

ELECTROPHYSIOLOGY June 11 – July 30th

Section head: Carlos Aizenman, Professor at Brown University

Section Description: The objective of the electrophysiology section is to learn electrophysiology from first principles to practical application. Students will receive lectures from leading scientists that range from the basics of whole cell recordings to ion channel structure/function to the molecular basis and modulation of synaptic transmission. Students will rotate through a series of experimental preparations that include the invertebrate neuromuscular junction, single channel recording and analysis in cultured cells, whole cell currents in cultured cells, and in vivo patch clamp recordings in tissue slices and intact central nervous system. Rotations will be followed by independent research projects. These projects will be short, original research projects designed and executed under the guidance of individual teams of faculty and TAs. The goal is to attain a basic understanding of the theory and application of a wide range of modern electrophysiological techniques and the application of these techniques toward solving outstanding questions in modern neuroscience.

Faculty:

Carolos Aizenman	Brown University	Carlos_Aizenman@brown.edu
Ricardo Araneda	U. Maryland	araneda@umd.edu
Patrick Kanold	U. Maryland	pkanold@umd.edu
Emily Liman	U. Southern California	liman@usc.edu
Ellen Lumpkin	Columbia U.	eal2166@cumc.columbia.edu
Martin Mueller	U. Zurich	martin.mueller@imls.uzh.ch
Kara Pratt	U. Wyoming	kpratt4@uwyo.edu
Jon Sack	UC Davis	jsack@ucdavis.edu

Teaching Assistants:

Alexander Cooper	Team Liman	cooperAJ@usc.edu
Julia Henschke	Team Kanold	Julia.Henschke@lin-magdeburg.de
Rose Hill	Team Bautista/Lumpkin	rzhill@berkeley.edu
Ben Hoffman	Team Bautista/Lumpkin	buh2003@columbia.edu
Ruilong Hu	Team Araneda	hu.ruilong@gmail.com
Maria Landinez Macias	Team Mueller	maria.landinezmarcias@uzh.ch
Zhenyu Liu	Team Aizenmann/Pratt	zliu3@uwyo.edu
Xiangying Meng	Team Kanold	lindamengxy@gmail.com
Rebecka Sepela	Team Sack	rjsepela@ucdavis.edu

Special Lecturers:

Barry Connors	Brown U.	BC@Brown.edu
Karla Kaun	Brown U.	karla_kaun@brown.edu
Stuart Firestein	Columbia University	sjf24@columbia.edu
Rod MacKinnon	Rockefeller University	rodmackinn@mail.rockefeller.edu
Gina Turrigiano	Brandeis U.	turrigia@brandeis.edu

General Daily Schedule

9:00 – 12:00:	Lecture
12:00 – 1:30 pm:	Lunch/ Free time
1:30 – 6:00 pm:	Lab
6:00 – 7:00 pm:	Dinner/Free time
7:00 pm – midnight:	Lab/seminars

June 11 - Sun **5:00pm:** Meet Physiology Faculty. Bar-B-Q in front of Loeb.

June 12 - Mon **9am-11:30 Lecture:** Jon Sack & Diana Bautista –

Intro to Voltage Clamp/whole cell recording

11:30-1:30 Lunch and free time
1:30-6:00pm Model Cell Demo, Rig tour
6:00-7:00 Dinner/Free time

8:00pm Kravitz Lecture: Karla Kaun, Brown U.

June 13 - Tues 9am-11:30 Lecture: Jon Sack – Single Channel Recording

11:30-1:30 Lunch and free time
1:30-6:00pm Rotation #1
6:00-7:00 Dinner/Free time
7:00-midnight Rotations

June 14 - Wed 9am-11:30 Lecture: Carlos Aizenman –AP's/Regulation of excitability

11:30-1:30 Lunch and free time
1:30-6:00pm Rotation #2
6:00-8:00 Dinner/Free time
8:00-9:00pm **NS&B Lecture: Eric Jarvis, The Rockefeller U.**

June 15 - Thurs 9am-11:30 Lecture: Ellen Lumpkin- Mechanotransduction

11:30-1:30 Lunch and free time
1:30-6:00pm Rotation #3
6:00-7:00 Dinner/Free time
7:00-midnight Rotations

June 16 - Fri 9am-11:30 Lecture: Rod MacKinnon –Channel Structure Function

11:30-1:30 Lunch and free time
1:30-6:00pm Rotation #4
6:00-7:00 Dinner/Free time
7:00-midnight Lab

