

# Fall 2021 Half Courses

*\*Referred to as "Full Term" in GSAS Academic Calendar\**

## ENROLLMENT DEADLINES

Check-in Opens	Aug. 2
Course Registration	Aug. 16
Check-in Deadline	Aug. 16
Course Reg. Deadline	Aug. 26
Fall Full Term Begins	Sept. 1
Add/drop no fee	Sept. 20
Last day to add/enroll	Oct. 18
Last day to drop	Nov. 1

## GSAS ACADEMIC CALENDAR



<https://registrar.fas.harvard.edu/gsas-academic-calendar>

## REMINDERS

You **cannot register** for courses until you **CHECK-IN** (or go to: <https://registrar.fas.harvard.edu/online-check-in>)

Register for **16 credits** for full-time student status and health insurance eligibility

Register by going to <https://my.harvard.edu/>

For questions, contact: [dms\\_courses@hms.harvard.edu](mailto:dms_courses@hms.harvard.edu)



**BBS 301 Embedded Teaching Practicum (for Graduate TFs)**

Jason Heustis

**BBS 330 Critical Thinking & Research Proposal Writing**

Rosalyn Adam, Matthew Harris

**BCMP 200 Principles of Molecular Biology**

Joseph Loparo, Karen Adelman, Alan Brown, Lee Churchman, Frank Slack, Ralph Scully

**BCMP 218 Molecular Medicine**

Suneet Agarwal

**BCMP 230 Principles & Practice of Drug Development**

Stan Neil Finkelstein, Peter Sorger

**BMIF 201 Concepts in Genome Analysis**

Shamil Sunyaev, Cheng-Zhong Zhang, Michael Baym, Heng Li

**GENETIC 201 Principles of Genetics**

Fred Winston, Maxwell Heiman, Thomas Bernhardt, Jenna Galloway, Stephanie Mohr, Steven McCarroll

**HBTM 235 Principles of Human Disease: Physiology & Pathology**

Connie Cepko

**IMMUN 201 Advanced Topics in Immunology**

Thorsten Mempel, Shiv Pillai

**IMMUN 301 Immunology Seminar**

Shiv Pillai, Galit Alter

**MED-SCI 250AB Human Functional Anatomy**

Lee Gehrke



**MICROBI 202 Mechanisms of Bacterial Pathogenesis & Host Immune Response**

Marcia Goldberg, Barczak, Amy, Helaine, Sophie, Higgins, Darren, Kagan, Jonathan, Ravel, Deepali, Starnbach, Michael

**MICROBI 205 Mechanisms of Microbial Pathogenesis**

Sanjat Kanjilal

**NEUROBIO 212 Mathematical Tools for Neuroscience**

Eleanor R. Batty, John Assad

**NEUROBIO 215A The Discipline of Neuroscience**

John Assad, Lisa Goodrich, Tari Tan

**NEUROBIO 230 Visual Recognition: Computational & Biophysical Perspective**

Gabriel Kreiman

**SHBT 200 Acoustics, Production & Perception of Speech**

Satrajit Ghosh, Sunil Puria, Heidi Nakajima

**SHBT 201 Biology of the Inner Ear**

Charles Liberman, Stéphane Maison

**VIROLOGY 200 Introduction to Virology**

Jonathan Abraham, Philip Kranzusch

**VIROLOGY 202 Proposal Writing**

Daniel Lingwood, Todd Allen, Samuel Rabkin, Smita Gopinath, Gaurav Gaiha



## Biological & Biomedical Sciences

### **BBS 301 Embedded Teaching Practicum (for Graduate TFs)**

Jason Heustis

4 units. Instructor consent required

Time varies by date; details of date and time to be shared by instructors

**Meeting Dates:** Aug. 10 – Dec. 15, 2021

**Meeting Location:** Shared by instructors

The Embedded Teaching Practicum serves to enhance the teaching experience for TFs and the learning experience for enrollees in the core BBS courses. While TFs serve different functions and experience teaching from different perspectives in each of our core courses, they collectively serve a vital role in helping with the delivery of a contemporary, high-quality and accessible education to HMS graduate students. The embedded teaching practicum provides practice-based training in curriculum design, developing learning objectives, assessment development and DBER; facilitating a group discussion; professionalism in the classroom; minding and supporting student wellness; and preparation for teaching throughout and beyond time in graduate school. Teaching fellows are provided training and experience in the development of an early-career teaching philosophy. Required course for TFs working in BCMP 200; other TFs may register for this course pending approval of the Course Director.

