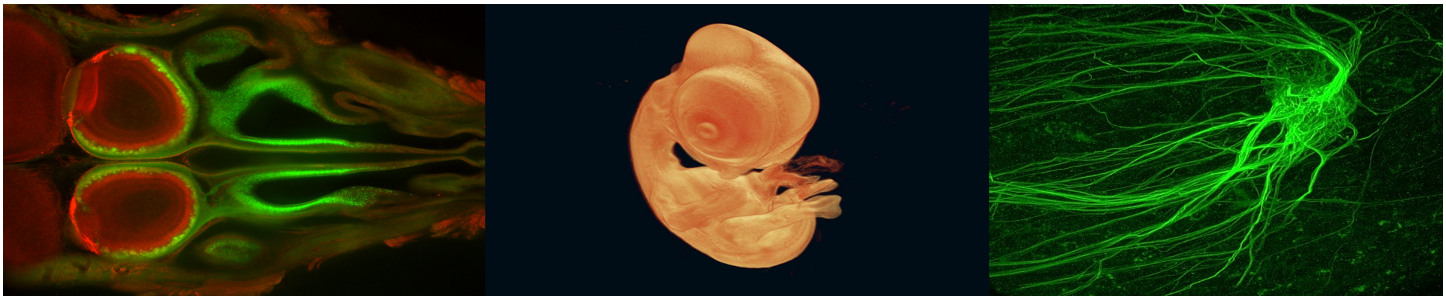

Visionary Seminar Series at USC

Friday, May 01, 2015 at 2 PM

Ray R Irani Hall Conference Room 101

Keith Cheng, M.D., Ph.D.

Distinguished Professor of Pathology
Director of Experimental Pathology
Penn State College of Medicine

"Pan-Cellular Tissue Tomography: Enabling quantitative 3D phenotyping of optically opaque tissues at cell resolution"

In medicine, multiple organ systems are commonly affected, necessitating a complete "review of systems" approach to obtaining data for the diagnosis and treatment of disease. Similarly, "complete" assessments of phenotype in model organisms ideally detect change in any cell type or organ system caused by disruption in gene function or by environmental (e.g. chemical) exposures. In mm-scale samples, changes in every cell can be considered in context of the whole, facilitating elucidation of cellular mechanisms. Neither affected cell types and tissues nor affected life stages can be predicted ahead of time, requiring phenotyping methods with pan-cellular capabilities even into older life stages. Since many differentiated tissues are optically opaque, histology is commonly used to study mutant phenotypes. While pan-cellular in nature, highly sensitive, and of high resolution, histology lacks significant 3D perspective, is subject to sample mal-orientation, lacks ability to view alternative planes, and has low throughput.

We are working towards higher-throughput, comprehensive, 3D morphological phenotyping of optically opaque organisms. Ideally, every cell type can be studied in the context of the whole organism. Assessing tissue architecture requires 3D images. Detecting cytological change requires voxel resolutions of ~ 1 micron. Any developmental stage may be affected, necessitating imaging at different life stages. Light-based 3D imaging methods including fluorescence microscopy are precluded in opaque, thick, or pigmented tissue samples. We are planning to develop kits for community use of a synchrotron X-ray based tool we call Pan-cellular Tissue Tomography (PANCETTO), which provides ~1 micron voxel resolution in whole, optically opaque, mm-scale organisms and samples. We report progress towards work towards elements of automation of imaging, digital orientation to a coordinate system, and detection and measurement of tissue volumes, and propose to take advantage of cloud-based access to sets of slice and slab visualizations, segmentations, annotations, and phenotyping. High-throughput phenotyping based on PANCETTO is being pursued across model organisms and tissues. The proposed tools will be model system-agnostic, and applicable to the identification of phenotypic signatures of disease, chemical exposures, and genetic deficiencies. We expect the intersections between disease, chemical, and genetic phenomes to be meaningful and useful.

Host: Provost Professor Scott Fraser
Tel: 213-740-2233 http://bioimaging.usc.edu/events.html#