NON-INVASIVE MALARIA DETECTION

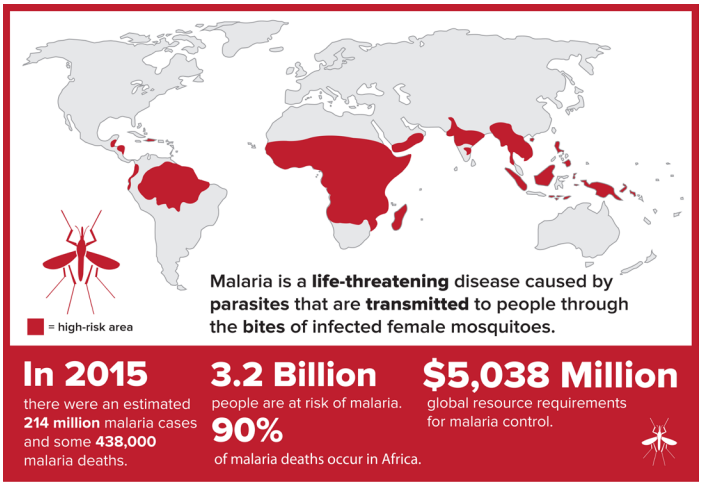
Malaria is an infectious disease transmitted by mosquitoes that affects 40% of the world's population, resulting in 300 to 500 million new infections yearly. Of the different types of malaria, Plasmodium Falciparum and Plasmodium Vivax are the two most deadly and prevalent. While treatment is available, 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.

DEVELOPMENT

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 16.21 ± 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.

INVENTOR

Dr. Subramaniam's research focus is on the interaction between low-frequency weak electromagnetic fields and tissues, cells and similar biological systems. He is interested in electromagnetic waves and how they interact with biological systems. It has been recently found that weak electromagnetic fields with frequencies on the order of 100 kHz or smaller affect cell migration, wound healing, cellular signaling, cell differentiation and disruption of antibiotic-resistant bacterial biofilm networks. This topic is prevalent in his work and research.



Rendition of smallest producible size for rapid detection system.

OPPORTUNITY

Various test kits are available to detect antigens derived from malaria parasites. Such immunologic ("immunochromatographic") tests most often use a dipstick or cassette format, and provide results in 2-15 minutes. These "Rapid Diagnostic Tests" (RDTs) offer a useful alternative to microscopy in situations where reliable microscopic diagnosis is not available. Malaria RDTs are currently used in some clinical settings and programs. However, before malaria RDTs can be widely adopted, several issues remain to be addressed, including improving their accuracy, lowering their cost, and ensuring their adequate performance under adverse field conditions.

Detection of malaria can be difficult and critical when administering other medical services. In some malaria-endemic areas, malaria transmission is so intense that a large proportion of the population is infected but not made ill by the parasites. Such carriers have developed just enough immunity to protect them from malarial illness but not from malarial infection. In that situation, finding malaria parasites in an ill person does not necessarily mean that the illness is caused by the parasites.

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). This scenario helps to keep the cost low and user training minimized. Thus allowing for simplified deployment in regions with limited medical professionals to administer the tests. It is also believed that through large quantity production, the cost be reduced to the point that the device could be issued to all ex-patriates working in high risk regions of the world so they can conduct continuous self-checks to verify the effectiveness of their antimalarial regiment.

KEY FEATURES AND BENEFITS

- No need to draw blood from patients (safety).
- Quick and reliable diagnosis.
- Can be performed in absence of medical professionals.
- Ability to be shared among affected populations.

MARKET OPPORTUNITIES

- **NGO Organization:** Volunteers, Exposed Groups at Risk.
- **International Business Partners:** Returning Travelers.
- **Millitary Personnel:** Non-combatant, Medic.
- **Medical:** Refugee Camps, Third World Hospitals, Villages.
- **Consumer:** Personal product for extended travel.

THE OHIO STATE UNIVERSITY

CDME is supporting the commercialization of technologies that emerge from Ohio State's annual research efforts. Ohio State has one of the largest research and development budgets of all universities. The amount of annual funding is a leading indicator of the breakthrough innovation occurring within the University. Recent annual highlights from OSU:

- $943 Million: Total research and development (R&D) expenditures
- $470 Million: Federal R&D expenditures
- $101 Million: Industry-sponsored research expenditures

Whether your interest is in licensing, sponsored research, joint ventures, investment, corporate giving or placement of our best students, Ohio State is here to help accelerate your business through innovation.

Categories

Non-Invasive Diagnosis, Rapid Detection, Disease Control.

College

College of Engineering (COE)

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