - c. Are there platelets? What do platelets look like?
3. If your teacher gives you permission and you have a cell phone camera, hold it up to the microscope eye-piece and take photos with the flash off.

Slide Observation Table

Type of slide	Description of what you see under the microscope	Sketch
Healthy human blood		
Healthy frog blood		
Sickle cell anemia blood		
Human blood with trypanosomes (Protists that cause African sleeping sickness and Chagas disease)		
Human blood with <i>Plasmodium</i> (Protists that cause malaria)		
Healthy human tonsil (A good substitute for healthy human spleen)		
Human spleen with leukemia		
Human spleen with <i>Plasmodium</i> (Protists that cause malaria)		
Red bone marrow		
Mosquito		

6. Answer the following comprehension questions. Use the Centers for Disease Control and Prevention website on Diseases and Conditions for additional information: www.cdc.gov/DiseasesConditions/.
- Explain how human blood is different than frog blood. Why are the features identified in human blood helpful for human survival (do additional research if necessary)?
 - How does the sickle cell anemia sample compare with healthy human blood? What are some disease symptoms of sickle cell anemia? How might the characteristics you observe contribute to disease symptoms?
 - Locate *Plasmodium* and trypanosomes in the samples. What are the differences in where *Plasmodium* and trypanosomes appear to live in the samples? What are differences in their methods of locomotion?
 - How is spleen tissue affected by malaria? What are the common symptoms of malaria? Based on what you observe in the slides, what might be causing these symptoms?
 - What differences do you see between cells in blood and those in red bone marrow? Explain why these differences might exist.
 - Describe the different parts of the strawlike proboscis of a mosquito. How could this structure benefit a mosquito's ability to draw blood from an animal? Why is the structure of the proboscis beneficial for transmitting malaria?