ウィスパリング・ギャラリー・モードによるリガンド―受容体相互作用の新規高感度検出法

High performance novel sensing of receptor-ligand interactions by whispering gallery mode resonators

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It is extremely important to develop highly sensitive technologies to detect very small molecules, both in air and water, for various applications such as early pathogen detection which can prevent outbreaks. Malaria is one of the important diseases in the world causing high levels of morbidity and mortality, killing almost 1 million people every year. Development of rapid and sensitive diagnosis techniques for malaria is still an important need for robust and effective treatment regimens.

Hemozoin is a bio-crystalline metabolite of *Plasmodium* parasites. During blood circulation of *Plasmodium* parasites, hemozoin is continuously produced and released and captured by immune cells. Because hemozoin crystals are the unique signature of malaria parasites, detection of hemozoin in circulating blood or serum with high sensitive platforms, even at the single nanocrystal/molecule resolution, would be the ideal platform for the early diagnosis of malaria disease. Furthermore, hemozoin is known as biologically active molecule that interacts with various immune cells and immune-mediated signaling cascades. Hence, the highly sensitive platforms which can detect hemozin accurately would be beneficial to study hemozoin's interaction with immune cell (i.e. macrophages).

Whispering-gallery-mode (WGM) resonators have recently been emerged as new sensing platform that the ultrahigh quality factor (Q) and microscale mode volume (V) enable high-fidelity optical measurements with superior sensitivity. They have been potential platforms for sensing DNA, proteins and pathogens such as viruses. With an international collaboration between Osaka University and Washington University in St. Louis, we have recently explored the use of WGM microtoroidal optical resonators both in air and liquid (placed in a liquid environment) as a platform for label-free detection and measurement of hemozoin crystals with single crystal resolution. We have further explored the detection of changes during hemozoin and macrophage interaction at various single molecule, crystal and cell levels.