**General Malaria Lesson Plan 1**

**Session Duration:** 40 minutes

**Objective:** Raise student’s awareness that Africa is in the midst of a malaria crisis – a disease that kills one million people a year, with 90% of the deaths in Africa. We can solve the crisis through education. Students will be expected to learn basic facts about the disease.

**Motivation:**

Ask several students to provide a fact they know about malaria. For each fact ask the class if that fact is correct or not. Provide confirmation of its accuracy or correct their mistake.

**Information:**

Write malaria facts on the board for students to copy and leave facts on the board for the duration of the lesson.

Facts:

1. Malaria is a preventable life-threatening disease that can kill you and your dreams.

2. Malaria is transmitted only by a special kind of mosquito – called the Anopheles mosquito – which primarily bites at night.

3. The most common malaria symptoms are fever, chills, headache, vomiting and other flu-like symptoms.

4. Malaria should be treated immediately. If you think you or someone in your family might have malaria, visit a health clinic as soon as possible. They have a test to tell if you have malaria.

5. Malaria has been eliminated in much of the world through the use of insecticides, medicine and mosquito nets.

6. Malaria is preventable and curable. You have the power to end malaria deaths in your community, your country and throughout Africa.

**Activity:**

Tell the class that they must learn and understand a total of nine important facts about malaria and mosquito nets, which will be taught today and maybe tomorrow. In this lesson, students will be taught six facts about malaria. At this time, you may ask students what they know about malaria to engage them and get the conversation started. Then ask students to write down the six facts about malaria. Once they have written down the facts, ask for volunteers to read each fact. Encourage students to share what they have learned about
malaria with family and friends at home. Have each student pick one fact from today’s lesson and quiz their family to see if they know whether it is true or false. Students can then share what they learned during the next lesson.
General Malaria Lesson Plan 2

**Session Duration:** 40 minutes

**Objective:** Review facts about malaria from previous lesson and learn more about malaria prevention

**Information:**

Facts:

1. Mosquito nets at night really do work and can prevent malaria.

2. All people need to sleep under a mosquito net every night of the year, not just kids and pregnant women. Mosquito nets need to be used all year round, even when there are not many mosquitoes.

3. Mosquito nets can save your life; your goals and dreams begin under a mosquito net.

Discuss these facts with students so that they understand them fully. Students should understand that they can and should be part of the solution to eliminating malaria. If they work hard in the next few years to help eliminate malaria, their children will not have to live with it. This will improve the lives of their family, community and country.

**Activity**

Read the facts out loud, ask students to write down the facts, ask the entire class, or select students, to repeat each fact out loud. By having students write the facts down, it will help reinforce the learning and they will have a copy of the facts to study at home and share with their family and friends.
**General Malaria Lesson Plan 3**

**Session Duration:** 40 minutes

**Objective:** Understand how to properly set up a bed net.

**Information:**

Facts:

1. Mosquito nets at night really do work and can prevent malaria.

2. All people need to sleep under a mosquito net every night of the year, not just kids or pregnant women. Mosquito nets need to be used all year round, even when there are not many mosquitoes.

3. Mosquito nets can save your life; your goals and dreams begin under a mosquito net.

**Activity**

Set up a mosquito net in your classroom. Use your own bed-net or borrow from the local hospital or clinic if possible.

The mosquito net should be hung up in the classroom and left up for the remainder of the curriculum for all students to see.

If space is limited, find another place in the school, or outside, to hang the mosquito net where students can practice taking turns setting up a mosquito net.

Ask students if they actually slept under a bed net last night and if their other family members did. Have a general discussion on the importance of sleeping under a bed net, regardless of age.

Select one student volunteer that has a net at home to show the class how to set up a net. Ask for 2-3 more volunteers (students with nets at home) to help teach their classmates how to set-up a net.

Discuss the importance of having the net set-up each night before 9 P.M. and for all their family members, especially younger siblings and pregnant mothers, to sleep under the net.

