

MCDB/BCHM 5312 - QUANTITATIVE OPTICAL IMAGING

Brief outline of each lecture

■ = Homework Assigned (A) or Due (D); homework is due at the beginning of class

■ = Lab days for **IQ Bio students only**

■ = Journal Club

■ = Mid-terms/Final

TC = Tom Cech, JD = Joe Dragavon, JT = Jian Tay, GS = Graduate Student,

GL = Guest Lecturer: Evan Pratt (FRET, Biosensors); Orit Peleg (Macroimaging, object tracking);

DoubleHelix (Super Res, PSF)

Office Hours:

Monday: 10 – 11:00 (JSCBB B421, no MATLAB) Monday: 2 – 3:00 (MATLAB only, JSCBB B331)

Thursday: 11 – 12:00 (JSCBB B421, no MATLAB)

Date	Lecturer	HW /La b	Topic	Details
Week 1				
8/26	TC		Intro	Class overview; MATLAB requirement – Need to download; What is Light?
8/28	TC	1A	Light	
8/29	JD, JT	Lab	Microscope	Microscope and MATLAB training
8/30	JT		MATLAB	Introduction to MATLAB and matrices
Week 2				
9/2	No class			
9/4	TC	1D, 2A	Light	Reflection, Refraction, Diffraction, Fluorescence
9/5	JD, JT	Lab	Microscope	Microscope and MATLAB training
9/6	JT		MATLAB	Matrix operations and scripting
Week 3				
9/9	JD		Microscope	Microscope overview: parts, history, advancements, hands-on with old microscope
9/11	JD	2D/ 3A	Brightfield	Leeuwenhoek microscope; brightfield, phase DIC, ball lens, condenser arm, Köhler alignment
9/12	JD, JT	Lab 1A	Objects	Find and count fluorescent objects
9/13	JT		MATLAB	Introduction to image analysis

MCDB/BCHM 5312 - QUANTITATIVE OPTICAL IMAGING

Week 4				
9/16	TC		Biology	Fluorescent proteins: GFP, Halo, etc
9/18	TC	3D/4A		Journal Club
9/19	JD, JT	Lab 1B	MATLAB	MATLAB training and work session
9/20	JT		MATLAB	Object segmentation
Week 5				
9/23	JD		Objectives 1	History, various properties: Plan, chromatic, aberrations, resolution XY/Z, focal depth, WD
9/25	JD	4D	Objectives 2	Finish Objectives 1, Start Fluorophores (See below)
9/26	JD, JT	Lab 1C	mFile	mFile presentations for Lab 1
9/27	JT		MATLAB	Improving and validating segmentation
Week 6				
9/30	JD		Fluorophores	History, organic, synthetic, genetic, ex/em spectra, Jablonski
10/2	TC, JD		Mid-term 1	Mid-Term 1 covers lectures and homework 8/26 – 9/27
10/3	JD, JT	Lab 2A	Cells	Counting cell nuclei and cell bodies; Lab 1 mFiles due
10/4	JD		Light Sources	Lamps, LEDs, Lasers, spectra, filter cubes
Week 7				
10/7	JD		Detectors 1	CCD, EMCCD, sCOMS, dynamic range, bit-depth
10/9	JD	5A	Detectors 2	PMT, GaAsP, APD, Hybrid
10/10	JD, JT	Lab 2B	MATLAB	MATLAB training and work session
10/11	JT		MATLAB	Image corrections
Week 8				
10/14	JD		PSF/TIRF	Point spread function, TIRF, evanescent waves
10/16	JD	5D/6A	Confocal	Spinning disc, laser scanning, other approaches
10/19	JD, JT	Lab 2C	mFile	mFile Presentations for Lab 2
10/18	JT		MATLAB	Curve fitting
Week 9				
10/21	JD		Super Res	Deconvolution, brief overview of SIM, STED, STORM/PALM, 4Pi
10/23	JD	6D/7A	F-Techniques	FRAP, FRET, FLIM, Spectral
10/24	JD, JT	Lab 3A	Cyanobacteria	Phototoxicity measurements using fluorescent Cyanobacteria; Lab 2 mFiles due
10/25	JT		MATLAB	Particle detection

MCDB/BCHM 5312 - QUANTITATIVE OPTICAL IMAGING

Week 10				
10/28	GL1			GL1 General Lecture: Evan Pratt, PhD, Palmer lab – FRET, Biosensors
10/30	GL1	7D		GL1 Journal Club: Evan Pratt, PhD
10/31	JD, JT	Lab 3B	MATLAB	MATLAB training and work session
11/1	JT		MATLAB	Application I: Measuring FRET (ratiometric imaging)
Week 11				
11/4	GL2			GL2 General Lecture: Orit Peleg, Associate Professor, BioFrontiers Institute
11/6	TC, JD		Mid-term 2	Mid-Term 2 covers lectures and homework 9/30 – 11/1
11/7	JD, JT	Lab 3C	mFile	mFile Presentations for Lab 3
11/8	GL2			GL2 Journal Club: Orit Peleg, Associate Professor, BioFrontiers Institute
Week 12				
11/11	JT		MATLAB	Application II: Tracking bees
11/13	GS1/2			GS1/2 Journal Club - Carmen Butler and Jonathan Stripen
11/14	JD, JT	Lab 4A	Populations	Subpopulation distributions using Cyanobacteria; Lab 3 mFiles due
11/15	GS3/4	8A		GS3/4 Journal Club
Week 13				
11/18	GL3			GL3 General Lecture: Anurag Agrawal, PhD, Double Helix Optics
11/20	JT	8D/9A	MATLAB	Application III: Single particle tracking in 3D with a double helix point spread function
11/21	JD, JT	Lab 4B	MATLAB	MATLAB training and work session
11/22	GL3			GL3 Journal Club: Warren Colomb, PhD, Double Helix Optics
Week 14				
11/25	No Class			Happy Thanksgiving!
11/27	No Class			
11/29	No Class			
Week 15				
12/2	GS5/6			GS5/6 Journal Club
12/4	GS7/8	9D/10A		GS7/8 Journal Club - Ruiqi Li and Daniel Zarate
12/5	JD, JT	Lab 4C	mFile	mFile Presentations for Lab 4
12/6	GS9/10			GS9/10 Journal Club

MCDB/BCHM 5312 - QUANTITATIVE OPTICAL IMAGING

Week 16				
12/9	JD	10D	Recap	Semester summary
12/11	TC		Recap	Semester summary; Final discussion; Lab 4 mFiles due
12/??			Final	The Final covers all lectures and homework from 8/26 – 12/11