BioSyM Seminar Series 2017

Magnetic Resonance Relaxometry detection of early stage infection and Artemisinin resistant of *Plasmodium falciparum*

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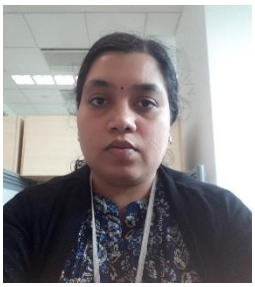

Date : 23rd October 2017, Monday

Time : 12 pm to 1 pm

Venue : Level 5, Perseverance Room

Abstract

Rapid and quantitative diagnosis of malarial parasite infection in red blood cells (RBCs) using Magnetic Resonance Relaxometry (MRR) was previously reported. Upon *Plasmodium falciparum* infection of the RBCs, the parasite replicates and consumes haemoglobin resulting in the release of free heme which is rapidly converted to hemozoin crystallites. The bulk magnetic susceptibility of infected RBCs (iRBCs) is changed due to ferric (Fe^{3+}) paramagnetic state in hemozoin crystallites which induce a measurable change in spin-spin relaxation (transverse relaxation) rate in proton nuclear magnetic resonance (NMR) of iRBCs. Earlier, our group reported that this transverse relaxation rate (R_2) can be measured by an inexpensive, portable 0.5 Tesla bench top MRR system with minimum sample preparation and is able to detect very low levels of parasitemia in both blood cultures as well as animal models. However, it was challenging to diagnose malaria clinically using MRR, mainly due to the inherent variation of R_2 values of clinical blood samples, caused by many physiological and genotypic differences not related to the parasite infection. To resolve the problem of baseline R_2 rates, we have developed an improved saponin lysis protocol for enrichment of parasites from iRBCs. With this new protocol and by processing larger volume of blood (>1ml), we are able to detect very low level of parasitemia (representing early stage of infection, ~0.0001%) with stable baseline and improved sensitivity using the current MRR system. In addition, artemisinin (ART) resistance of *Plasmodium falciparum* strains can also be detected within 24 hours as compared to the 72 hours currently needed using the Ring Survival Assay. These results may have a potential to improve clinical diagnosis of malaria using MRR, in terms of both rapid, in-the-field diagnosis and lab-based surveillance of infection even on stored (frozen) samples. The assessment of artemisinin effectiveness and surveillance of the spread of ART resistance using MRR diagnosis method would be helpful for the world malaria elimination effort in future.

Biography

Dr Smitha is currently a postdoctoral associate in Biosystems and Micromechanics Inter-Disciplinary Research Group of Singapore-MIT Alliance for Research and Technology (SMART). She received her Ph.D. in Chemistry from Leiden Institute of Chemistry, Leiden University, Netherlands. Her current research focuses increasing the sensitivity and selectivity of the micro magnetic resonance relaxometry and its applications for monitoring various diseases.