

Chemistry 791: Fluorescence Spectroscopy and Imaging

Spring 2023

Date and Time: Tue & Thu 11:00 to 12:15 3/14/23 - 4/18/23

Professor: D. A. Erie 4360 Genome Sciences Building
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Course Structure:

The class will follow a student-led discussion format. Student teams will provide power point presentations to stimulate discussion. On the class day before a given presentation, students should plan to have a draft prepared and to remain for an hour or so after class, if possible, so that the instructor monitoring that paper can assist with questions and improvements to the presentation. For every day of class, students should read the material in advance, and are required to submit an informal note listing at least four comments or questions about the material and any assigned questions to be discussed on that day. These comments and questions must be uploaded to the homework section by 9:30 AM prior to class.

Students should read both the main paper and any supplemental material associated with it.

Tentative Course Outline

Classes 1 & 2

Lakowicz JR (2006) Principles of Fluorescence Spectroscopy (3rd edition) Springer, Chapter 1 (available in electronic form at UNC-CH library)

Please supplement your section with additional materials as you see fit. For example, on-line tutorials or Ishikawa-Ankerhold HC, Ankerhold R, Drummen PC (2012) Advanced fluorescence microscopy techniques – FRAP, FLIP, FRAP, FRET and FLIM. Molecules 17: 4047-4132

Lakowicz Section 1.1	Lakowicz Section 1.6
Lakowicz Section 1.2	Lakowicz Section 1.7
Lakowicz Section 1.3	Lakowicz Section 1.8
Lakowicz Section 1.4	Lakowicz Section 1.9 & 1.10
Lakowicz Section 1.5	Lakowicz Section 1.11 & FRAP

Class 3

Susanne Trautmann, Volker Buschmann, Sandra Orthaus, Felix Koberling, Uwe Ortmann, Rainer Erdmann, Fluorescence Lifetime Imaging (FLIM) in Confocal Microscopy Applications: An Overview, PicoQuant GmbH, Rudower Chaussee 29, 12489 Berlin, Germany, info@picoquant.com

Class 4

Yildiz A, Forkey JN, McKinney SA, Ha T, Goldman YE, Selvin PR (2003) Myosin V walks hand-over-hand: Single fluorophore imaging with 1.5-nm localization. Science 300: 2061–2065

Class 5

Reyes-Lamothe R, Sherratt D, Leake M (2010) Stoichiometry and architecture of active DNA replication machinery in Escherichia coli. Science 328: 498-501

Class 6

Betzig E, Patterson GH, Sougrat R, Lindwasser OW, Olenych S, Bonifacino JS, Davidson MW, Lippincott-Schwartz J, Hess HF (2006) Imaging intracellular fluorescent proteins at nanometer resolution. Science 313: 1642-1645

Bates M, Huang B, Dempsey GT, Zhuang X (2007) Multicolor super-resolution imaging with photo-switchable fluorescent probes. Science 317: 1749-1753

Class 7

LeBlanc SJ, Gauer JW, Hao P, Case BC, Hingorani MM, Weninger KR, Erie DA (2018) Coordinated protein and DNA conformational changes govern mismatch repair initiation by MutS. Nucleic Acids Res. 46: 10782-10795

Class 8

Nagerl UV, Willig KI, Hein B, Hell SW, Bonhoeffer (2008) Live-cell imaging of dendritic spines by STED microscopy. PNAS 105: 18982-18987

Class 9

Gustafsson MGL (2005) Nonlinear structured-illumination microscopy: Wide-field fluorescence imaging with theoretically unlimited resolution. PNAS 102: 13081-13086

Class 10

TBA

Wed Apr 21 to Mon Apr 26

A take-home final exam will be distributed on Wed Apr 21. Students should select a single 5-hour time period during the next few days to complete the final, which will be closed-book. Final grades will be determined by preclass notes, class participation, and performance on the final exam.