Researchers report breakthrough in rapid malaria detection

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A research team led by Dr. Paul Wiseman of the Departments of Physics and Chemistry at McGill University has developed a radically new technique that uses lasers and non-linear optical effects to detect malaria infection in human blood, according to a study published in the Biophysical Journal. The researchers say the new technique holds the promise of simpler, faster and far less labour-intensive detection of the malaria parasite in blood samples.

Malaria is a vector-borne infectious disease spread by parasites of the genus Plasmodium. Most common in tropical and subtropical regions, it is a global scourge with 350 to 500 million new cases – and one to three million fatalities – reported annually. Most of the fatalities are concentrated in sub-Saharan Africa, where the resources and trained personnel currently required to accurately diagnose the disease are spread the thinnest.

Current detection techniques require trained technicians to stain slides, look for the parasite's DNA signature under the microscope, and then manually count all the visible infected cells, a labourious process dependent on the skill and availability of trained analysts. By contrast, the proposed new technique relies on a known optical effect called third harmonic generation (THG), which causes hemozoin – a crystalline substance secreted by the parasite – to glow blue when irradiated by an infrared laser.

"People who are familiar with music know about acoustic harmonics," said Dr. Wiseman. "You have a fundamental sound frequency and then multiples of that frequency. Non-linear optical effects are similar: if you shine an intense laser beam of a specific frequency on certain types of materials, you generate multiples of the frequency. Hemozoin has a huge, non-linear optical response for the third harmonic, which causes the blue glow."

Dr. Wiseman and his colleagues now hope to adapt well-established existing technologies like fibre-optic communications lasers and fluorescent cell sorters to quickly move the technique out of the laboratory and into the field.

"We're imagining a self-contained unit that could be used in clinics in endemic countries," said Dr. Wiseman. "The operator could inject the cell sample directly into the device, and then it would come up with a count of the total number of existing infected cells without manual intervention."

Source: McGill University

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