June 17 Sat & June 18 Sun OFF

June 19 - Mon 9am-11:30 Lecture: Emily Liman – Taste transduction

11:30-1:30 Lunch and free time
1:30-6:00pm Rotation #5
6:00-8:00 Dinner/Free time

8:00pm Monday Night Lecture: Stuart Firestein, Columbia University

June 20 - Tues 9am-1:00 Lecture: Rotation #6

1:00-2:00 Lunch and free time
2:00-6:00pm Rotation #7
6:00-7:30 Dinner/Free time
7:00pm Project discussion

June 21 - Wed 9am-11:30 Lecture: Ricardo Araneda – Olfactory Processing

11:30-1:30 Lunch and free time
1:30-6:00pm Projects
6:00-7:00 Dinner/Free time
7:00pm Projects Discussion/Selection

June 22 – Thur 9am-11:30 Lecture: Barry Connors, Brown University – Neural Circuit Dynamics

11:30-1:30 Lunch and free time
1:30-6:00pm Projects

	6:00-7:00	Dinner/Free time
	7:00-midnight	Projects
June 23 - Fri	9am-11:30	Lecture: Patrick Kanold-neural circuits & auditory processing
	12:00-1:30	Lunch and free time
	1:30-6:00pm	Projects
	6:00-7:00	Dinner/Free time
	7:00-midnight	Projects
June 24 - Sat	9:00-5pm	Projects
June 25 - Sun	OFF	
June 26 - Mon	9am-11:30	Lecture: Martin Mueller; Synaptic Transmission, Ca ⁺⁺ Signaling
	11:30-1:30	Lunch and free time
	1:30-6:00pm	Projects
	8:00pm	Monday Night Lecture: Gina Turrigiano, Brandeis University
June 27 - Tues	9am-11:30	Lecture: Gina Turrigiano – Synaptic Plasticity
	11:30-1:30	Lunch and free time
	1:30-6:00pm	Projects
	6:00-7:00	Dinner/Free time
	7:00-midnight	Projects
		Patrick Kanold – Tools for probing Neural Circuits
June 28 – Wed	9am-11:30	Lecture: Villu Maricq- Synaptic transmission and cellular trafficking
	11:30-1:30	Lunch and free time
	1:30-6:00pm	Projects
	6:00-7:00	Dinner/Free time
	7:00-midnight	Projects-last night for recording
June 29 - Thur	9am-11:30	Lecture: Kara Pratt – Development of Neural Circuits
	11:30-1:30	Lunch and free time
	1:30-6:00pm	Data Analysis/Talk preparation
	6:00-7:00	Dinner/Free time
	7:00-midnight	Data Analysis/ Talk preparation
June 30- Fri	1:00-4:00pm:	Student Presentations
	6:30pm:	End of Cycle Party
July 1 - Sat		Day off
July 2 - Sun		Day-Off (Back by 5pm to meet Imaging faculty)

IMAGING July 2 – July 19

Section head: Darcy Peterka, Columbia University

Section Description:

The objective of the imaging section will be to learn modern tools of microscopy from first principle optics to the application of super-resolution microscopy in modern neuroscience. Students will receive lectures from leading scientists on optics, resolution, super-resolution light microscopy, electron

microscopy, array tomography and the application of imaging toward solving outstanding questions in neurobiology. Students will be able to rotate through several imaging systems, gaining hands-on experience with a range of imaging systems. Students will pursue original research projects, designed and executed under the guidance of individual teams of faculty and TAs.

Faculty:

Adam Douglas	Univ. of Utah	adam.douglass@neuro.utah.edu
Erik Jorgensen	Univ. of Utah	erik.m.jorgensen@gmail.com
Darcy Peterka	Columbia Univ	dp2403@columbia.edu
Hari Shroff	NIH	hari.shroff@nih.gov
Shigeki Watanabe	Johns Hopkins U.	shigeki.watanabe@jhmi.edu
Ryohei Yasuda	Max Planck FLA	Ryohei.Yasuda@mpfi.org
Karen Zito	UC Davis	kzito@ucdavis.edu
Yi Zuo	UC Santa Cruz	yizuo@ucsc.edu

Teaching Assistants:

Evan Ardiel	Team Shroff	eardeil@yahoo.ca
Josh Barrios	Team Douglass	Josh.Barrios@utah.edu
Ryan Christensen	Team Shroff	ryanc8u7@gmail.com
Paul Evans	Team Yasuda	Paul.Evans@mpfi.org
Eddie Hujber	Team Jorgensen	edward.hujber@gmail.com
Jesse Jackson	Team Peterka	jc.jackson27@gmail.com
Grant Kusick	Team Watanabe	gkusick1@jhmi.edu
Shuo Liu	Team Watanabe	sli54@jhu.edu
Caitlin Moyer	Team Zuo	cemoyer@ucsc.edu
Sebatian Ivar Stein	Team Zito	sistein@ucdavis.edu
Thien Vu	Team Jorgensen	thienvu91@gmail.com
Long Yan	Team Yasuda	long.yan@mpfi.org

Special Lecturers:

Jeff Lichtman	Harvard U.	jeff@mcb.harvard.edu
Tom Reese	NIH	reese@mail.nih.gov

General Daily Schedule (plus/minus 30 mins)

9:00 – 12:00:	Lecture
12:00 – 1:30 pm:	Lunch/ Free time
1:30 – 6:00 pm:	Lab
5:30 – 6:30 pm:	Dinner/Free time
7:00 pm – midnight:	Lab/seminar

July 2 - Sun **5pm** Meet Imaging Faculty. Bar-B-Q in front of Loeb.

July 3 - Mon 9am-12:00 Lecture: Jeff Lichtman – Introduction to Microscopy
12:00-1:30 Lunch and free time
1:30-6:00pm Rotations
6:00-8:00 Dinner/Free time
8pm Monday night Lecture: Jeff Lichtman

- July 4 – Tues** 9am-12:00: Parade Prep and Parade
12:00-1:30 Lunch and free time
1:30-3:30 Jeff Lichtman – Fluorescence Microscopy
3:30-5:15pm Rotations
5:15:00-6:15 Dinner/Free time
6:30:00-11:30 Rotations
- July 5 – Wed** 9am-12:00: Lecture: Darcy Peterka – Scanning fluorescence microscopy for functional Imaging
12:00-1:30 Lunch and free time
1:30-5:30pm Rotations
5:30-7:00 Dinner/Free time
7:00-midnight
Project Discussion/Selection
- July 6 – Thur** 9am-12:00 Lecture: Yi Zuo - Structural Plasticity *in vivo*
12:00-1:30 Lunch and free time
1:30-6:00pm Projects/Lab practicals
6:00-7:00 Dinner/Free time
7:00-midnight Rotations
- July 7 – Fri** 9am-12:00 Lecture: Hari Shroff, Extended Resolution – SIM and Light Sheet
12:00-1:30 Lunch and free time
1:30-6:00pm Projects/Lab practicals
6:00-7:00 Dinner/Free time
7:00-midnight Projects
- July 8 - Sat** 9am-12:00 Lecture: Adam Douglass –TBD
12:00-1:30 Lunch and free time
1:30-6:00pm Projects
6:00-7:00 Dinner/Free time
7:00-midnight Projects
- July 9 - Sun** **OFF**
- July 10 - Mon** 9am-12:00 Lecture: Ryohei Yasuda – FRET and FLIM
12:00-1:30 Lunch and free time
1:30-6:00pm Projects
6:00-8:00 Dinner/Free time
8:00pm Monday Night Lecture: Tom Reese, NIH
- July 11 - Tue** 9am-12:00 Lecture: Karen Zito
12:00-1:30 Lunch and free time
1:30-6:00pm Projects
6:00-7:00 Dinner/Free time
7:00-midnight Projects
- July 12 - Wed** **9am-12:00** Lecture: Erik Jorgenson and Shikeyi Wantanabe : Electron Microscopy
12:00-1:30 Lunch and free time
1:30-6:00pm Projects
6:00-7:00 Dinner/Free time
7:00-midnight Projects

July 13 - Thurs	9am-10:30 No Lecture/ Projects 12:00-1:30 Lunch and free time 1:30-6:00pm Projects/Presentation prep 6:00-7:00 Dinner/Free time 7:00-midnight Projects/Presentation prep
July 14 - Fri	1:00pm – 4pm Presentations 6:30pm End of Cycle Party
July 15 - Sat	Day off
July 16 - Sun	Day-Off (Back by 5pm to meet Cell Bio faculty)

NEURONAL CELL BIOLOGY July 16 – July 30

Section head: Marc Hammerlund

Section Description:

The objective of the will be to have an experimental immersion in modern neuronal cell biology. Students will pursue original research projects, designed and executed under the guidance of individual teams of faculty and TA. Projects will take advantage of the principles and techniques that were introduced in the earlier sections of the course. Projects will range from studies of synaptic vesicle recycling, glutamate receptor trafficking, neuronal regeneration, and the application of optogenetic techniques for control of neural function. Students will present research hypotheses and progress in periodic laboratory meetings so that all students gain an understanding of the projects being pursued in each individual research group.