When students demonstrate they are confident about setting up a mosquito net, check to see if there are any questions.
Inform students that this is the final lesson in this curriculum and that there will be a test about the facts.

Teachers should address that sleeping under a mosquito net is not just for the rainy season and not just for pregnant mothers and children under 5. While it is true that these are the most vulnerable times and people, the only way to eliminate malaria is for everyone to take responsibility and sleep under a mosquito net every night.
Lesson Plans – English

Malaria Lesson Plan- English

**Session Duration:** 40 minutes

**Previous Knowledge Required/Previous Lesson:** Continuous and simple past verbs

**Objective:** Practice continuous and simple past verbs based upon a passage

**Malaria in Various Tenses**

Copy this paragraph into your notebook and underline the verbs in continuous tense:

Amelia was walking to school yesterday when she began to feel sick. She had not been sleeping under a bed net for a week and her body was covered in mosquito bites. She was feeling sick in the morning before eating rice, but her mother sent her to school because she had been absent last month when she thought she had malaria. While she was sitting in class her had was aching, and she laid her head on her desk. Her teacher told her there is no sleeping in school and told her she should go to the clinic to find out what is wrong.

When you finish writing and underlining ALL continuous verbs, we’ll read the passage together.

Now write down the verbs from the passage that are in simple past tense.

**Reading comprehension about the passage.**

1) What do you think is wrong with Amelia?

2) Do you think she has malaria?

3) How do you know if she does or not?

4) Is it okay to go to school if you may have malaria?

5) Does malaria cause any of you to miss school like Amie?

**Activity**

**PRACTICE QUESTIONS**

1. She _________ by a mosquito because she didn’t sleep under a net last night.
   
   A) is bitten B) was bitten C) was biting d) has bitten

2. Maria and her brother Bernardo _______ malaria many times.
   
   A) has B) have C) have had D) has had
3. Mr. Macuacua ________ to the clinic yesterday to get a finger test because he was feeling cold.
   A) goes  B) go  C) is going  D) went

4. Grandma ________ treatment medicine right away when she feels sick.
   A) take B) takes C) is taking D) took

5. Felicidade was already sick with malaria when her sister ________ ill, too.
   A) became  B) become  C) becomes  D) is becoming
Session Duration: 40 Minutes

Objective: By the end of this lesson, students will know how to properly end a sentence and they will understand the difference between a full stop and a comma.

Information

Write this passage on the board:

“Adelcia believes she has malaria, She wants to go to the clinic but she doesn’t have money, Her parents are farmers. And they don’t have enough money to pay for her treatment, What is she going to do? She decides to ask her friend Maria, Maria tells her that the medicine at the clinic is free, Adelcia does not believe her and tells Maria that nothing is free is Pemba, However. Adelcia decides to try anyway and goes to the clinic and is given a blood test and tests positive for malaria. The nurse hands her the ACT medicine and Adelcia pretends to search in her pockets for money but the nurse says the medicine is free and Adelcia should go home and eat and take the medicine for three days.”

Tell the class that there are many mistakes in this passage having to do with punctuation and that they should copy the passage into their notebooks but try to fix the mistakes. Give them approximately 10 minutes.

Now call up a student to fix one mistake and call another and another until you have fixed all the mistakes in the passage.

See if one of them can give the definition of a full stop and a comma and write them on the board so that the entire class gets them into their notebooks.

Practice

Have each student write a few sentences on their own about their family’s experience with malaria. Have the students pass their notebooks to the person to their right and have each person correct everyone else’s sentences for proper punctuation. Go around and check to make sure everyone is doing it correctly.

Activity

Give the class an assignment to write a story about the affects malaria has had on one of their family members or let them make it up if they don’t have a family member with malaria although that is unlikely.
**Malaria Lesson Plan – Literature**

**Session Duration:** 45 Minutes

**Objective:** Have students learn/review literary terms (simile and metaphor) and be able to make their own, original similes and metaphors.