**Course Notes:** This course runs from August 10, 2021 - December 15, 2021. Time varies by date; details of date and time to be shared by instructors. Sessions scheduled in August will be held to complete essential training prior to the start of the class; these will be held virtually to ensure students can participate remotely.

TFs should contact Jason Heustis, [ronald\\_heustis@hms.harvard.edu](mailto:ronald_heustis@hms.harvard.edu). Required Course for TFs working in BCMP 200. Open to TFs serving in other BBS core classes. Registration for this class is limited to students serving as Teaching Fellows for BBS core. Class meetings will be scheduled during daytime and evening hours, and will be communicated by the instructor. TFs are required to participate in all synchronous and asynchronous components of the course in which they are serving as a TF.

**Course Head:** Jason Heustis, [ronald\\_heustis@hms.harvard.edu](mailto:ronald_heustis@hms.harvard.edu)



## **BBS 330 Critical Thinking & Research Proposal Writing**

Rosalyn Adam, Matthew Harris

4 units.

Th, 2:00pm – 3:30pm

**Meeting Dates:** Sept. 9 – Dec. 17, 2021

**Meeting Locations:** Session 1 & 2 (lectures) NRB 350

A small group tutorial systematically guiding students in the writing of original, hypothesis-driven research proposals from initial topic selection through completion of a final draft.

**Course Notes:** This course is open to second year BBS students. Others need permission of the instructors. Dates, times and locations for Sessions 3 and 4 will be determined by the faculty running the small group sessions. Students will be able to sign up for their specific group on a first-come, first-served basis until the group limit (5 students) is reached. The BBS office will coordinate this process. Group assignments will be posted on the course [website](#).

**Class Notes:** Session 1 (lecture) will be held on Sept. 9, 2:00pm - 3:30pm. Session 2 (lecture) will be held on Sept. 30, 2:00pm - 3:30pm. Small group sessions will be scheduled by faculty instructors and will occur on Zoom.

**Recommended Prep:** Check course [website](#) for downloadable material

**Course Heads:** Rosalyn Adam, [rosalyn.adam@childrens.harvard.edu](mailto:rosalyn.adam@childrens.harvard.edu), Matthew Harris, [matthew.harris@childrens.harvard.edu](mailto:matthew.harris@childrens.harvard.edu)

**Other instructors:** Caroline Burns, [caroline.burns@childrens.harvard.edu](mailto:caroline.burns@childrens.harvard.edu), Geoff Burns, [geoff.burns@childrens.harvard.edu](mailto:geoff.burns@childrens.harvard.edu), April Craft, [april.craft@childrens.harvard.edu](mailto:april.craft@childrens.harvard.edu), Christina Jacobsen [Christina.jacobsen@childrens.harvard.edu](mailto:Christina.jacobsen@childrens.harvard.edu), Hong Chen [hong.chen@childrens.harvard.edu](mailto:hong.chen@childrens.harvard.edu), Christian Dibble [ccdibble@bidmc.harvard.edu](mailto:ccdibble@bidmc.harvard.edu), Ming-Ru Wu [Ming-Ru\\_Wu@DFCI.HARVARD.EDU](mailto:Ming-Ru_Wu@DFCI.HARVARD.EDU), Sean Stowell, [srstowell@bwh.harvard.edu](mailto:srstowell@bwh.harvard.edu), Yu-Hua Tseng, [yu-hua.tseng@joslin.harvard.edu](mailto:yu-hua.tseng@joslin.harvard.edu), John (Sean) Clohessy, [jclohess@bidmc.harvard.edu](mailto:jclohess@bidmc.harvard.edu), Duane Wesemann, [dwesemann@partners.org](mailto:dwesemann@partners.org), Ralph Scully, [rscully@bidmc.harvard.edu](mailto:rscully@bidmc.harvard.edu), Mimi Bandopadhyay, [Pratiti\\_Bandopadhyay@DFCI.HARVARD.EDU](mailto:Pratiti_Bandopadhyay@DFCI.HARVARD.EDU), Natalie Artzi, [nartzi@bwh.harvard.edu](mailto:nartzi@bwh.harvard.edu)



## Biological Chemistry & Molecular Pharmacology

### **BCMP 200 Principles of Molecular Biology**

Joseph Loparo, Karen Adelman, Alan Brown, Lee Churchman, Frank Slack, Ralph Scully

4 units. Enrollment limited to 78. Instructor consent required.

