CSHL School of Biological Sciences
Core Course on Specialized Disciplines, Fall 2024
Course Outline

Module: Cancer

Course Faculty

Organizers:	Corina Amor Vegas
	Peter Westcott
Invited Experts:	Semir Beyaz
	Jeremy Borniger
	Camila dos Santos
	Hannah V. Meyer
	Tobias Janowitz
	Michael Lukey
	Christopher Vakoc
Tutor:	Mackenzie Callaway

Lectures and Meetings:

Wednesday, September 25: Westcott
2:00pm – 4:00pm: Oncogenes and the origins of cancer
Delbruck

Friday, September 26: Amor
2:00pm – 4:00pm: Tumor Suppressors
Samet (Koch)

Tuesday, September 27: Westcott
2:30pm – 4:30pm: Cancer Genome
James Library

Wednesday, October 1: Amor
2:00pm – 4:00pm: Tumor Suppressors (Paper Discussion)
Plimpton (Beckman)

Thursday, October 2: Lukey
10:00am – 12:00pm: Cancer Metabolism
Plimpton (Beckman)

Friday, October 4: Lukey
10:00am – 12:00pm: Cancer Metabolism (Paper Discussion)
Plimpton (Beckman)

Monday, October 7: Vakoc
2:00pm – 4:00pm: Signal Transduction & Targeted Therapy
Bush Fireplace room

Tuesday, October 8: dos Santos
10:00am – 12:00pm: Tumor lineage plasticity & epigenetics
James Library

Wednesday, October 9: Borniger
2:00pm – 4:00pm: Cancer Neuroscience
Delbruck

Thursday, October 10: Meyer
9:00am – 11:00pm: Development of Immune Tolerance (and Implications for Cancer Biology)
Delbruck

Thursday, October 10: Westcott
2:00pm – 4:00pm: Tumor microenvironment
Samet (Koch)

Friday, October 11: Beyaz
2:30pm – 4:30pm: Tumor Immunology
Delbruck

Tuesday, October 15: Janowitz
10:00am – 12:00 pm: Clinical Side of Cancer Biology
Delbruck

Thursday, October 17: Amor, Westcott
2:00pm – 4:00 pm: Problem Set Discussion
Samet (Koch)

Thursday, November 7: Westcott
10:00am – 12:00pm: Tumor Microenvironment (Paper Discussion)
Bush Fireplace room

Student Evaluation:

- 40% participation in daily discussions during lectures
- 40% based on paper discussions
- 20% based on problem set

Learning Objectives
Gain proficiency in the following:

- Oncogenes and Tumor suppressors
- Hallmarks of cancer
- Cancer genome
- Tumor microenvironment
- Cancer metabolism
- Cancer epigenetics
- Tumor immunology
- Approaches to treating cancer, including targeted therapy

Learning Outcomes

- Elaborate on an understanding of cancer as a pathological process
- Discuss how cancer progresses
- Contemplate how to expand on current methods to treat cancer
- Design tractable methods to investigate fundamental aspects of cancer biology
- Discuss translational approaches to defeating cancer

Reference Material
Textbooks:

- Weinberg, RA 2014. The Biology of Cancer

Reviews:

- Hanahan, D., and Weinberg, R.A. 2011. Hallmarks of cancer: the next generation. *Cell* **144**: 646-674.
- Harper, J.W., and Elledge, S.J. 2007. The DNA damage response: ten years after. *Mol Cell* **28**: 739-745.
- Lowe, S.W., Cepero, E., Evan, G. 2004. Intrinsic tumor suppression. *Nature* **432**: 307-315.
- Kaelin, W.G., 2005. The concept of synthetic lethality in the context of anticancer therapy. *Nat Rev Cancer* **5**: 689-698.
- Meacham, C.E. and Morrison, S.J. 2013. Tumor heterogeneity and cancer cell plasticity. *Nature* **501:** 328–337.
- Holohan, C., Van Schaeybroeck, S, Longley, D.B, and Johnston, P.G. 2013. Cancer drug resistance: an evolving paradigm. *Nat Rev Cancer* **13**: 714-726.

Supplemental reading

- Alberts, B et al. 2008. Molecular Biology of the Cell
- Mukherjee S. 2011. The Emperor of All Maladies: A Biography of Cancer

Discussion Papers

Tuesday, October 1: Amor
Serrano M, Lin A.W, McCurrach M.E, Beach D, Lowe S.W. 1997. Oncogenic *ras* provokes premature cell senescence associated with accumulation of p53 and $p16^{INK4a.}$ *Cell* **5**: 593-602.

Friday, October 4: Lukey
Diehl FF, Lewis CA, Fiske BP, Vander Heiden MG. 2019. Cellular redox state constrains serine synthesis and nucleotide production to impact cell proliferation. *Nat Metab.* **1**: 861-867.

