Parasite Predicament

*Parasite Predicament* is an activity developed by Learning Undefeated to explore the prevalence and effects of malaria worldwide.

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female mosquitoes. About 3.2 billion people – almost half of the world’s population – are at risk of malaria. Young children, pregnant women and non-immune travelers from malaria-free areas are particularly vulnerable to the disease when they become infected.

Malaria is preventable and curable, and increased efforts are dramatically reducing the malaria burden in many places. Between 2000 and 2015, the rate of new cases (malaria incidence) fell by 37% globally. In that same period, malaria death rates fell by 60% globally among all age groups, and by 65% among children under five. Sub-Saharan Africa carries a disproportionately high share of the global malaria burden. In 2015, the region was home to 89% of malaria cases and 91% of malaria deaths.

Students will learn how to complete an enzyme-linked immunosorbent assay (ELISA) in order to determine whether or not their patient has contracted the malaria parasite.

**LEARNING OBJECTIVES**

**Students will know:**

* The purpose of the immune system.
* Difference between innate and adaptive immunity.
* About antigens and their relationship to pathogens
* Real life examples of antigens and antibodies in relation to malaria

**Students will understand:**

* The different components that make up the immune system
* The antibody antigen relationship

**Students will be able to:**

* Construct scientific explanations that predict patterns between malaria and Sickle Cell Disease
* Conduct an investigation to detect the presence of the *Plasmodium* parasite
* Develop and use a model to explain how an ELISA test can detect the presence of the *Plasmodium* parasite

**UNIT PLAN**

**Pre-Laboratory Engagement (45-60 minutes)**

1. Students will [Watch Immune System: Innate and Adaptive Immunity Explained by Science ABC](https://www.youtube.com/watch?v=PzunOgYHeyg) (7:10) and complete a [background worksheet](https://drive.google.com/open?id=1Nf41871Tj_vfEaF4OZg3B58p-Fnf5CtcvAJadX3Iwd0) on the immune system.
   1. [Antibodies Neutralizing Pathogens Worksheet KEY](https://drive.google.com/open?id=1JIahzBSGd1w2WBUXyxWzB7h4w4dYQxLntp7i8DakaNw)
2. Students will [Watch Antibodies-An Introduction (3:00)](https://www.youtube.com/watch?v=ezNP76vtQeo&feature=youtu.be) and complete the [student worksheet.](https://drive.google.com/open?id=1V_m7KH67GqkwrzicJWHuClSId2UjL-DlLio68BGeSLQ)
   1. The worksheet asks students to create a diagram to show the antibody -antigen relationship. This [video](https://www.dropbox.com/s/5u2ch0ns73ya3bj/Parasite%20Predicament%20Pre-lab.mp4?dl=0) can be provided as a guide.
   2. [Student Worksheet KEY](https://drive.google.com/open?id=1sGjeP6KgHKJ0KWGK56amnGB1vR7Hdo4G7WYaGQhWkW8)

**Laboratory Activity (60-75 minutes)**

1. Students watch the introductory lab video [“Parasite Predicament Part One”](https://vimeo.com/420719765) (5:05)
   1. Students will complete Part I of the [student handout.](https://drive.google.com/open?id=1ZEAKHFzP6BMpZZiwdXwcfs_dvL4c5DjM0YZnaEe-uUU)
2. Students will watch the lab video [“Parasite Predicament Part Two”](https://vimeo.com/420767471) (6:53)
   1. Students will complete Part II, III, and IV of the [student handout.](https://drive.google.com/open?id=1ZEAKHFzP6BMpZZiwdXwcfs_dvL4c5DjM0YZnaEe-uUU)
      1. Students can also be supplemented with this [result](https://drive.google.com/open?id=13zJBOG_1p4D47ITpQMH1NXLSdTL9DSGl)
   2. Students may use the [worksheet walk through](https://vimeo.com/420712632) (10:26) to help them answer the questions and learn the material.
      1. Video can be supplied before or after student work is submitted.
      2. [Student Handout KEY](https://drive.google.com/open?id=11qCF1KarpIUtGTqql59KVJcMwUtL_cV2L8zcWMEaPs0)

**Post-Laboratory Extension (60-75 minutes)**

1. Students will play one of the games from [Solve the Outbreak](https://www.cdc.gov/mobile/applications/sto/web-app.html) available from the CDC. This game has students investigate different disease outbreaks and use clues to track how each outbreak started.
2. Then students will complete the activity [Outbreak!: COVID-19](https://drive.google.com/open?id=1Jc3MaQ3QQE_fRCODT00Jqv8zWzswUGf938Ct_BLaVmw) to devise an action plan to contain the disease’s spread.
   1. [Outbreak!: COVID-19 KEY](https://drive.google.com/open?id=1_9ruBkUjpptO6GCyP_ZM0x9PVYNo7hGQykmm1_XOPy0)

**STANDARDS ALIGNMENT**

**NGSS CONNECTIONS**

**HS-LS1-2:** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms

**HS-LS2-8:** Evaluate evidence for the role of group behavior on individual species’ chances to survive and reproduce.

**TEKS CONNECTIONS**

**BIOL.9(A):** Compare the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids;

**BIOL.10(A):** Describe the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals;

**BIOL.12(A)**: Interpret relationships, including predation, parasitism, commensalism, mutualism, and competition, among organisms;

**LOUISIANA STANDARDS FOR SCIENCE CONNECTIONS**

**HS-LS1-2:** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms

**HS-LS2-8:** Evaluate evidence for the role of group behavior on individual species’ chances to survive and reproduce.