



## CHM 725-152, Independent Study - Fall 2017

**Instructor:** *Yuanwei Zhang, Ph.D.*

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Office Hours: M, W 10:15 am – 11:15 pm. And by appointment.

**Textbook:** Principles of Fluorescence Spectroscopy, Third Edition, by Joseph R. Lakowicz.

**Course Content:** Tentative material to be covered.

Chapter 1. Introduction to Fluorescence  
Chapter 2. Instrumentation for Fluorescence Spectroscopy  
Chapter 3. Fluorophores  
Chapter 6. Solvent and Environmental Effects  
Chapter 8. Quenching of Fluorescence  
Chapter 9. Mechanisms and Dynamics of Fluorescence Quenching  
Chapter 13. Energy Transfer  
Chapter 19. Fluorescence Sensing  
Chapter 23. Single-Molecule Detection

The intention is to provide students a comprehensive overview of fluorescence technique, including basic photophysics, principles of optical microscopy, and selected applications. Emphasis will be placed on developing a basic, foundational understanding of advanced fluorescence microscopy techniques useful in bioimaging. Student will develop literature research, review, and presentation skills via an oral presentation based on selected course materials (Super Resolution PAINT).

**Grading:** The grade will be determined by the quality of the presentation and slides preparation. The presentation slides must be turned in to the instructor for evaluation.

References Preparation 30%

Presentation Slides 20%

Final Presentation 50%

A (90-100%), B+ (85-89.9%), B (80-84.9%), C+ (75-79.9%), C (70-74.9%), D (60-69.9%), F (below 60%)

Required Reading:

Evanko, D., Primer: Fluorescence Imaging under the Diffraction Limit. *Nat. Methods* **2009**, *6*, 19-20.

Hell, S. W. Far-field Optical Nanoscopy. *Science* **2007**, *316*, 1153-1158.

Vaughan, J. C.; Jia, S.; Zhuang, X. Ultra-bright Photoactivatable Fluorophores Created by Reductive Caging. *Nat. Methods* **2012**, *9*, 1181-1184.

Cordes, T.; Blum, S. A. Opportunities and Challenges in Single-molecule and Single-particle Fluorescence Microscopy for Mechanistic Studies of Chemical Reactions. *Nat. Chem.* **2013**, *5*, 993.

Walter, N. G.; Huang, C.-Y.; Manzo, A. J.; Sobhy, M. A. Do-it-yourself Guide: How to use the Modern Single-Molecule Toolkit. *Nat. Methods* **2008**, *5*, 475.

Dai, M.; Jungmann, R.; Yin, P. Optical Imaging of Individual Biomolecules in Densely Packed Clusters. *Nat. Nanotech.* **2016**, *11*, 798.

Jungmann, R.; Avendano, M. S.; Woehrstein, J. B.; Dai, M.; Shih, W. M.; Yin, P. Multiplexed 3D Cellular Super-resolution Imaging with DNA-PAINT and Exchange-PAINT. *Nat. Methods* **2014**, *11*, 313.

Chen, J.; Bremauntz, A.; Kisley, L.; Shuang, B.; Landes, C. F. Super-resolution mbPAINT for Optical Localization of Single-stranded DNA. *ACS Appl. Mater. Interfaces* **2013**, *5*, 9338.