Friday, October 11: Westcott
Albrengues J, Shields MA, Ng D, Park CG, Ambrico A, Poindexter ME, Upadhyay P, Uyeminami DL, Pommier A, Küttner V, Bružas E, Maiorino L, Bautista C, Carmona EM, Gimotty PA, Fearon DT, Chang K, Lyons SK, Pinkerton KE, Trotman LC, Goldberg MS, Yeh JT, Egeblad M. 2018. Neutrophil extracellular traps produced during inflammation awaken dormant cancer cells in mice. *Science* **361**.

CSHL School of Biological Sciences
Core Course on Neuroscience, Fall 2024
Course Outline

Course Faculty

Organizers:	Arka Banerjee
	Stephen Shea
	Jessica Tollkuhn
Guest Lecturers:	Florin Albeanu
	Lucas Cheadle
	Helen Hou
	Hiro Furukawa
	Mitra Javedzadeh
	Gabrielle Pouchelon
	Tony Zador
Tutor(s):	Alexandria Battison
	Priyanka Gupta

Methods Bootcamps:
Thursday, October 17, 2024 (5:00pm-8:00pm)
Monday, October 21, 2024 (5:00pm-8:00pm)

Lectures:
Tuesday, October 22, 2024 (10:00am-12:00pm):
Fundamentals of Neurophysiology (**Shea**)

Wednesday, October 23, 2024 (10:00am-12:00pm):
Ion Channel Structure and Function (**Furukawa**)

Thursday, October 24, 2024 (2:00pm-4:00pm):
Neurodevelopment: Building the Brain (**Tollkühn**)

Tuesday, October 29, 2024 (10:00am-12:00pm):
Neurodevelopment: Wiring the Brain I (**Pouchelon**)

Wednesday, October 30, 2024 (10:00pm-12:00pm):
Neurodevelopment: Wiring the Brain II (**Tollkühn**)

Thursday, October 31, 2024 (3:00pm-5:00pm):
Glia and Non-Neuronal Cell Types (**Cheadle**)

Monday, November 4, 2024 (2:00pm-4:00pm):
Sensory Systems I: Brain structure to function (**Shea/Tollkuhn**)

Tuesday, November 5, 2024 (2:00pm-4:00pm):
Sensory Systems II: Detecting the World (**Shea**)

Thursday, November 7, 2024 (2:00pm-4:00pm):
Mechanisms of Memory (**Shea**)

Monday, November 11, 2024 (2:00pm-4:00pm):
Motor Control: How do you move? (**Hou**)

Tuesday, November 12, 2024 (3:30pm-5:30pm):
Active Sensing: Exploring the World (**Banerjee/Shea**)

Wednesday, November 13, 2024 (10:00am-12:00pm):
Neuromodulation: Generating valence and persistent states (**Shea**)

Thursday, November 14, 2024 (2:00pm-4:00pm):
The Predictive Brain: Detecting Deviance (**Albeanu**)

Tuesday, November 19, 2024 (9:30am-11:30pm):
The Predictive Brain: Reward Prediction Error **(Banerjee/Shea)**

Wednesday, November 20, 2024 (2:00pm-4:00pm):
Modeling the Mind (**Banerjee**)

Thursday, November 21, 2024 (2:00pm-4:00pm):
Population Dynamics (**Javedzadeh**)

Friday, November 22, 2024 (2:30pm-4:30pm):
Can we model neuropsychiatric conditions? (**Shea/Tollkuhn**)

Monday, November 25, 2024 (2:00pm-4:00pm):
A Brief History of Intelligence (**Zador**)

Student Evaluation: There will be three main components to the class: lectures, a problem set and paper presentations. Evaluation will be based on participation during the lectures and performance during paper presentations and the problem set.

Paper Presentations: 50%
Lecture participation: 25%
Problem set: 25%

Quantitative Biology Course (Specialized Discipline), 2024

Instructors: Justin Kinney (lead), jkinney@cshl.edu
Benjamin Cowley cowley@cshl.edu
Helen Hou, hou@cshl.edu
Ivan Iossifov, iossifov@cshl.edu
Peter Koo, koo@cshl.edu
Hannah Meyer, hmeyer@cshl.edu
Saket Navlakha, navlakha@cshl.edu
Adam Siepel, asiepel@cshl.edu
Course TAs: Ari Benjamin, benjami@cshl.edu
Kaiser Loell, loell@cshl.edu

Quantitative reasoning is a powerful means of understanding biological systems and uncovering biological principles. With the advent of high-throughput technologies, it has become increasingly necessary for researchers in Biology to be able to analyze and interpret large data sets and to quantitatively frame scientific hypotheses. To this end, the 2024 Quantitative Biology (QB) Course will aim to equip the students with a working knowledge of statistics and Python programming, as well as provide exposure to more advanced topics in machine learning, algorithms, evolution, genomics, and biophysics.

Homework: Problem sets will be assigned most weeks during the QB Course, and will generally be due by midnight on Friday the week after the lectures that cover the relevant material. Optional problem sessions will be held by the TAs each week that a problem set is due. Unless otherwise stated, problem sets should be completed as Jupyter notebooks and emailed to the TAs. Generally, an assignment submitted after the specified date will be accepted with a late penalty of 30% off of the final grade, and will not be accepted after one week past the deadline. If you will be unable to turn in your assignment on time due to an emergency or other unavoidable circumstance, please contact Justin Kinney.

