

The Applications of Real-time Intravital Imaging for Various Disease Models

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KEY WORDS: Intravital imaging, in vivo labeling, myocardial infarction, circulating tumor cell

In this lecture, we will discuss the applications of real-time intravital imaging in various disease models. Since heart disease and cancer are the top two leading causes of death in United States, we will focus on the applications of real-time intravital imaging for these two disease models. In the heart disease model, the beating heart rate in a mouse is about 6–8 Hz, which is about six times faster than a human's heartbeat. If we utilize a two-photon microscope with a resonance scanner running at 30 Hz to image the beating heart in a living mouse, we will still obtain very blurry images. In order to minimize the influence of a beating heart, we synchronized the scanner of a confocal microscope to the beating heart. When the imaging system was synchronized with the heartbeat, it allowed us to conduct a detailed analysis of individual blood cell behavior in the blood vessels on the beating heart. In the case of tumor imaging, we are interested in the real-time imaging of the circulating tumor cells (CTCs). CTCs are very important for tumor metastasis. The number of CTCs has been used as an indicator for the progress of a tumor state. However, the way in which CTCs travel in the bloodstream and the way in which they cross the endothelial barrier are not known. We will discuss the way in which to utilize the real-time intravital imaging system to monitor the behavior of individual CTCs and the subpopulation of CTCs. We will also discuss the applications of real-time intravital imaging in other models such as immune responses and drug delivery.

[1] Tony WH Tang ,et al, “Loss of Gut Microbiota Alters Immune System Composition and Cripples Post-Infarction Cardiac Repair” *Circulation*, online, (2018)

[2] Jasmine P. J. Wu, et al, “Reloadable multidrug capturing delivery system for targeted ischemic disease treatment” *Science Translational Medicine*, **8**, 365ra160 (2016)