M/W/F, 11:00am – 12:00pm

**Meeting Dates:** Sept. 1 – Dec. 6, 2021

**Meeting Location:** The course will meet in the Cannon room for the first day of class. After that, the main course room will be TMEC 227. Please see course page for breakdown.

Principles of Molecular Biology is a course organized around the Central Dogma of Biology with presentations covering fundamental aspects of DNA and RNA structure, their function, and their interactions with proteins. The course opens with a discussion of the physical and chemical properties that drive the interactions of proteins with nucleic acids. This is used as a basis for understanding the material presented in the subsequent six modules, which cover DNA replication, DNA repair, gene regulation, transcription, RNA processing, and translation. Throughout this course, an emphasis will be placed on how the structure of small molecular machines (proteins) define their function in the processes and pathways that are introduced.

**Recommended Prep:** Intended primarily for graduate students familiar with basic molecular biology or with strong biology/chemistry background.

**Course Head:** Joseph Loparo, [joseph\\_loparo@hms.harvard.edu](mailto:joseph_loparo@hms.harvard.edu)

**Other Instructors:** Karen Adelman, Alan Brown, Lee Churchman, Frank Slack, Ralph Scully

**Curriculum Fellow:** Madhvi Venkatesh, [madhvi\\_venkatesh@hms.harvard.edu](mailto:madhvi_venkatesh@hms.harvard.edu)

### **BCMP 218 Molecular Medicine**

Suneet Agarwal

4 units. Enrollment limited to 25. Instructor consent required

T, 1:00pm - 3:00pm

**Meeting Dates:** Sept. 14 – Dec. 7, 2021

**Meeting Location:** TMEC 447



A seminar on various human diseases and their underlying genetic or biochemical bases. Primary scientific papers discussed. Lectures by faculty and seminars conducted by students, faculty supervision.

**Course Notes:** Faculty mentors will guide student-led discussions of the papers. Jointly offered with the Medical School as HT 140.

**Prerequisites:** College-level mastery of principles of cellular and molecular biology and genetics.

**Course Head:** Suneet Agarwal, [suneet.agarwal@childrens.harvard.edu](mailto:suneet.agarwal@childrens.harvard.edu)

## **BCMP 230 Principles & Practice of Drug Development**

Stan Neil Finkelstein, Peter Sorger

4 units.

Wed., 3:00pm - 6:00pm

**Meeting Dates:** Sept. 8 – Dec. 8, 2021

**Meeting Location:** MIT 4-237

Critical assessment of the major issues and stages of developing a pharmaceutical or biopharmaceutical. Drug discovery, preclinical development, clinical investigation, manufacturing and regulatory issues considered for small and large molecules. Economic considerations of the drug development process.

**Course Heads:** Stan Finkelstein, [finkelst@hcp.med.harvard.edu](mailto:finkelst@hcp.med.harvard.edu), Peter Sorger, [peter\\_sorger@hms.harvard.edu](mailto:peter_sorger@hms.harvard.edu)

**Other Instructors:** Nienke Moret, GK Raju

## **Biomedical Informatics**

### **BMIF 201 Concepts in Genome Analysis**

Shamil Sunyaev, Cheng-Zhong Zhang, Michael Baym, Heng Li

4 units.

M/W, 2:30pm - 4:00pm

**Meeting Dates:** Sept. 1 – Dec. 1, 2021

**Meeting Location:** TMEC 250 Mini Amphitheater



This course focuses on quantitative aspects of genetics and genomics, including computational and statistical methods of genomic analysis. We will introduce basic concepts and discuss recent progress in population and evolutionary genetics and cover principles of statistical genetics of Mendelian and complex traits. We will then introduce current genomic technologies

and key algorithms in computational biology and bioinformatics. We will discuss applications of these algorithms to genome annotation and analysis of epigenomics, cancer genomics and metagenomics data. Proficiency in programming and basic knowledge of genetics and statistics will be assumed.

