Fall 2023 – Quantitative Optical Imaging MCDB 5312 (3cr) Course Syllabus

Mon/Wed/Fri 11:40am-12:30pm, JSCBB B331

Instructors: Joseph Dragavon and Jian Wei Tay

Course Information

Explores the fundamentals of optical imaging in biology, especially molecular and cellular biology. Covered topics include an introduction to optics and microscopes, fluorescence microscopy and image analysis, and biological applications. MATLAB will be taught at the beginning of the course and used throughout for image processing. Prior experience with MATLAB (or Python) is highly recommended but not required.

Learning Outcomes

We will build on the following 3 primary learning outcomes throughout the term:

- Light microscopy
  - Understand the basic concepts of optical imaging
  - Learn how modern microscopes work
- Image Analysis
  - Learning the basics of programming in MATLAB
  - Learn common algorithms used in image analysis
  - Develop your own image analysis scripts
- Applications of quantitative imaging
  - Understand how imaging and analysis work together to answer biological questions

Assignments

Homework (20 points each)

There are 11 problem sets for this course. Each assignment is split between microscopy and image analysis questions. Assignments will be released on Friday and will generally cover material from the week (i.e., Monday – Friday), unless otherwise specified. The purpose of the assignments is to reinforce the concepts that we have covered during the week. Assignments will be due on the following Friday of class (Note that problem set 10 will be due after the Thanksgiving break as noted on the assignment sheet). Assignments will be provided on Canvas and answers must be submitted as a PDF on Canvas. For the microscopy questions that include calculations, you must include your work to gain the full points. For image analysis questions that involve coding, you must include your full code for full points. You may not use a large language AI model (e.g., ChatGPT, Bard, etc.) for your answers.

Exams (100 points)

The midterms will include material covered in the previous weeks:

- Midterm 1 – Weeks 1 – 4
- Midterm 2 – Weeks 5 – 8

The final exam will be comprehensive and include all material covered in the course, including the journal clubs.

The midterms will reinforce the concepts that we have covered in class, with some additional questions that aim to encourage critical thinking to connect concepts.