Department of Biomedical Engineering
UNIVERSITY OF WISCONSIN–MADISON

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Seminar Series

Novel approaches to resolve the blood stem cell niche

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Hematopoietic stem and progenitor cells (HSPCs) reside in complex microenvironment made up of many different cell types. An understanding of the signals and communication between HSPCs and their niche is critical for improving curative treatments for blood cancers and disease. We are applying new technologies to reveal novel aspects of the endogenous HSPC niche, including spatial distribution of metabolites, and the complete ultrastructure at nanometer resolution. For example, we are using Imaging Mass Spectrometry (IMS) to analyze the localization of gamma-aminobutyric acid (GABA) that is produced in the mammalian bone marrow. We have shown that GABA has a specific requirement in regulation of HSPCs and their differentiation towards the B cell lineage. GABA is spatially enriched in the endosteum of the bone marrow, which is considered a subdomain of the niche that favors B cell production. In another project, we are using Correlative Light and Electron Microscopy (CLEM) to integrate different imaging modalities. We are using light sheet and confocal microscopy to image fluorescently labeled HSPCs in their niche in transgenic zebrafish embryos. We then process the same embryos for serial section blockface electron microscopy, a technique that creates a massive 3D volume of electron microscopy data for an entire tissue. Using software to align the light and electron microscopy datasets, we can correlate the positions of single HSPCs, and identify all neighboring niche cells and their subcellular contacts with the HSPCs. This has allowed identification of cell types that were not previously known to contribute to the HSPC niche. Together, these new technologies are providing unique spatial maps of HSPCs niches and are changing our view of HSPC regulation.

ABOUT the SPEAKER

Dr. Tamplin is an Assistant Professor at the University of Wisconsin-Madison in the Department of Cell and Regenerative Biology. His lab studies the blood stem cell microenvironment or niche using complementary mouse and zebrafish models. Dr. Tamplin earned his BSc in Biochemistry from McGill University, Canada. He received his PhD in Molecular Genetics from the University of Toronto, Canada, where he worked in the laboratory of Dr. Janet Rossant studying the development of the mouse embryo. For his postdoctoral fellowship, Dr. Tamplin joined the lab of Dr. Leonard Zon at Boston Children's Hospital and Harvard Medical School. During his fellowship, he developed the first highly specific transgenic reporter of blood stem cells in the zebrafish. This allowed direct visualization of endogenous stem cells in their niche. He described a novel cellular structure that involves a group of endothelial cells wrapping around a single stem cell. His lab is now dissecting the function and mechanisms of stem cell interactions with the niche using genetic tools, live imaging, and serial section electron microscopy.

Monday, October 24 at noon
1003 Engineering Centers (Tong Auditorium)