**Course Head** Shamil Sunyaev, [ssunyaev@rics.bwh.harvard.edu](mailto:ssunyaev@rics.bwh.harvard.edu)

**Other Instructors:** Cheng-Zhong Zhang, Michael Baym, Heng Li

## Genetics

### **GENETIC 201 Principles of Genetics**

Fred Winston, Maxwell Heiman, Thomas Bernhardt, Jenna Galloway, Stephanie Mohr, Steven McCarroll

4 Units.

M/W/F, 9:00am – 10:20am

**Meeting Dates:** Lectures will be in the Cannon Room, beginning Wed., Sept. 1 through Dec. 9. There will also be eight discussion sections during the semester. All problems sets and exams will be posted on the course website during the semester.

**Meeting Location:** Cannon Room, Building C 114

An in-depth survey of genetics that covers basic principles and modern approaches. We will draw on examples from various systems, including bacteria, yeast, *Drosophila*, *C. elegans*, zebrafish, mouse, and human.

**Course Notes:** Intended for first-year graduate students.

**Course Heads:** Fred Winston, [winston@genetics.med.harvard.edu](mailto:winston@genetics.med.harvard.edu), Max Heiman, [heiman@genetics.med.harvard.edu](mailto:heiman@genetics.med.harvard.edu)



## Human Biology & Translational Medicine

### **HBTM 235 Principles of Human Disease: Physiology & Pathology**

Connie Cepko

4 units

M/W/F, 9:00am - 10:30am

Breakdown (subject to change): M/F – lectures, W – tutorials

**Meeting Dates:** Sept. 1 – Dec. 1, 2021

**Meeting Location:** Locations vary by date – please see course page

This course covers the normal physiology and pathophysiology of selected organs, through lectures, readings, tutorials based on clinical cases, and patient presentations. Human biology is emphasized, with some examples also drawn from model organisms. Recent therapeutic approaches, including RNAi, gene therapy, and genome editing will be covered

**Course Note:** Course enrollment is open to graduate students from any program as well as undergraduates.

**Prerequisites:** Knowledge of introductory biochemistry, molecular biology, and cell biology required (MCB52 and MCB54 or equivalent and one year of organic chemistry for undergraduates).

**Course Head:** Connie Cepko, [cepko@genetics.med.harvard.edu](mailto:cepko@genetics.med.harvard.edu)

## Immunology

### **IMMUN 201 Advanced Topics in Immunology**

Thorsten Mempel, Shiv Pillai

4 units. Enrollment limited to 50. Instructor consent required

T/Th, 1:30pm – 3:00pm EST

**Meeting Dates:** Sept. 2 – Dec. 2, 2021

**Meeting Location:** Modell 100A, Fred S. Rosen Lecture Hall



This course provides an intensive and in-depth examination of a selection of fundamental concepts in immunology. It takes advantage of the unique expertise of members of our

Immunology faculty to illustrate how these concepts have been established and continue to be developed based on seminal work in the field including contributions from their own laboratories.

**Course Notes:** Intended for students who have had prior exposure to immunology on the undergraduate level. In the absence of such exposure, students must obtain the permission of the Course Director.

**Prerequisites:** A background in genetics and biochemistry is strongly recommended.

**Course Heads:** Thorsten Mempel, [tmempel@mgh.harvard.edu](mailto:tmempel@mgh.harvard.edu), Shiv Pillai, [pillai@helix.mgh.harvard.edu](mailto:pillai@helix.mgh.harvard.edu)

**Other Instructors:** Jonathan Kagan, Ulrich von Andrian, Frederick Alt, Nir Hacohen, Amy Wagers, Michael Carroll, Facundo Batista, Kai Wucherpfennig, Vijay Kuchroo, Arlene Sharpe, Judy Lieberman, Lydia Lynch, Stephanie Dougan, Kate Jeffrey

## IMMUN 301 Immunology Seminar

Shiv Pillai, Galit Alter

4 units. Enrollment limited to 20. Instructor consent required.

