



HARVARD
DIVISION OF MEDICAL SCIENCES

Half Courses

Fall 2020

Enrollment deadlines

Check-in	July 27 – Aug 17
Course Registration	Aug 17-Aug 26
Add/drop no fee	Sept 21
Last day to add	Oct 19
Last day to drop, no WD	Nov 2



**GSAS Academic
Calendar 2020-21**

16 credits for full-
time student status



Contact

617-432-0605

dms_courses@hms.harvard.edu

BBS 301 Embedded Teaching Practicum (for Graduate TAs)

Jason Heustis, Madhvi Venkatesh

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, Johannes Walter

BCMP 218 Molecular Medicine

Suneet Agarwal

BCMP 230 Principles & Practice of Drug Development

Stan Neil Finkelstein

BMIF 201 Concepts in Genome Analysis

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

CELLBIO 201 Principles of Cell Biology

Adrian Salic

CELLBIO 235 History & Philosophy of Experimentation in Biology

David Glass, Janet Browne, Ned Hall

GENETIC 201 Principles of Genetics

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

HBTM 235 Principles of Human Disease: Physiology & Pathology

Connie Cepko

IMMUN 201 Advanced Topics in Immunology

Thorsten Mempel, Shiv Pillai, Stephanie Dougan

IMMUN 301 Immunology Seminar

Shiv Pillai, Galit Alter

MED-SCI 250AB Human Functional Anatomy

Lee Gehrke, Mohini Lutchman, Trudy Van Houten, Sabine Hildebrandt

MICROBI 202 Mechanisms of Bacterial Pathogenesis & Host Immune Response

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



MICROBI 205 Mechanisms of Microbial Pathogenesis

Clyde S. Crumpacker, Harvey Simon

NEUROBIO 212 Mathematical Tools for Neuroscience

Eleanor R Batty, John Assad, Lucy Lai, Alex Chen

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, Hideko Heidi Nakajima, Sunil Puria

SHBT 201 Biology of the Inner Ear

Charles Liberman, Stéphane Maison

VIROLOGY 200 Introduction to Virology

Jonathan Abraham, Philip Kranzusch

VIROLOGY 202 Proposal Writing

Jim DeCaprio, Sylvie Le Gall, Daniel Lingwood, Alex Balazs



Biological & Biomedical Sciences

BBS 301 Embedded Teaching Practicum (for Graduate TAs)

Jason Heustis, Madhvi Venkatesh

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

The Embedded Teaching Practicum serves to enhance the teaching experience for TAs and the learning experience for enrollees in the core BBS courses. While TAs 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; and preparation for teaching throughout and beyond time in graduate school. Teaching assistants are provided training and experience in the development of an early-career teaching philosophy. Course for TAs working in BCMP 200.

Course Notes This course runs from August 18, 2020 - December 10, 2020. Time varies by date; details of date and time to be shared by instructors.

TAs should contact Jason Heustis, ronald_heustis@hms.harvard.edu. Required Course for TAs working in BCMP 200. Open to TAs serving in other BBS core classes. Registration for this class is limited to students serving as Teaching Assistants for BBS core. Class meetings will be scheduled during daytime and evening hours, and will be communicated by the instructor. TAs are required to participate in all synchronous and asynchronous components of the course in which they are serving as a TA.

Meeting Dates August 18, 2020 - December 10, 2020

Course Head Jason Heustis, ronald_heustis@hms.harvard.edu

BBS 330 Critical Thinking & Research Proposal Writing

Rosalyn Adam, Matthew Harris

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.

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 10, 2:00pm - 4:00pm. Session 2 (lecture) will be held on Oct 1, 2:00pm - 4:00pm.

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



Meeting Dates Sept 10 - Dec 16

Course Heads Rosalyn Adam, rosalyn.adam@childrens.harvard.edu, Matthew Harris, matthew.harris@childrens.harvard.edu

Biological Chemistry & Molecular Pharmacology

BCMP 200 Principles of Molecular Biology

Joseph Loparo, Karen Adelman, Alan Brown, Lee Churchman, Frank Slack, Johannes Walter

MWF, 12:30pm – 1:29pm

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 five 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.

Course Notes Offered jointly with the Medical School as BP 723.0

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

Meeting Dates Sept 2, 2020 - Dec 7, 2020

Course Head Joseph Loparo, joseph_loparo@hms.harvard.edu

Curriculum Fellow Madhvi Venkatesh, madhvi_venkatesh@hms.harvard.edu

BCMP 218 Molecular Medicine

Suneet Agarwal

T, 12:30pm - 3:00pm

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.