**Motivation**

Show several objects to the class:
1) a bed net, 2) picture of a mosquito, 3) a mosquito coil

Make a simile or metaphor for each of them.

Ex: A bed net is a cave protecting me from the hum and buzz of the darkness.
Ex: Mosquitoes are chapos of death.
Ex: A burning mosquito coil looks like an angry snake.

Ask the students if they can determine if each comparison is an example of a simile or a metaphor. Ask them what is being compared in each. Provide the students with the answers if they do not know them, then move on.

**Information**

Similes and metaphors are figures of speech that compare two unlike things or ideas.

“From the example given earlier, ‘a bed net is a cave protecting me from the hum and buzz of the darkness,’ what two things are being compared?”

ANSWER: a bed net and a cave

- “Why is a bed net being compared to a cave?”
  - Possible answers:
    a) It is an enclosed place like a cave.
    b) At night, when you used a bed net, it is dark like a cave.
    c) You sleep under a bed net and animals sleep in caves.

**Definitions:**

Simile: a figure of speech used in describing or explaining something. It describes or explains a likeness between two different objects or ideas. A simile uses 'like' or 'as' to make the comparison or likeness of the two different objects or ideas.

Ex: “From the example given earlier, ‘a burning mosquito coil looks like an angry snake,’ a simile is used to describe the likeness of a burning mosquito coil to that of an angry snake.”
Ex: “A mosquito acts as a chapa carrying death from community to community.” In this example a mosquito is being compared to a chapa that brings death to communities because it is the insect that carries the malaria parasite.

Metaphor: a figure of speech that makes a comparison of two unlike objects or ideas. It is an expression taken from one field of experience and used to say something in another field. A metaphor does not use ‘like’ or ‘as’.
Ex: “The example given earlier, ‘mosquitoes are chapas of death,’ describes mosquitoes as chapas, a mode of transport.

Ask your students:

1. Why would a mosquito be compared to a chapa? Is it a good metaphor?
   a. A mosquito can be compared to a chapa of death because mosquitoes carry the malaria parasite which they transport to humans for their blood. Mosquitoes will give a human malaria in exchange for blood.

More examples:

“Malaria is a hundred thousand bombs exploding inside you causing you to shake and dream dreams you never return from.”

In this example malaria is compared to bombs that ‘explode’ inside a person causing them to shake and then enter into a delirium that they do not recover from because they die.

Summary:
Both similes and metaphors make comparisons and describe the likeness between two objects or ideas. They are both figures of speech but a simile uses a connecting word ‘like or ‘as,’ to make comparisons whereas a metaphor does not use a connecting word.

Similes and metaphors are useful tools of the English language that allow us to make expressions unique to our experiences. Both figures of speech give the English language the ability to capture our experiences and share them. Without similes and metaphors the scope of our expressions would be limited and our lives less rich.

Activity

Throughout this lesson the similes and metaphors have been about malaria and mosquitoes. Malaria is endemic to Mozambique, meaning it is everywhere, and is harmful to an individual and their community. Using the theme of malaria write three similes and three metaphors. You can use ideas and objects associated with malaria and how to prevent it (bed nets, coils, cleaning, quinine, ACTS, RDTS, etc.) Use the examples given to guide you.
Lesson Plans – Math

The 80%- Percentages and Malaria

Session Duration: 60 minutes

Previous Knowledge Required/Previous Lesson: Percentage, calculating percentage

Objective: Students will be motivated to use bed nets and tell others to use bed nets. They will be able to apply knowledge of percentage to malaria statistics.

Motivation

Questions to ask the class:

- How many of you have had malaria before?
- How many of you know someone close to you that has died from malaria?
- How many of you sleep under a bed net at night?

Information

Malaria is the #1 cause of death in Mozambique. It killed approximately 1,000,000 people worldwide last year.