W, Speaker Meet and Greet 12:00pm - 1:00pm, Discussion Class 2:00pm - 3:30pm EST

**Meeting Dates:** Sept. 1 – Dec. 1, 2021

**Meeting Location:** Modell 100A, Fred S. Rosen Lecture Hall

Gives students exposure to research topics in immunology. Students prepare for the weekly seminar through readings, discussions, and preparing brief write-ups. These discussions are facilitated by members of the Committee on Immunology.

**Course Note:** Required for, and limited to, first-year Immunology graduate students. All others will be evaluated for enrollment on a case by case basis. Attendance is required at both the speaker Meet and Greets and the seminars. Meet and Greet timing can be found in class notes in my.harvard.

**Course Heads:** Shiv Pillai, [pillai@helix.mgh.harvard.edu](mailto:pillai@helix.mgh.harvard.edu), Galit Alter, [GALTER@mgh.harvard.edu](mailto:GALTER@mgh.harvard.edu)



## Medical Sciences

### **MED-SCI 250AB Human Functional Anatomy**

Lee Gehrke

4 units. Enrollment limited to 48. Instructor consent required.

M/W/F, 1:30pm – 6:00pm

Breakdown: Lecture: 1:30pm-2:45pm; Laboratory: 3:00pm -6:00pm

**Meeting Dates:** Sept. 8 – Dec. 10, 2021

**Meeting Location:** Armenise Amphitheater (lecture) plus TMEC Anatomy Labs

Lectures, prosections, and donor cadaver dissections provide a thorough exploration of the gross structure and function of the human body. Fundamental principles of embryology and bioengineering promote analytical approaches to understanding the body's design.

**Course Notes:** Open to qualified graduate students with research interests in organismic and evolutionary biology (OEB), with permission of the course director. The course has a minimum enrollment of 30. This course requires rental of a locker for a fee. Offered jointly with the

Medical School as HT010, which is open to M.D. candidates in the Health Sciences and Technology Program, Harvard Medical School

**Course Head:** Lee Gehrke, [lee\\_gehrke@hms.harvard.edu](mailto:lee_gehrke@hms.harvard.edu)

**Other Instructors:** Trudy van Houten Ph.D., Mohini Lutchman Ph.D., Sabine Hildebrandt, M.D.

## Microbiology & Immunobiology

### **MICROBI 202 Mechanisms of Bacterial Pathogenesis & Host Immune Response**

Marcia Goldberg, Amy Barczak, Sophie Helaine, Darren Higgins, Jonathan Kagan, Michael Starnbach, Deepali Ravel

4 units. Enrollment limited to 20. Instructor consent required.

T/ Th, 10:00am - 12:00pm

**Meeting Dates:** Sept. 2 – Dec. 2, 2021

**Meeting Location:** NRB 1031



This course focuses on molecular mechanisms of bacterial pathogenesis and the host response to infection. The class consists of lectures and group discussions emphasizing themes of pathogenesis, methods, results, and interpretations of classic and contemporary literature.

Subjects including bacterial secretion systems, mechanisms of entry into host cells, biofilm formation, and motility are viewed primarily from the pathogen's perspective, whereas topics including inflammasome activation, TLR signaling, and adaptive immune responses provide a host-centric view. Additional sessions are spent examining current methods of antibiotic discovery and vaccine development.

The course also introduces students to the wide diversity of pathogenic bacteria. Organisms discussed include pathogenic *E. coli*, *Shigella* species, *Vibrio cholerae*, *Listeria monocytogenes*, *Chlamydia trachomatis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*, as well as a discussion of the challenges presented by currently unculturable species. Where relevant, connections will also be made with pathogenesis and immune responses to viruses (particularly SARS-CoV-2), parasites, and fungi.

**Course Notes:** Designed to complement Microbiology 201; however, students who have not taken Microbiology 201 previously are welcome. Designed for graduate students in their first year or beyond, however undergraduates with specific interest in the field may also enroll.

**Course Head:** Marcia Goldberg, [marcia.goldberg@mgh.harvard.edu](mailto:marcia.goldberg@mgh.harvard.edu)

**Other Instructors:** Amy Barczak, Sophie Helaine, Darren Higgins, Jonathan Kagan, Michael Starnbach, Deepali Ravel

## **MICROBI 205 Mechanisms of Microbial Pathogenesis**

Sanjat Kanjilal

4 units. Enrollment limited to 40. Instructor consent required.