Meeting Dates Sept 15 - Dec 3

Course Head Suneet Agarwal, suneet.agarwal@childrens.harvard.edu



BCMP 230 Principles & Practice of Drug Development

Stan Neil Finkelstein

W, 3:00pm - 6:00pm

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.

First Meeting Date: Sept 2, 2020

Course Head Stan Finkelstein, finkelst@hcp.med.harvard.edu

Biomedical Informatics

BMIF 201 Concepts in Genome Analysis

Shamil Sunyaev, Cheng-Zhong Zhang, Michael Baym

MW, 2:30pm - 4:00pm

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

Cell Biology

CELLBIO 201 Principles of Cell Biology

Adrian Salic, Radhika Subramanian, Susan Shao, David Pellman, Danesh Moazed, Daniel Finley, David Van Vactor, Malcolm Whitman, Wade Harper, Senthil Muthaswamy, John Hanna, Ed Chouchani, Pere Puigserver, Taru Muranen, Elaine Elion, Steve Gygi, Jennifer Waters, Spyros Artavanis-Tsakonas, Maofu Liao, Andrea McClatchey

Tu Th 12:00pm - 1:30pm

This is a graduate level course in which students examine both fundamental and novel concepts and methodologies in cell biology with expert faculty from the field. Through a combination of weekly asynchronous lectures on content and methodology, and weekly synchronous problem-solving and paper discussion sessions, students will explore a broad range of topics including: the molecular basis of cellular organization, subcellular compartmentalization, protein trafficking,



chromosome organization and epigenetics, regulated ubiquitin-proteasome pathways, cell cycle regulation, signal transduction, and more. By the end of this course, students should be able to:

- Evaluate primary scientific literature from a broad range of topics in cell biology;
- Identify current questions in cell biology and the co-evolving methodologies used to address those questions;
- Design appropriate experimental approaches to address hypotheses related to cell biology.

Course Notes Methodological focus on current approaches in cell biology including quantitative tools. Emphasis on experimental design. Offered jointly with the Medical School as CB 713.0.

Recommended Prep Basic knowledge in biochemistry, genetics, and cell biology.

Meeting Dates Sept. 2 – Dec. 10

Course Head Adrian Salic, adrian_salic@hms.harvard.edu

Curriculum Fellow Saoirse McSharry, saoirse_mcsharry@hms.harvard.edu

CELLBIO 235 History & Philosophy of Experimentation in Biology

David Glass, Janet Browne, Ned Hall

M, 6:30pm - 8:30pm

How did developments in philosophy of science, technology, and statistics relate to practices in biology over time? We will trace the influence of particular philosophical arguments concerning science that have developed over the last 500 years, following the development of distinct types of “Scientific Method” in biology. The course will offer a foundation for exploring how today’s dominant scientific method relates to scientific research, medicine, and society’s popular understanding of science, and may help give perspective as to how modern practices of scientific method have come to be. Learning of alternate approaches to science and scientific epistemology might be of particular importance now, given current controversies relating to the reproducibility of many published findings.

Meeting Dates Sept 7 - Nov 30, 2020

Course Head David Glass, david_glass@hms.harvard.edu



GENETIC 201 Principles of Genetics

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

An in-depth survey of genetics, beginning with basic principles and extending to modern approaches and special topics. 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. Offered jointly with the Medical School as GN 701.0.

Meeting Dates This course will be taught online in 2020. Lectures, problems sets, and exams will be posted at the course website during the semester, between Sept 2 - Dec 10. The first lecture with an introduction to the course will be posted at the course web site on Wed., Sept 2.

Course Heads Fred Winston, winston@genetics.med.harvard.edu, Max Heiman, heiman@genetics.med.harvard.edu

Human Biology & Translational Medicine

HBTM 235 Principles of Human Disease: Physiology & Pathology

Connie Cepko

MWF, 9:00am - 10:30am (lectures) (MW, 9:00am - 10:30am tutorials on select dates)

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).

First Meeting: Sept 2, 2020

Course Head Connie Cepko, cepko@genetics.med.harvard.edu



Immunology

IMMUN 201 Advanced Topics in Immunology

Thorsten Mempel, Shiv Pillai

T/Th, 12:30pm - 2:45pm

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. Offered jointly with the Medical School as IM 702.0.

Prerequisites A background in genetics and biochemistry is strongly recommended.

Meeting Dates Sept 3 - Dec 3, 2020

Course Heads Thorsten Mempel, tmempel@mgh.harvard.edu, Stephanie Dougan, stephanie_dougan@dfci.harvard.edu

IMMUN 301 Immunology Seminar

Shiv Pillai, Galit Alter

W, 12:30pm – 2:00pm

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.

