

CELL TRACKING IN VIVO: FROM HEMATOPOIETIC STEM CELLS TO MATURE LEUKOCYTES

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Hematopoiesis is the process of blood cell production that takes place primarily in the bone marrow. Upstream of this process sit the primitive hematopoietic stem cells (HSCs) from which all blood cells are derived, and far downstream are the mature blood cells, including leukocytes (white blood cells) that are released into the circulation to carry out immune functions throughout the body. We have developed intravital microscopy (IVM) techniques for tracking individual HSCs and characterizing their local microenvironment in the bone marrow. We have further developed a new method, called Image-seq (image-guided single cell RNA sequencing), that enables transcriptomic profiling of the exact same cells whose location and division history have been documented by IVM. This method therefore integrates spatial, temporal, and molecular information captured with the same optical platform. Downstream, we are developing methods for tracking leukocytes in the microcirculation and envision a path toward clinical translation by label-free imaging based on oblique back-illumination microscopy (OBM). We present a miniaturized OBM instrument for noninvasive assessment of host (human) immune response to infection and inflammation.