T/Th, 8:30am - 12:00pm

**Meeting Dates:** Sept. 7 – Dec. 13, 2021

**Meeting Location:** Building C 114 Cannon

Microbes occupy every niche of our environment and our bodies. They shape the way we develop, mature, and stay healthy. A subset of these organisms lead to states of infection, some of which have shaped the very foundations of our society. While the 20th century saw remarkable reductions in the burden of infectious diseases, they remain very much a part of our world, as evidenced by the COVID-19 pandemic. In HST 040, we will provide students an overview of the major microbial pathogens that students will encounter frequently in medical practice, their intrinsic microbiological properties, their epidemiology and their manifestations



of infection. Along the way, we will have interactive discussions around the decision-making processes to help the patient with infection, modern diagnostics, and the operation of the clinical microbiology laboratory in the 21st century. Students will also meet patients who will provide their lived experiences with acute and chronic infections. Finally, we will discuss a wide range of research topics scaling from host / microbiome interactions at the molecular level, to next generation viral and bacterial diagnostics, to applications of AI models for predicting antibiotic resistance, to global pandemic simulations and health disparities manifested through infectious diseases. In addition to the core clinical and research material, students will also have opportunities to gain skills in scientific communication through engagement with the wider public and their classmates.

**Course Notes:** Offered jointly with the Medical School as HT 040.

**Prerequisites:** A background course in molecular biology is strongly encouraged

**Course Head:** Sanjat Kanjilal, [SKANJILAL@BWH.HARVARD.EDU](mailto:SKANJILAL@BWH.HARVARD.EDU)

**Other Instructors:** Hysell, Kristen

## Neurobiology

### **NEUROBIO 212 Mathematical Tools for Neuroscience**

Eleanor R. Batty, John Assad

4 units. Enrollment limited to 20. Instructor consent required.

T/Th, 3:00pm - 4:30pm

**Meeting Dates:** Sept. 3 – Dec. 9, 2021

**Meeting Location:** TMEC 330

This course aims to equip graduate students with the fundamental quantitative skills necessary for neuroscience research and to serve as a solid foundation for further computational neuroscience classes. The course is aimed at first-, second- or third-year students in the Neuroscience PhD program, and is open to other graduate students in the biosciences. This course will cover the basics of linear algebra, differential equations, probability/statistics, and machine learning (focusing on areas applicable to neuroscience). You will not need any math experience beyond high school calculus. Some amount of coding in Python is necessary for this class. This course will be a flipped classroom course with prerecorded lectures and students working together on problem sets & programming exercises during class time.

**Course Notes:** There will be some programming exercises in Python so some coding experience will be necessary (email instructor for advice on how to prepare).



**Course Heads:** Eleanor R. Batty, [Eleanor\\_Batty@hms.harvard.edu](mailto:Eleanor_Batty@hms.harvard.edu), John Assad, [john\\_assad@hms.harvard.edu](mailto:john_assad@hms.harvard.edu)

## **NEUROBIO 215A The Discipline of Neuroscience**

John Assad, Lisa Goodrich, Tari Tan

4 units. Instructor consent required.

T/Th, 9:00am – 12:00pm

**Meeting Dates:** Sept. 7 – Dec. 16, 2021

**Meeting Location:** Warren Alpert (WAB) 236

This course will endow students with the broad conceptual fluency in the discipline of neuroscience required to relate genes to circuit function, metabolism to neurological disease, and cell biology to neural computations. Through a combination of asynchronous, recorded

lectures and synchronous in-class activities, students will learn to design, quantitatively analyze, and interpret experiments that address a variety of questions spanning molecular to systems neuroscience. During the first semester, students will think critically about the fundamental units of the nervous system within the context of cellular function, electrical conduction, and chemical signaling. The second half of the course builds upon this foundation to focus on broadly defined “networks of neural function”; as related to coordinated neural activity, the concerted execution of genetic programs, and anatomically defined structural networks. The course culminates with students writing a grant proposal in the style of the NIH NRSA. Part one of a two-part series. The curriculum for this course builds throughout the academic year. Students are strongly encouraged to enroll in both the fall and spring course within the same academic year.