Sleeping under a bed net is the easiest way to prevent malaria! Mosquitoes bite more frequently at nighttime, while you are sleeping. Not only do bed nets not let in mosquitoes, but they have insecticide in them that kills mosquitoes if they touch it.

Malaria is a community problem, not an individual problem. If at least 80% of a population uses bed nets, mosquitoes will have less people to bite and will eventually die off, helping the whole community. Malaria cases will drop significantly.

Examples:

Find the amount of people in the population required to sleep under bed nets to reach the 80% (i.e., find 80% of the population).

1. If we have a community of 100 residents, how many people need to sleep under bed nets to reach the 80%?

2. If we have a community of 500 residents, how many people need to sleep under bed nets to reach the 80%?
Practice

Find the amount of people in the population required to sleep under bed nets to reach the 80% (i.e., find 80% of the population).
1. If we have a community of 1000 residents, how many people need to sleep under bed nets to reach the 80%?

2. If we have a community of 200 residents, how many people need to sleep under bed nets to reach the 80%?

3. If we have a community of 5000 residents, how many people need to sleep under bed nets to reach the 80%?

Application

Ask class:
- How many people live in your village?
- How many people need to sleep under a bed net in your village to reach the 80%?

Sleep under a bed net!!

Assessment

Ask students next class:
- How many of you slept under a bed net last night?
- How many of you got your whole family to sleep under a bed net?
- How many people are in the class?
- Find 80% of class; see if the class reaches the 80%.
Malaria Lesson Plan - Math

**Session Duration:** 40 minutes

**Previous Knowledge Required/Previous Lesson:** An understanding of word problems, and how to approach them

**Objective:** To improve critical thinking skills and to practice extracting important, relevant mathematical information from story problems

**Motivation**

Work through the following problems together:

1. Use the following data to answer the questions:

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent of population who say they had malaria that year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>68%</td>
</tr>
<tr>
<td>2</td>
<td>75%</td>
</tr>
<tr>
<td>3</td>
<td>82%</td>
</tr>
<tr>
<td>4</td>
<td>79%</td>
</tr>
<tr>
<td>5</td>
<td>95%</td>
</tr>
</tbody>
</table>

   a. Identify the mean, median, and mode for the data set.

   b. What was the range value between 2001 and 2005?

   c. Calculate the average percent increase from year to year.
2. Fernando was born in 1955 and has averaged 2 cases of malaria per year every year since he was 5 years old. How many cases of malaria has Fernando had thus far in his lifetime?

**Activity**

Assign the following problems as homework, and review them with the entire class during the next class period.

1. Cristina was born in 1982 and says she has had malaria about 50 times in her life since she was 5 years old. How many times each year, on average, has Cristina had malaria, since she was 5 years old?
2. Momad has had malaria approximately 40 times in his life. Each time, he misses 4 days of school/work because he is not feeling well. How many total days of school/work has Momad missed due to malaria?
3. Use the following table to answer the questions about the hospital in Boane.
<table>
<thead>
<tr>
<th>Year</th>
<th>Number of malaria cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>2,018</td>
</tr>
<tr>
<td>200</td>
<td>3,050</td>
</tr>
<tr>
<td>200</td>
<td>3,212</td>
</tr>
<tr>
<td>200</td>
<td>2,988</td>
</tr>
</tbody>
</table>

a. What is the mean, median, mode, and range for the data set?
b. What is the average year-to-year change?
c. Graph the data set.
Malaria Lesson Plan – Math

Percentages

**Session Duration:** 45 Minutes

**Previous Knowledge Required/Previous Lesson:** Division and multiplication

**Objective:** Practice percentages using malaria data.

**Information**

Percentages: A percentage is another form of a fraction, ratio or proportion. Typically, a percentage is a part of one hundred units. Any fraction can be expressed as a percentage. Example, 5/100 = 5 percent (5%).

**Activity**

**Question 1:** In a school, there are 1,200 students: 65% boys and 35% girls. Only 40% of all the students use mosquito nets every night. Predict how many girls use nets.

