NON-INVASIVE MALARIA DETECTION

Malaria is an infectious disease transmitted by mosquitoes that affects 40% of the world’s population, resulting in 300 to 500 million new infections yearly. Of the different types of malaria, Plasmodium Falciparum and Plasmodium Vivax are the two most deadly and prevalent. While treatment is available, malaria is often difficult to detect with a blood draw because the parasite sequesters in internal organs during various phases of its reproductive cycle. Malaria infects red blood cells, converting the hemoglobin in the red blood cells into iron rich particles called hemozoin. The hemozoin crystals can be as large as 1 μm in size and several clusters are stored in the food vacuoles of the parasite since they are toxic to it and the host alike. Malaria is predominant in low and middle-income countries where pathologists and microscopes are not widely available to confirm the presence of this species of malaria. Consequently, an inexpensive, non-invasive, continuous, and direct indicator of malaria is needed.

OSU’s Dr. Vish V. Subramaniam and Dr. Mark Drew have developed and tested a laboratory scale device (henceforth device) to detect the hemozoin crystals deposited in food vacuoles by malaria. Measurements with the device were performed first on iron oxide particles ranging in sizes from less than 44 μm up to 720 μm. The trials successfully demonstrated that measurements of iron particles on the scale of less than 44 microns were detectable and repeatable. Preliminary device measurements with food vacuoles trapped in small capillary tubes confirm feasibility of the method with indicated voltage differences of 44.7 ± 25.7 mV versus voltage readings for a control (capillary tube without trapped food vacuoles) of 16.2 ± 4.3 mV. Preliminary optimization of the device has illustrated that greater sensitivity is achievable through continued development and creation of a commercial scale device. The research conducted to date has demonstrated great promise for finding an alternative to existing methods (mainly peripheral blood draws) for the detection of malaria.

PROGRAM OBJECTIVES

The goal of this program is to exploit the paramagnetic properties of hemozoin and to commercialize a non-invasive, electromagnetic detection device that can detect when an individual is infected by malaria. Conceptually, it is envisioned that the commercial device will have a simple binary output (e.g. a red LED indicating the presence of infected cells and a green LED lighting up indicating no infection).

CONTACTS

CDME
1314 Kinnear Road, Columbus OH, 43212
cdme.osu.edu
Eric Wagner, Collaboration Manager
wagner.293@osu.edu • 614-477-0303

Mechanical and Aerospace Engineering
Dr. Vish Subramaniam, Professor
subramaniam.1@osu.edu