Biophysics 210: Biological Light Microscopy
Kurt Thorn
Syllabus

Discussion section meets Tuesdays from 1-2:30pm in MH2100
Labs meet Thursday or Friday from 2-5pm (location varies)

Week 9: Super-resolution Microscopy

Goals: Understand the three most common super-resolution methods: Structured Illumination (SIM), Localization Microscopy (STORM, PALM, etc.), and Stimulated Emission Depletion Microscopy (STED).

Discussion Section: May 26th
Labs: May 28th and 29th
Lectures (watch before discussion section):

- Super-Resolution: Overview and Stimulated Emission Depletion (STED) Microscopy
- Super-Resolution: Localization Microscopy
- Super-Resolution: Structured Illumination Microscopy (SIM)

Additional Reading (optional):

- Cell Size and Scale
- E.F. Fornasiero, and F. Opazo, "Super-resolution imaging for cell biologists", *BioEssays*, pp. 436-451, 2015.
- Donna R. Whelan and Toby D. M. Bell, "Super-resolution single-molecule localization microscopy: Tricks of the trade", *J. Phys. Chem. Lett.* 2015 **6**:374-382
- Whelan, D. R. & Bell, T. D. Image artifacts in Single Molecule Localization Microscopy: why optimization of sample preparation protocols matters. *Sci Rep* **5**, 7924 (2015).
- Dempsey, G. T., Vaughan, J. C., Chen, K. H., Bates, M. & Zhuang, X. Evaluation of fluorophores for optimal performance in localization-based super-resolution imaging. *Nat. Methods* **8**, 1027–36 (2011).
- Huang, B., Babcock, H. & Zhuang, X. Breaking the diffraction barrier: super-resolution imaging of cells. *Cell* **143,** 1047–58 (2010).

Microscopy Matters Blog Posts on Super-Resolution Imaging:

- Overview of techniques at Janelia Farms
- Probes for Single Molecule Localization Microscopy
- Structured-Illumination Microscopy: What types of samples are not suitable and why

Discussion Section Topic: We will discuss the mechanisms by which the various super-resolution techniques provide resolution beyond the diffraction limit, the sample requirements for each technique, and their strengths and weaknesses.

Lab: Demos of Structured Illumination Microscopy and localization microscopy (Nikon Imaging Center)