

## EMBRIO SPRING 2025 SEMINAR SERIES

### Chemically Selective Imaging and Control of Biomolecular Functions in Live Cells

**March 10, 2025, 3pm EST, Thrust 3B Collaboration**

**Zoom:** <https://purdue-edu.zoom.us/j/97946412458?pwd=YUUrFKck0n1am07eA7b0O0TVKsVwpC.1&from=addon>

**Speaker: (Jesse) Chi Zhang, Ph.D.**

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**Abstract:** Understanding complex biological functions and tracking pathological changes require precise measurements of chemical compositions within biological systems. Advances in optical microscopy, particularly Coherent Raman Scattering (CRS), have enabled high-resolution imaging of physical and chemical properties, making it an invaluable tool for visualizing lipids and pharmaceutical compounds in biological samples. In this presentation, I will briefly introduce recent breakthroughs in CRS spectroscopy and microscopy from my research group.

The core focus of this talk will be Real-Time Precision Opto-Control (RPOC), a novel technology that enables site-specific, chemically selective control of subcellular processes with submicron precision. RPOC not only enhances chemical imaging but also allows for active, localized opto-control, such as generating reactive oxygen species, activating drugs, photo-uncaging small molecules, regulating cell division, and selectively eliminating cells. These capabilities have revealed new insights into site-specific molecular functions and facilitated sub-organelle-level microsurgery in live cells. In zebrafish embryos, RPOC enables precise stimulation and analysis of calcium wave dynamics during ATP uncaging and tissue wounding. I will discuss the development and applications of RPOC, emphasizing its potential to advance biological and medical research.

**Bio.**

Dr. Chi Zhang is an Assistant Professor in the Department of Chemistry at Purdue University. He earned his Ph.D. in 2014 from the University of Michigan, specializing in surface nonlinear optical spectroscopy. From 2014 to 2020, his postdoctoral work at Purdue University, Boston University, and the University of Illinois focused on nonlinear optical spectroscopy and imaging for biomedical research. He began his independent research career at Purdue University in 2020, within the Analytical Division of the Chemistry Department.

Dr. Zhang's current research focuses on developing novel optical imaging and opto-control technologies for biological applications. He has authored over 60 peer-reviewed journal articles and holds five patents. His lab specializes in Raman spectroscopy, coherent Raman scattering microscopy, and fluorescence imaging. In addition, his lab has pioneered Real-Time Precision Opto-Control (RPOC) technology, which enables precision optical control of chemical processes in live biological samples. His research is funded by the National Institutes of Health, the National Science Foundation, Merck & Co., BASF, the Purdue Trask Foundation, the Showalter Foundation, and the Center for Bioanalytical Metrology. Notably, he received the Maximizing Investigators' Research Award (MIRA) with 2 Million in support from the National Institute of General Medical Sciences. Additionally, Dr. Zhang is the Founder of Photokinesis LLC, a company dedicated to the commercialization of advanced optical control technologies.