**Course Notes:** Please note that Program in Neuroscience (PiN) students must take both semesters to fulfill the requirement. Non-PiN students may enroll in just the fall semester with instructor approval.

**Course Heads:** John Assad, [john\\_assad@hms.harvard.edu](mailto:john_assad@hms.harvard.edu), Lisa Goodrich, [lisa\\_goodrich@hms.harvard.edu](mailto:lisa_goodrich@hms.harvard.edu), Tari Tan, [taralyn\\_tan@hms.harvard.edu](mailto:taralyn_tan@hms.harvard.edu)

**Other Instructors:** Bruce Bean, David Corey, Michael Do, Pascal Kaeser, Joshua Kaplan, Wade Regehr, Bernardo Sabatini, Thomas Schwarz, Gary Yellen



## **NEUROBIO 230 Visual Recognition: Computational & Biophysical Perspective**

Gabriel Kreiman

4 Units. Enrollment limited to 50. Instructor consent required  
M, 3:00pm – 5:00pm

**Meeting Dates:** Sept. 1 – Dec. 14, 2021

**Meeting Location:** BioLabs 2062

How does cerebral cortex store information, compute and learn? How can we build prosthetic devices to fix or augment brain function? How can we build biologically inspired artificial intelligence? This course will examine these questions in the context of visual cognition. Topics: architecture of visual cortex, neurophysiology, visual consciousness, computational neuroscience, models of pattern recognition and computer vision, artificial intelligence, brain-machine interfaces.

**Course Notes:** Jointly offered with Faculty of Arts & Sciences as NEURO 130. NEUROBIO 230 cannot be taken if NEURO 130 has been taken. NEUROBIO 230 cannot be taken concurrently with NEURO 130.

**Course Website:**

[http://klab.tch.harvard.edu/academia/classes/hms\\_neuro300\\_vision/Harvard\\_Biological\\_and\\_Computer\\_Vision.html](http://klab.tch.harvard.edu/academia/classes/hms_neuro300_vision/Harvard_Biological_and_Computer_Vision.html)

**Prerequisites:** Life Sciences 1a (or Life & Physical Sciences A) and Life Sciences 1b (or equivalent)

**Recommended Prep:** Math (Maa/Mab, Math 1A, 1B, Math 19 a/or equivalent). Physical Sciences 1. MCB 80.

**Course Head:** Gabriel Kreiman, [gabriel.kreiman@childrens.harvard.edu](mailto:gabriel.kreiman@childrens.harvard.edu), (617) 919-2530

## **Speech & Hearing Bioscience and Technology**

### **SHBT 200 Introduction to Sound, Speech, and Hearing**

Satrajit Ghosh, Sunil Puria, Heidi Nakajima

4 units. Instructor consent required  
T/W/TH

**W**, 11:00am - Noon (recitations), **T/TH**, 3:00pm – 4:30pm (lectures)

**Meeting Dates:** Sept. 8 – Dec. 9, 2021

**Meeting Location:** MIT, 46-5056



Speech and hearing are fundamental to our ability to communicate, yet in the US alone millions of people suffer from some form of speech or hearing impairment. As engineers and scientists, it is important to understand the underlying principles of speech and hearing. The goals of this course are to introduce students to the acoustics, anatomy, physiology, and mechanics related to speech and hearing and to build a foundational understanding of one of the most complex, interdisciplinary, and fascinating areas of bioengineering. Particular attention will be paid to how humans generate and perceive speech. Topics include acoustic theory of speech production, basic digital speech processing, control mechanisms of speech production and basic elements of speech and voice perception. These fundamental topics will be explored through applications and challenges involving acoustics, speech recognition, and speech disorders, which are especially relevant given the ubiquity of recording and playback devices such as smartphones and home assistants. On the hearing side, topics include acoustics and mechanics of the outer ear, middle ear, and cochlea, how pathologies affect their function, and methods for clinical diagnosis. Surgical treatments and medical devices such as hearing aids, bone conduction devices, and implants will also be covered.

**Course Note:** This course is taught as course in consort with HST.714J at the Massachusetts Institute of Technology.

**Prerequisites:** Mathematical methods in science (Applied Mathematics 21a or Mathematics 21a) or equivalent. Calculus and introductory physics. Rigid body mechanics (Physics 11A), or Electrical circuits (Engineering Science 154) or permission of the instructor.

