15.10C: Malaria

LEARNING OBJECTIVES

- Reconstruct the route of transmission and life cycle for Plasmodium species that cause malaria and describe its symptoms

Malaria is a parasitic disease that is caused by the bite of an infected Anopheles mosquito. Malaria can be transmitted from mother to baby and by blood transfusions. The Anopheles mosquito transmits the parasites, called sporozoites, upon biting the hosts, into the bloodstream to the liver, where the parasites continue their life cycle. In the liver, the parasites mature and release another form called merozoites, which enter the bloodstream and infect the red blood cells. In the red blood cells, they develop into ring forms called trophozoites and schizonts that in turn, produce further merozoites. Upon infection of the red blood cells, the parasite is able to multiply within the cell, break open and continue infecting additional red blood cells. The symptoms occur in a cyclical manner every 48-72 hours. Malaria is characterized by the development of symptoms that include high fevers, shaking chills, flu-like symptoms, and anemia. The symptoms that persist due to parasitic infection are a result of the release of merozoites into the bloodstream, destruction of the red blood cells and the free circulation of large amounts of hemoglobin in the red blood cells due to disruption.
Figure: The malaria plasmodium: Malaria is transmitted to people and animals by mosquitoes. Malarial sporozoites develop inside oocysts and are released in large numbers into the hemocoel of Anopheles stephensi mosquitoes. This false-colored electron micrograph shows a sporozoite migrating through the cytoplasm of midgut epithelia.

The five types of malaria parasites include species of Plasmodium. The fives species include: Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae, and Plasmodium knowlesi. Plasmodium falciparum is responsible for the majority of deaths caused by infection and Plasmodium vivax, ovale and malariae cause a milder form of malaria. The species, Plasmodium knowlesi, commonly causes malaria in macaques but can also cause severe infections in humans.

Malaria is common in temperate climates and the Centers for Disease Control and Prevention (CDC) estimates 300-500 million cases each year. In addition, it is estimated that 1 million people die from it each year as well. Malaria is typically diagnosed by microscopic examination of blood or with antigen-based rapid diagnostic tests. Disease transmission can be reduced by preventing mosquito bites through the use of mosquito nets and insect repellents. However, the mosquitoes which transmit malaria have begun to develop resistance to insecticides and the parasite itself has developed resistance to commonly used antibiotics. As a result of increased resistance, it is extremely difficult to contain the spread of this disease.

Key Points

- The five common species of Plasmodium that cause malaria include: Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae and Plasmodium knowlesi.
- Mosquitoes transmit the protists by injecting sporozoites into the bloodstream of humans.
- The sporozoites injected into the bloodstream, travel to the liver where they multiply into merozoites, rupture the liver cells, and then return to the bloodstream.
- A mosquito, upon feeding off an already infected individual, will carry the protists and become infectious.
• The symptoms of malaria can present in a cyclic manner.

Key Terms

• **merozoites**: the organisms formed by multiple fission of a sporozoite within the body of the host.
• **antigen**: A substance that induces an immune response, usually foreign.
• **sporozoites**: Any of the minute active bodies into which a sporozoan divides just before it infects a new host cell.