Faculty:

Carrie Adler	Cornell U.	adler.carrie@gmail.com
Jennifer Garrison	Buck Institute	jgarrison@buckinstitute.org
Marc Hammarlund	Yale U.	marc.hammarlund@yale.edu
Michael Higley	Yale U.	m.higley@yale.edu
Gunther Hollopeter	Cornell U.	guntherh@gmail.com
Michael Hoppa	Dartmouth U.	hoppam@gmail.com
Mary Logan	OHSU	loganm@ohsu.edu
Sean Speese	OHSU	speese@ohsu.edu

Teaching Assistants:

Tisha Bohr	Team Adler	tishaboehr@gmail.com
Courtney Hudson	Team Garrison	chudson@buckinstitute.org
Ed Partlow	Team Hollopeter	eap248@cornell.edu
Alex Lin-Moore	Team Hammarlund	alexander.lin-moore@yale.edu
Arpita Ray	Team Logan/Speese	raar@ohsu.edu
Kacey Rajkovich	Team Higley	kacey.rajkovich@yale.edu

Special Lecturers:

Zachary Knight	UCSF
Tom Schwarz	Harvard U.

General Daily Schedule

9:00 – 12:00:	Lecture
12:00 – 1:30 pm:	Lunch/ Free time
1:30 – 6:00 pm:	Lab
6:00 – 7:00 pm:	Dinner/Free time
7:00 pm – midnight:	Lab/seminar

July 16 - Sun **5:00pm:** Meet Cell Biology Faculty. Bar-B-Q in front of Loeb.

July 17- Mon **9am-12:00 Lecture:** Marc Hammarlund – Degeneration, regeneration
12:00-1:30 Lunch and free time
1:30-6:00pm Rotations
6:00-8:00pm Dinner/Free time
8:00pm Monday Lecture: **Tom Schwarz, Harvard U.**

July 18 - Tues **9am-12:00 Lecture:** Mary Logan- Glia
12:00-1:30 Lunch and free time
1:30-6:00pm Rotations
6:00-7:00 Dinner/Free time
7:00-midnight Rotations

July 19 – Wed **9am-12:00 Lecture:** Mike Hoppa – Excitability and APs
12:00-1:30 Lunch and free time
1:30-6:00pm Projects
6:00-7:00 Dinner/Free time
7:00-midnight Projects

July 20 – Thurs **9am-12:00 Lecture:** Jennifer Garrison- Neuropeptides

12:00-1:30 Lunch and free time
1:30-6:00pm Projects
6:00-7:00 Dinner/Free time
7:00-midnight Projects

July 21 – Fri **9am-12:00 Lecture:** Sean Speese – Synapse development

12:00-1:30 Lunch and free time
1:30-6:00pm Projects
6:00-7:00 Dinner/Free time
7:00-midnight Projects

July 22 – Sat **9am-12:00** Groups present hypothesis, background, techniques

12:00-1:30 Lunch and free time
1:30-5:00pm Projects

July 23 – Sun **Day off**

July 24- Mon 9am-12:00 Lecture: Carrie Adler- Stem cells in the nervous system

12:00-1:30 Lunch and free time
1:30-6:00pm Projects
6:00-8:00pm Dinner/Free time
8:00pm Monday Lecture: Zachary Knight, UCSF.

July 25 - Tues **9am-12:00 Lecture:** Gunther Hollopeter- SV cycle

12:00-1:30 Lunch and free time
1:30-6:00pm Rotations
6:00-7:00 Dinner/Free time
7:00-midnight Rotations

July 26 – Wed **9am-12:00 Lecture:** Mike Higley – Spines and dendrites

12:00-1:30 Lunch and free time
1:30-6:00pm Projects
6:00-7:00 Dinner/Free time
7:00-midnight Projects

July 27 – Thurs **9am-12:00 Lecture:** All Faculty: Where do we go from here?

12:00-1:30 Lunch and free time
1:30-6:00pm Projects/Presentation prep
6:00-7:00 Dinner/Free time
7:00-midnight Projects/Presentation prep

July 28 – Fri **9am-12:00pm Clean and pack course**

1:00pm – 4pm Presentations
6:00pm End of Course party