Solution:

Let ‘a’ represent the total number of girls at the school.

\[
\frac{35}{100} = \frac{a}{1,200} \Rightarrow (1,200)(35) = 100a
\]

\[a = 420\]

Let ‘b’ represent the total number of students who use nets.

\[
\frac{40}{100} = \frac{b}{1,200} \Rightarrow (40)(1,200) = 100b
\]

\[b = 480\]

Let ‘c’ represent the total number of girl students who use nets.

\[
\frac{420}{1,200} = \frac{c}{480} \Rightarrow (420)(480) = 1,200c
\]

\[c = 168\]

At the school, 168 female students use bed nets every night.

**Question 2:** In one week 50 people go to the local community clinic for malaria treatment (ACT). 70% of the patients paid for the treatment whereas 30% did not pay. Of those patients who paid, 60% paid 10MZN and 40% paid 20MZN. How many people paid 20MZN for ACT treatment?*

Solution:

Let ‘x’ represent the number of people who paid for treatment.

\[
\frac{70}{100} = \frac{x}{50} \Rightarrow (70)(50) = 100x
\]

\[x = 35\]

Let ‘y’ represent the number of people who paid 20MZN for treatment.
\[ \frac{y}{35} = \frac{40}{100} \]
\[ (35)(40) = 100y \quad y = 14 \]

At this clinic, 14 patients paid 20MZN for ACT treatment that week.

*NOTE: EVERYONE should be able to get free ACT (Artemisinin Combination therapies) treatment.*
Lesson Plans – Science

Malaria Lesson Plan – Integrated Science

**Session Duration:** 45 Minutes

**Objective:** To understand what malaria is, what causes it, the symptoms, and the best prevention methods.

**Information**

**What is malaria?**

Malaria is a parasitic infection of the blood that causes chills and high fever. It can lead to death if it is not treated.

**How is malaria spread?**

It is spread ONLY by mosquitoes! You cannot get malaria from eating or drinking anything. Mosquitoes suck up malaria *parasites* in the blood of an already infected person, and then inject the parasites into the next person they bite.

*Parasite* – worms or tiny animals that live in or on another animal or person and cause them harm. They are too small to see.

**What are common symptoms of malaria?**

- Fever
- Chills
- Body aches
- Weakness
- Poor appetite
- Sweating

**How do I prevent malaria?**

ALWAYS sleep under a bed net.
Clean your compound and get rid of standing water (this is where mosquitoes lay eggs).

**How do I treat malaria?**

Go to the health clinic and take malaria medicine (ACT or SP). It should be FREE for everyone.
Activity

List 10 symptoms on the board (five for malaria and five others, like bleeding, coughing, etc).

Divide the class into two teams

Have a race between teams as they send one person up each and place symptoms in the correct category (malaria vs. not malaria).
Malaria Lesson Plan – Integrated Science

Session Duration: 45 Minutes

Objective: To understand how malaria is spread and to discuss all the misconceptions about how it is spread.

Information

Malaria is only spread by infected mosquito bites. Ask the class all the other ways they have heard they can get malaria: mangoes, dirty water, rice, etc

Explain that while dirty water around your house may help breed mosquitoes (they lay their eggs there) it does not directly give you malaria. Only a bite from a mosquito that is infected will give you malaria.

Ask the class, if they cannot get malaria from all the things they listed, how does a mosquito become infected?

Answer: by biting someone who already has malaria!

Activity

Have five students stand in the front of the classroom and explain that they all live in one community. Tell them one of them has malaria, he does not get treated and he does not sleep under a bed net. At night, none of them use bed nets either and a mosquito comes and bites the infected person, then flies to another two houses and bites them. In the morning, now three of the 5 in the community are infected.

You see how it spreads?