First Meeting Date Sept 2, 2020

Course Heads Shiv Pillai, pillai@helix.mgh.harvard.edu, Galit Alter, galter@partners.org

Medical Sciences

MED-SCI 250AB Human Functional Anatomy

Lee Gehrke, Mohini Lutchman, Trudy Van Houten, Sabine Hildebrandt

MWF, 2:00pm - 5:00pm

Lectures, small group cases, and live-streamed prosections 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 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.

Meeting Dates Sept 9 - Dec 11, 2020

Course Head Lee Gehrke, lee_gehrke@hms.harvard.edu

Microbiology & Immunobiology

MICROBI 202 Mechanisms of Bacterial Pathogenesis & Host Immune Response

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

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

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, 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.

Meeting Dates Sept 3 - Dec 3, 2020

Course Head Marcia Goldberg, marcia.goldberg@mgh.harvard.edu

Curriculum Fellow Deepali Ravel, deepali_ravel@hms.harvard.edu



MICROBI 205 Mechanisms of Microbial Pathogenesis

Clyde S. Crumpacker, Harvey Simon

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

The mechanisms of bacterial, mycoplasmal, fungal, and viral pathogenesis are covered. Topics are selected for intrinsic interest and cover the spectrum of pathophysiologic mechanisms of the infectious process. Emphasis on pathogenesis at the molecular level.

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

Prerequisites A background course in molecular biology is strongly encouraged.

Meeting Dates Sept 8 - Dec 12, 2020

Course Head Clyde S. Crumpacker, ccrumpac@bidmc.harvard.edu

Neurobiology

NEUROBIO 212 Mathematical Tools for Neuroscience

Eleanor R Batty, John Assad, Lucy Lai, Alex Chen

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

This course aims to equip graduate students with the fundamental skills in quantitative modeling necessary for neuroscience research and to serve as a solid foundation for further computational neuroscience classes. The course is aimed at 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).

Meeting Dates Sept 8, 2020- Dec 10, 2020

Course Heads Eleanor R Batty Eleanor_Batty@hms.harvard.edu

NEUROBIO 215A The Discipline of Neuroscience

John Assad, Lisa Goodrich, Tari Tan

T/Th, 10:30am - 12:30pm

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 lectures and 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.

Meeting Dates Sept 3 - Dec 15, 2020

Course Heads John Assad, john_assad@hms.harvard.edu, Lisa Goodrich, lisa_goodrich@hms.harvard.edu, Tari Tan, taralyn_tan@hms.harvard.edu

NEUROBIO 230 Visual Recognition: Computational & Biophysical Perspective

Gabriel Kreiman

M, 3:00pm - 4:59pm

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.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.

Meeting Dates Sept 9 - Nov. 30

Course Head Gabriel Kreiman, gabriel.kreiman@childrens.harvard.edu, (617) 919-2530



Speech & Hearing Bioscience and Technology

SHBT 200 Introduction to Sound, Speech, and Hearing

Satrajit Ghosh, Hideko Heidi Nakajima, Sunil Puria

W/F, 9:00am - 10:29am (lectures); M, 9:00am - 9:59am (recitations)

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.

Course Website <https://goo.gl/rhNqY4>

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.

First Meeting Date Sept 1

Course Heads Satrajit Ghosh, satra@mit.edu, Hideko Nakajima, heidi_nakajima@meei.harvard.edu

SHBT 201 Biology of the Inner Ear

Charles Liberman, Stéphane Maison

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

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.



First Meeting Date Sept 3

Course Head Charles Liberman, charles_liberman@meei.harvard.edu

Virology

VIROLOGY 200 Introduction to Virology

Jonathan Abraham, Philip Kranzusch

MW, 1:30pm - 3:45pm

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. Offered jointly with the Medical School as MG 705.0.

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

Prerequisites Current Virology PhD student, or upon special consent

Meeting Dates Sept 9 - Dec 14, 2020

Course Heads Jonathan Abraham, abraham@crystal.harvard.edu, Philip Kranzusch, philip_kranzusch@dfci.harvard.edu

VIROLOGY 202 Proposal Writing

Daniel Lingwood, Alex Balazs, Kate Jeffrey, Todd Allen

W, 1:45pm - 3:59pm (first class meets Sept 4, 4:00pm - 6:00pm)

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

Course Note Offered jointly with the Medical School as MG 724.0.

Prerequisites General background in biochemistry and virology.

Meeting Dates Sept 4 - Oct 30, 2020

Course Head Daniel Lingwood, dlingwood@gm.harvard.edu

Teaching Assistant Austin Manny, austinmanny@g.harvard.edu