Student Evaluation: Problem sets: 80%, Lecture participation: 20%

Bootcamp: **Justin Kinney and Ivan Iossifov**
September 3 (10:00am-6:00pm), Plimpton, Beckman
September 4 (1:00pm-6:00pm), Plimpton, Beckman
September 5 (10:00am-5:00pm), Plimpton, Beckman

Lectures (subject to change):

Number	Topic	Lecturer	Date	Location
1	Statistics I + II	Justin	September 17, Tuesday, 2pm-4:30pm	James
2	Statistics III+IV	Ben	September 18, Wednesday, 2pm-4:30pm	James
3	Statistics V	Ben	September 19, Thursday, 2:00pm-4:00pm	Plimpton, Beckman
4	Statistics VI	Justin	September 20, Friday, 2:30pm-4:30pm	James
5	Algorithms I	Adam	October 2, Wednesday, 2pm-4:00pm	Delbruck
6	Algorithms II	Adam	October 4, Friday, 2:30pm-4:30pm	James
7	Algorithms III	Adam	October 8, Wednesday, 2pm-4pm	James
8	Machine Learning I	Peter	October 16, Wednesday, 2pm-4pm	Delbruck
9	Machine Learning II	Peter	October 18, Friday, 2:30pm-4:30pm	James
10	Graph Theory I	Saket	October 23, Wednesday, 12:30pm-2:30pm	Urey
11	Graph Theory II	Saket	October 23, Wednesday, 2:30pm-4:30pm	Urey
12	Genomics I	Hannah	October 25, Friday, 2:30pm-4:30pm	James
13	Genomics II	Hannah	October 30, Wednesday, 2pm-4pm	Delbruck
14	Biophysics I	Justin	November 1, Friday, 2:30pm-4:30pm	Delbruck
15	Biophysics II	Justin	November 6, Wednesday, 2pm-4pm	Delbruck
16	Data	Helen	December 6, Friday, 10am-12pm	Samet, Koch

Plant Biology Specialized Discipline Course
Fall 2024

Instructor: Dr. Ullas Pedmale (pedmale@cshl.edu)
Guest Lecturer: Dr. David Jackson
TA: Dr. Jason Lynn

Student Evaluation:
Problem sets: 40%; Journal club discussions: 30%; Lecture participation: 30%**.** This course emphasizes active commentary and discussion. All students are encouraged and expected to participate in the lectures and paper discussions.

Location: The course will take place in Delbruck unless otherwise noted.

This course integrates fundamental and advanced concepts of plant biology, focusing on the cellular, molecular, and genetic mechanisms that govern plant life. The curriculum is structured around critical areas of plant science: plant cell types, photosynthesis, plant hormones and their roles in growth and development, light signaling and flowering, plant stem cells, and stress biology and immunity.

The course will explore how plant cell types are specialized for different functions and how photosynthesis drives plant energy production. We will examine how plant hormones regulate growth and development, asking questions like: How do hormones interact to shape plant architecture? What are the molecular pathways that underlie these processes? The course will also delve into light signaling, examining how plants perceive light and how this influences their flowering patterns. Key questions include: How do plants integrate light signals into their growth and developmental programs? What genetic and molecular mechanisms control flowering time?

In studying plant stem cells/meristems, students will learn the genetic and signaling networks that control plant growth and organ formation. This section will ask: How are meristematic cells regulated at the molecular level? What are the key genetic interactions that maintain meristem function? Finally, the course will address plant stress biology and immunity, exploring how plants detect and respond to environmental stresses and pathogens. Key topics include: What are the signaling pathways involved in plant immunity? How do plants adapt to abiotic stresses such as drought or high salinity?

Through a combination of lectures, and paper discussion, this course will provide students with a deep understanding of plant biology, preparing them to tackle complex research questions in life science.

Student Evaluation:
paper discussions: 30%; Lecture participation: 30%**.** This course emphasizes active commentary and discussion. All students are encouraged and expected to participate in the lectures and paper discussions.

Location: The course will take place in Delbruck unless otherwise noted.

Textbook: Taiz and Zeigler, Taiz, Møller, Murphy, Zeiger, Plant Physiology and Development, 7th edition

Schedule:

Tuesday, October 15 (2:30-4:30): Pedmale
Topic: Plant cell types and photosynthesis

Thursday, October 17 (10:00-12:00): Pedmale
Topic: Plant Hormones

Friday, October 18 (10:00-12:00): Pedmale
Topic: growth and development

Monday, October 21 (2:00-4:00): Jackson
Topic: Genetics and signaling of the plant meristem

Thursday, October 24 (10:00-12:00): Pedmale
Topic: light perception and flowering

Friday, October 25 (10:00-12:00): Pedmale
Paper Discussion: TBA

Monday, October 28 (2:00-4:00): Pedmale
Topic: Plant stress biology and immunity

Thursday, October 31 (10:00-12:00): Pedmale
Topic: Paper Discussion: TBA