In the next part, the one still has malaria but the rest of the community uses bed nets. The Mosquito comes and bites the man, but cannot bite the others because they are under bed nets. They are all protected. Now, if the infected man goes to the clinic and gets treatment as well as sleeps under a bed net he will be cured and the whole community will be safe from malaria.
Malaria Lesson Plan –Science

Session Duration: 90 Minutes (two periods required)

Previous Knowledge Required/Previous Lesson: Before the lesson students need to understand the following evolutionary concepts – concept of Gene, Phenotype and Genotype, variations, mutations, locus vs allele, allele frequency, Hardy-Weinberg Equilibrium.

Information

What Drives Evolution? How do we test for evidence of evolution at a molecular level?:

Natural selection acts on genetic variation that exists within populations. Testing populations for evidence of natural selection is done by measuring traits—in this case we’re using genetic traits, alleles, to see if any are found more often than would be expected.

If a population is sufficiently large and mating is random (requirements for testing Hardy Weinberg Equilibrium) a test of allele frequencies can be used to predict whether a population is undergoing natural selection. Deviation from Hardy-Weinberg (genetic) equilibrium means that the frequency of alleles seen among individuals is different than you would expect to see if the alleles were functionally equivalent. However, there are other factors that may affect allele frequencies in a population. The following are a list of conditions that can cause such a deviation:

- Mutation
- Gene flow
- Nonrandom mating
- Genetic drift
- Natural selection

Adaptation Occurs Naturally:

Natural selection is the process by which populations become adapted to their biotic and abiotic environments. The biotic environment includes living factors such as: organisms that seek resources through competition, predation, and parasitism. The abiotic environment describes non-living factors, dependent mainly upon temperatures and precipitation.

Types of Selection:

Most of the traits on which natural selection acts are polygenic, that is: controlled by more than one pair of alleles located at different gene loci. These traits usually have a range of phenotypes, which can be represented in a bell-shaped curve.
There are three types of selection that can affect the distribution of a trait among individuals

1. Directional selection
2. Stabilizing selection
3. Disruptive selection

Directional Selection:

Directional selection occurs when an extreme phenotype is favored and the distribution curve shifts in that direction. Such a distribution can occur when a population is adapting to a changing environment.

Stabilizing Selection:

Under stabilizing selection an intermediate trait increases in a population and the distribution gets tighter around the mean trait measurement.

Disruptive Selection:

Under disruptive selection the frequency of the traits at the extremes of the curve increase in a population. This can happen through positive selection on individuals who possess the extreme traits or through negative selection on individuals who lie in the middle of the curve. The curve that results is the inverse of the normal distribution.

Examples of Evolution in Every Day Life

Bacteria and Insects:
Indiscriminate use of antibiotics and pesticides results in populations of bacteria and insects that are resistant to these chemicals. The mutation that permits resistance is already present before exposure; the chemicals are merely acting as a selective agent. Those organisms that survive exposure have offspring that are resistant and in this away the population becomes resistant.

What is the phenotype being measured?
Resistance to antibiotics. Survival of bacteria at a given dose.

What kind of selection is this?
Directional Selection. The extreme phenotype (resistance) is selected for and overtime the mean phenotype (level of resistance) becomes higher.

How can we avoid having antibiotic resistant bacteria?
Finish all courses of antibiotics prescribed by a doctor to ensure that resistant bacteria are not given a chance to reproduce and spread the resistant allele.

Malaria’s Role in Evolution:

Another example of directional selection is the human struggle against malaria, a disease caused by infection of the liver and the red blood cells. The *Anopheles* mosquito transmits the disease – causing protozoan *Plasmodium vivax, Plasmodium falciparum, Plasmodium malariae*, etc. from person to person. In the early 1960s, international health authorities thought that malaria would soon be eradicated. A new drug, chloroquine, was more effective than quinine that had been used against *Plasmodium*, and DDT (an insecticide) spraying had reduced the mosquito population. But in the mid-1960s, *Plasmodium* showed signs of chloroquine resistance and, worse yet, mosquitoes were becoming resistant to DDT. A few drug-resistant parasites and a few DDT – resistant mosquitoes had survived and multiplied, making the fight against malaria more difficult than ever. Thus, another avenue has now been taken – a vaccine against malaria is being developed.

