

**TELLING
BIOLOGY
TEACHER'S
GUIDE**

Episode 1: Mosquitoes in Malaysia

STANDARDS:

The following standards may be addressed by using the podcast in conjunction with the information provided in the Teacher's Guide:

NGSS Disciplinary Core Ideas: LS2.A

Interdependent Relationships in Ecosystems Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors

Crosscutting Concept: Energy and Matter

The transfer of energy can be tracked as energy flows through a natural system

Science and Engineering Practices: Developing and Using Models Common Core

Georgia professional Standard: The Living Environment

Evolution of Life: Standard 4EF

Common Core:

CCSS.ELA-Literacy.SL.6.2: Interpret information presented in diverse media and formats and explain how it contributes to a topic, text, or issue under study

CCSS.ELA-Literacy.SL.6.3: Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.

GPS Standard 4EF: Natural selection leads to organisms that are well suited for survival in particular environments. Chance alone can result in the persistence of some heritable characteristics having no survival or reproductive advantage or disadvantage for the organism. When an environment changes, the survival value of some inherited characteristics may change.

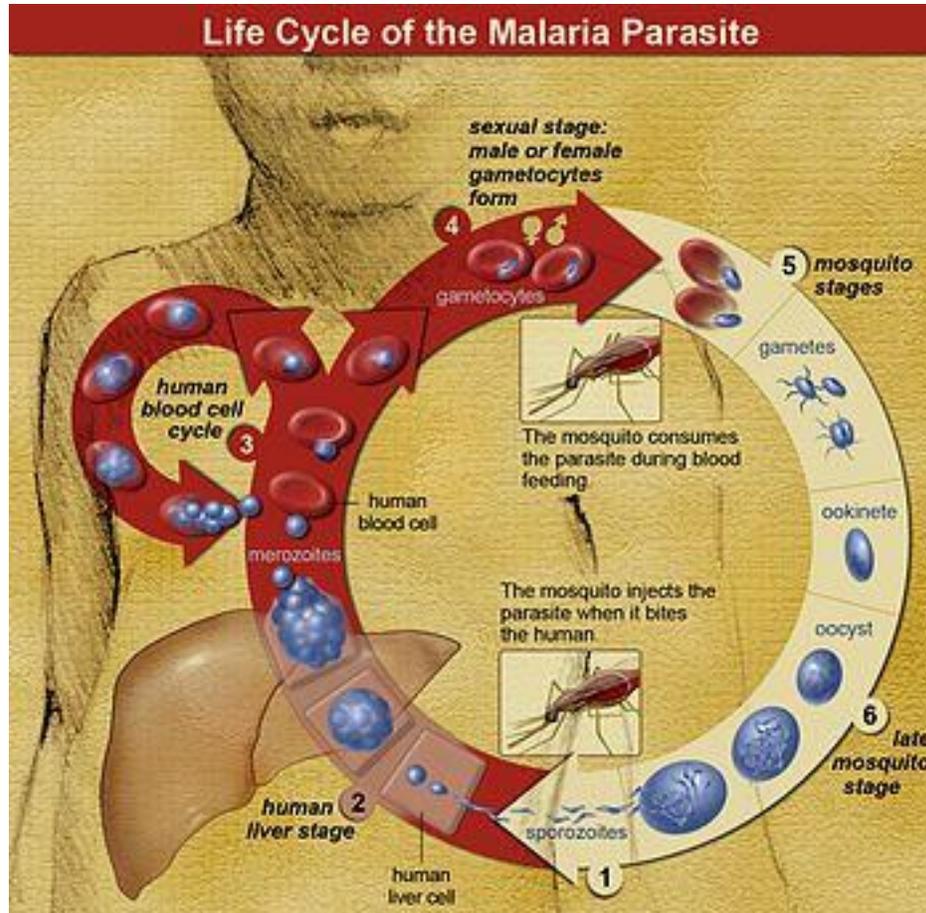
BACKGROUND:

The story of my journey to Malaysia shows how science is everywhere. In tropical environments around the world you have different challenges that are present in specific environments. In Malaysia and parts of the world with similar climate and

geo-makeup vector born diseases become a major concern and how these diseases have a profound impact on an individuals interaction, health and survival in unique environments. Another aspect of science that is prevalent is the roll that species like Mosquitoes play in the spread of parasites and disease and how prominent of a role our human interplay with species and disease affect our everyday life. Below you will find the life cycle of Malaria Parasite:

Life Cycle of the Malaria Parasite²

1. A female Anopheles mosquito carrying malaria-causing parasites feeds on a human and injects the parasites in the form of sporozoites into the bloodstream. The sporozoites travel to the liver and invade liver cells.
2. Over 5-16 days*, the sporozoites grow, divide, and produce tens of thousands of haploid forms, called merozoites, per liver cell. Some malaria parasite species remain dormant for extended periods in the liver, causing relapses weeks or months later.
3. The merozoites exit the liver cells and re-enter the bloodstream, beginning a cycle of invasion of red blood cells, asexual replication, and release of newly formed merozoites from the red blood cells repeatedly over 1-3 days*. This multiplication can result in thousands of parasite-infected cells in the host bloodstream, leading to illness and complications of malaria that can last for months if not treated.
4. Some of the merozoite-infected blood cells leave the cycle of asexual multiplication. Instead of replicating, the merozoites in these cells develop into sexual forms of the parasite, called male and female gametocytes that circulate in the bloodstream.
5. When a mosquito bites an infected human, it ingests the gametocytes. In the mosquito gut, the infected human blood cells burst, releasing the gametocytes, which develop further into mature sex cells called gametes. Male and female gametes fuse to form diploid zygotes, which develop into actively moving ookinetes that burrow into the mosquito midgut wall and form oocysts.
6. Growth and division of each oocyst produces thousands of active haploid forms called sporozoites. After 8-15 days*, the oocyst bursts, releasing sporozoites into the body cavity of the mosquito, from which they travel to and invade the mosquito salivary glands. The cycle of human infection re-starts when the mosquito takes a blood meal, injecting the sporozoites from its salivary glands into the human bloodstream.



The life cycle of malaria parasites. A mosquito causes an infection by a bite. Sexual forms are also produced, which, if taken up by a mosquito, will infect the insect and continue the life cycle.²

ACADEMIC LANGUAGE:

Parasite:

A parasite is an organism that lives on or in a host and gets its food from or at the expense of its host. Parasites can cause disease in humans. Some parasitic diseases are easily treated and some are not.³ The burden of these diseases often rests on communities in the tropics and subtropics, but parasitic infections also affect people in developed countries.³

Mosquito:

Mosquitoes is a small fly; the female mosquito acts as an ectoparasite, whereby they suck the blood of their host and typically leave behind an irritated area where stinger injected to obtain blood meal. The mosquito is a prototypical vector for blood-borne and parasitic diseases in humans and animals.

Malaria - is a mosquito-borne infectious disease of humans and other animals caused by single-cell parasitic protozoa *Plasmodium*; transmitted to humans via the bite of the female Anopheles mosquito; parasites multiply in the liver attacking red blood cells resulting in cycles of fever, chills, and sweats accompanied by anemia; death due to damage to vital organs and interruption of blood supply to the brain; endemic in 100, mostly tropical, countries with 90% of cases and the majority of 1.5-2.5 million estimated annual deaths occurring in sub-Saharan Africa⁴.

Dengue fever is a mosquito-borne tropical disease associated with urban environments; Symptoms include fever, headache, muscle and joint pains, and a characteristic skin rash that is similar to measles. A small percentage of cases result in death⁴.

Additional information for Scaffolding⁵:

- ❖ Vector-borne diseases account for more than 17% of all infectious diseases, causing more than 1 million deaths annually.
- ❖ More than 2.5 billion people in over 100 countries are at risk of contracting dengue alone.
- ❖ Malaria causes more than 600 000 deaths every year globally, most of them children under 5 years of age.
- ❖ Other diseases such as Chagas disease, leishmaniasis and schistosomiasis affect hundreds of millions of people worldwide.
- ❖ Many of these diseases are preventable through informed protective measures.
- ❖ Vector-borne diseases are illnesses caused by pathogens and parasites in human populations. Every year there are more than 1 billion cases and over 1 million deaths from vector-borne diseases such as malaria, dengue, schistosomiasis, human African trypanosomiasis, leishmaniasis, Chagas disease, yellow fever, Japanese encephalitis and onchocerciasis, globally.
- ❖ Vector-borne diseases account for over 17% of all infectious diseases.

Evidence:

Prior to me leaving for my trip to Kuala Lumpur, Malaysia, I had a 10 week long internship at The Centers for Disease Control and Prevention in Atlanta, Ga. During my internship I was able to use the CDC's web resources to answer my questions prior to traveling abroad, which included information about the most common vector borne diseases and environmental exposures, as well as prophylaxis. Additional information was available regarding the need to get a check up if you experience sickness of any kind. I am grateful to have had the experience at CDC and Kuala Lumpur, Malaysia. Malaria occurs mostly in poor tropical and subtropical areas of the world¹. In many of the countries affected by malaria, it is a leading cause of illness and death¹. In areas with high transmission, the most vulnerable groups are young children, who have not developed immunity to malaria yet, and pregnant women, whose immunity has been decreased by pregnancy¹. The costs of malaria – to individuals, families, communities, nations – are enormous¹.

Learn More:

How do I Contract a vector borne disease?

Can I do anything in advance or after to prevent the disease?

How do I know if I am sick?

Can we contract these diseases in the United States?

Are there other Vector borne diseases I should be aware of?

References

- 1) Center for Disease Control (CDC). (Updated March 26, 2014). Malaria: Worldwide. Retrieved from:
http://www.cdc.gov/malaria/malaria_worldwide/index.html
- 2) National Institute of Health, Allergy and Disease (NIH). (updated April 3, 2012). Parasites: Malaria. Retrieved from
<http://www.niaid.nih.gov/topics/malaria/pages/lifecycle.aspx>
- 3) Center for Disease Control (CDC). (updated April 21, 2014). Parasites –. Retrieved from: <http://www.cdc.gov/parasites/>
- 4) [CIA World Factbook](#) – (updated on June 30, 2015) Retrieved from:
http://www.indexmundi.com/malaysia/major_infectious_diseases.html
- 5) World Health Organization (WHO). (updated March, 2014). Vector Borne diseases. Retrieved from:
<http://www.who.int/mediacentre/factsheets/fs387/en/>