**Course Heads:** Satrajit Ghosh, [satra@mit.edu](mailto:satra@mit.edu), Sunil Puria, [sunil\\_puria@meei.harvard.edu](mailto:sunil_puria@meei.harvard.edu), Heidi Nakajima, [heidi\\_nakajima@meei.harvard.edu](mailto:heidi_nakajima@meei.harvard.edu)

## **SHBT 201 Biology of the Inner Ear**

Charles Liberman, Stéphane Maison

4 Units. Enrollment limited to 12. Instructor consent required.

**M**, 1:00pm - 2:30pm, **T/ Th**, 9:00am - 10:15am

**Meeting Dates:** Sept. 2 – Dec. 2, 2021

**Meeting Location:** TBD

Normal biology, biophysics, physiology and morphology of the inner ear, its sensory innervation and efferent control systems, and the mechanisms underlying sensorineural hearing loss and balance disorders. Material is presented through lectures, laboratory exercises and discussions of the primary literature.

**Course Notes:** Lecture notes will be available online.



**Prerequisite:** Introductory neurobiology recommended.

**Course Heads:** Charles Liberman, [charles\\_liberman@meei.harvard.edu](mailto:charles_liberman@meei.harvard.edu), Stéphane Maison, [stephane\\_maison@meei.harvard.edu](mailto:stephane_maison@meei.harvard.edu)

## Virology

### **VIROLOGY 200 Introduction to Virology**

Jonathan Abraham, Philip Kranzusch

4 units. Enrollment limited to 20. Instructor consent required.

M/W, 1:30pm - 3:45pm

**Meeting Dates:** Sept 8 - Dec 13

**Meeting Location:** TMEC 447

Introduction to virology. The lecture component reviews the basic principles of virology and introduces the major groups of human viruses. Weekly discussion groups critically analyze selected papers from the literature.

**Course Notes:** There will be mid-term and final projects consisting of proposals based on laboratory rotations.

**Course Website:** <http://www.courses.fas.harvard.edu/6075>

**Prerequisites:** Current Virology PhD student, or upon special consent

**Course Heads:** Jonathan Abraham, [abraham@crystal.harvard.edu](mailto:abraham@crystal.harvard.edu), Philip Kranzusch, [philip\\_kranzusch@dfci.harvard.edu](mailto:philip_kranzusch@dfci.harvard.edu)

### **VIROLOGY 202 Proposal Writing**

Daniel Lingwood, Todd Allen, Samuel Rabkin, Smita Gopinath, Gaurav Gaiha

4 units. Enrollment limited to 12. Instructor consent required.

W, 1:45pm – 4:00pm

**Meeting Dates:** Sept. 8 – Nov. 3, 2021

**Meeting Locations:** Location varies by date.



**General classroom meetings:**

**Group 1 meetings:** Conference room 852 at the Ragon institute, 400 Technology Square, Cambridge (Sept 15; Sept 22; Sept 29; Oct 6; Oct 13; Oct 20).

**Group 2 meetings:** Conference room 750 at the Ragon institute, 400 Technology Square, Cambridge (Sept 15; Sept 22; Sept 29; Oct 6; Oct 13; Oct 20).

**Group 3 meetings:** Rm 3820, Simches Research Bldg, MGH, 185 Cambridge St. Boston (Sept 15; Sept 22; Sept 29; Oct 6; Oct 13; Oct 20).

Students will write, present, and evaluate research proposals in the areas of virus replication, viral pathogenesis and treatment and prevention of viral infections.

**Prerequisites:** General background in biochemistry and virology.

**Course Head:** Daniel Lingwood, [dlingwood@gm.harvard.edu](mailto:dlingwood@gm.harvard.edu)

**Other Instructors:** Todd Allen [TALLEN2@mgh.harvard.edu](mailto:TALLEN2@mgh.harvard.edu), Samuel Rabkin [Rabkin@mgh.harvard.edu](mailto:Rabkin@mgh.harvard.edu), Smita Gopinath [sgopinath@hsph.harvard.edu](mailto:sgopinath@hsph.harvard.edu), Gaurav Gaiha [GGAIHA@mgh.harvard.edu](mailto:GGAIHA@mgh.harvard.edu)