Figure 2: Directional Selection with Malaria

Figure 2 demonstrates how with increasing time after chloroquine was developed more mosquitoes became resistant to the drug. This example demonstrates how directional selection favors an extreme phenotype and the curve shifts to that direction. If you measured the frequency of the allele that confers mosquito’s resistance to DDT in a population of mosquitoes after they had been exposed to DDT for a number of years would you expect the allele frequency to be under Hardy Weinberg Equilibrium?

No. DDT kills non-resistant mosquitoes so the frequency of mosquitoes that carry the allele should increase. DDT is the selective pressure acting on mosquito populations.
**Activity**

Problem:

Pregnant women are more susceptible to malaria and it is recommended that they take at least two doses of IPTp (intermittent treatment of malaria in pregnancy) to prevent malaria from affecting the mother and fetus. The common IPTp regimen includes SP (sulfadoxine-pyrimethamine). SP at one time was used, like chloroquine, as a treatment for malaria but due to resistance it is only used as a preventative measure. Over a fifty to one hundred year time period would you expect the effectiveness of SP to increase or decrease? Explain why or why not. Draw a series of bell-shaped curves to support your answer.
Malaria Lesson Plan—Biology

Session Duration: 45 minutes

Objective: To learn about and understand what symbioses are, and be able to list examples.

Information

Symbiosis. Describes a persistent biological relationship between two species. There are three types of symbiotic relationships—parasitism, commensalism and mutualism.

Parasitism is a symbiotic relationship in which one organism benefits while the other is negatively affected. This relationship can be abbreviated this way (+/-). The organism that benefit (+) called the parasite. The other organism that is harmed by the relationship (-) is called the host (-).

There are two main types of parasites. Ectoparasites such as ticks and lice, feed on the outside surface of the host. Endoparasites on the other hand, live within the body of their host. An example of this is a tapeworm, or the Plasmodium parasite that causes malaria.

At first the Plasmodium that parasitizes humans has a commensal relationship with an Anopheles mosquito. A commensal relationship is one where one species benefits but the other species is neither helped nor hurt (+/0). Once the Anopheles mosquito bites a human and injects Plasmodium sporozites, the Plasmodium is then a parasite to its human host. On the next page is a diagram showing how Plasmodium interacts with its two hosts.

There also exist mutualistic relationships where both organisms benefit from the symbiosis (+/+)

Some symbiotic relationships are obligate—meaning the two species cannot live or reproduce without the other while some are facultative where the two species can live with or without each other.
Activity

Ask the students:

Are there other symbioses you have encountered where one individual was benefitting and the other was being harmed?
Examples: Boils- You are the host for the bacteria; Typhoid Fever, Dengue, fresh colds. Corals—symbiotic algae produce food for the corals who in turn provide protection and shelter for the single celled algae. Certain birds pick parasites off the back of rhinoceroses. Honeyguide birds have specific songs just for helping humans find honey comb in exchange for a share of the find.

What about examples where both species are benefitting Or one is being hurt while the other is benefitting?

Ask students to decide which relationships are commensal (+/0) and which are parasitic (+/-)
**Application**

Depending on how active the class was in answering the practice questions, ask them to be observant when they go home and be ready to talk about and explain the mosquito/human phases of the *Plasmodium* lifecycle during the next class meeting.

**More Practice:**
Ask the students to classify the symbiotic relationship between the mosquito and *Plasmodium* as Parasitic, Commensal or Mutualistic, obligate or facultative. Then ask them to describe the relationship between humans and *Plasmodium*.

Mosquito/*Plasmodium* $\rightarrow$ Commensal relationship (+/0). Facultative for mosquito, obligate for *Plasmodium*

Mosquito/human $\rightarrow$ parasitic relationship (+/-). Obligate for *Plasmodium*. 