


Fall 2022 Half Courses

Referred to as “Full Term” in GSAS Academic Calendar

| ENROLLMENT DEADLINES | | GSAS ACADEMIC CALENDAR | |
|------------------------|----------|---|---|
| Check-in Opens | Aug. 1 |  https://registrar.fas.harvard.edu/calendars#upcoming | <h3>REMINDERS</h3> <p>You cannot register for courses until you CHECK-IN (or go to: https://registrar.fas.harvard.edu/online-check-in)</p> <p>Register for 16 credits for full-time student status and health insurance eligibility</p> <p>Register by going to https://my.harvard.edu/</p> <p>For questions, contact: dms_courses@hms.harvard.edu</p> |
| Course Registration | Aug. 17 | | |
| Check-in Deadline | Aug. 17 | | |
| Course Reg. Deadline | Aug. 26 | | |
| Fall Full Term Begins | Aug. 31 | | |
| Add/drop no fee | Sept. 19 | | |
| Last day to add/enroll | Oct. 17 | | |
| Last day to drop | Oct. 31 | | |



BBS 301 Embedded Teaching Practicum (for Graduate TFs)

Jason Heustis

BBS 230A (NEW! Part A) Analysis of Biological Literature

Davie Van Vactor, Eric Greer

BBS 330 Critical Thinking & Research Proposal Writing

Rosalyn Adam, Matthew Harris, April Craft

BCMP 200 Principles of Molecular Biology

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

BCMP 218 Molecular Medicine

Suneet Agarwal, Srinivas Viswanathan

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, Matthew Warman

HBTM 201 Tumor Microenvironment and Immuno-Oncology: A Systems Biology Approach

Rakesh Jain

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, Ruaidhri Jackson

INDP 300 Writing and Communication for the Biomedical Sciences (CROSS REGISTER)

Jason Silverstein, Naomi Hein

PLEASE NOTE: PhD students to follow CROSS-REGISTRATION deadlines for this course, 8/15 through 9/19

MED-SCI 250AB Human Functional Anatomy

Trudy Van Houten

MICROBI 202 Mechanisms of Bacterial Pathogenesis & Host Immune Response

Marcia Goldberg, Amy Barczak, Sophie Helaine, Jonathan Kagan, Michael Starnbach, Lauren Essler

MICROBI 205 Mechanisms of Microbial Pathogenesis

Sanjat Kanjilal, Kristen Hysell

NEUROBIO 212 Mathematical Tools for Neuroscience

Eleanor R. Batty

NEUROBIO 215A The Discipline of Neuroscience

John Assad, Lisa Goodrich, Tari Tan

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

Todd Allen, Smita Gopinath, Sizun Jiang, Max Nibert, Silvi Rouskin



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: August 15 – December 15, 6 sessions in August 2022, additional sessions throughout semester dependent on course in which TF is serving

Meeting Location: August sessions (virtual), Room TBD for in-person during semester

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 15, 2022 - December 15, 2022. Time varies by date; details of date and time to be shared by instructors. Sessions scheduled in August will be held to deliver essential training prior to the start of the class; these will be held virtually to ensure students can participate remotely. Sessions during the course of the semester will be held in person, and vary by the core course in which the TF serves.

TFs should contact Jason Heustis, 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



BBS 230A Analysis of Biological Literature

David Van Vactor, Eric Greer

2 units. Enrollment limited 60. Instructor consent required.

NOTE: Each course part, “A” and “B” is worth 2 credits. Complete both parts for full 4 credits.

Fall 1 Part A

T., 3:00pm – 5:00pm

TH., 10:00am – 11:00am OR 4:00pm – 5:00pm

Meeting Dates: September 1 – December 1

Meeting Locations: Tosteson Medical Education Ctr. (TMEC) – rooms vary by date

BBS 230A is an integrated literature analysis course comprised of two related components: (1) seminar-style, small group paper discussions with BBS faculty members that focus on understanding, dissecting, and evaluating seminal research papers; and (2) sections led by teaching fellows that focus on developing each student’s analytical approach to scientific literature, publication, and professional growth.

BBS 230A will take place between September and mid-October, with one additional session in December.

Course Notes: BBS 230A is open for enrollment only to BBS and BIG students. This course and its second part, BBS 230B, is required for first-year BBS students. Students must complete the fall semester (BBS 230A) to enroll in the summer semester (BBS 230B).

Course Heads: David Van Vactor, davie_vanvactor@hms.harvard.edu, Eric Greer, eric.greer@childrens.harvard.edu

Additional Instructors: TBD

BBS 330 Critical Thinking & Research Proposal Writing

Rosalyn Adam, Matthew Harris, April Craft

4 units

Th, 2:00pm – 3:30pm

Meeting Dates: September 8 – December 1

Meeting Locations: Session 1 and Session 2 (lectures) held in NRB 350, virtual small group session



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. Students will be placed in small groups using the sectioning tool in my.harvard. Dates, times and locations for Sessions 3 and 4 will be determined by the faculty running the small group sessions. Group assignments will be posted on the course [website](#).

Class Notes: Session 1 (lecture) will be held early in Sept. Session 2 (lecture) will be held later in same month. Small group sessions will be scheduled by faculty instructors and may occur on Zoom.

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

Course Heads: Rosalyn Adam, rosalyn.adam@childrens.harvard.edu, Matthew Harris, matthew.harris@childrens.harvard.edu, April Craft, april.craft@childrens.harvard.edu

Other instructors: Caroline Burns, caroline.burns@childrens.harvard.edu, Geoff Burns, geoff.burns@childrens.harvard.edu, Christina Jacobsen Christina.jacobsen@childrens.harvard.edu, William Pu, William.Pu@CARDIO.CHBOSTON.ORG Hong Chen hong.chen@childrens.harvard.edu, Sean Stowell, srstowell@bwh.harvard.edu, Evanna Mills, [Evanna Mills@DFCI.HARVARD.EDU](mailto:Evanna_Mills@DFCI.HARVARD.EDU), Christian Dibble ccdibble@bidmc.harvard.edu, Ming-Ru Wu [Ming-Ru Wu@DFCI.HARVARD.EDU](mailto:Ming-Ru_Wu@DFCI.HARVARD.EDU), Roby P. Bhattacharyya, rbhatt@broadinstitute.org, Yu-Hua Tseng, yu-hua.tseng@joslin.harvard.edu, John (Sean) Clohessy, jclohess@bidmc.harvard.edu, Duane Wesemann, dwesemann@partners.org, Ralph Scully, rscully@bidmc.harvard.edu, Yohannes Tesfaigzi, ytesfaigzi@bwh.harvard.edu, Mimi Bandopadhayay, [Pratiti Bandopadhayay@DFCI.HARVARD.EDU](mailto:Pratiti_Bandopadhayay@DFCI.HARVARD.EDU)

Biological Chemistry & Molecular Pharmacology

BCMP 200 Principles of Molecular Biology

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

4 units. Enrollment limited to 72. Instructor consent required.

M/W/F, 11:00am – 12:00pm

Meeting Dates: August 31 – December 12

Meeting Location: Tosteson Medical Ed. Ctr. (TMEC) Rm 227 and Countway Library – rooms vary by date



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

Other Instructors: Karen Adelman, Alan Brown, Stirling Churchman, Frank Slack, Johannes Walter

Curriculum Fellow: John Peters, john_peters@hms.harvard.edu

BCMP 218 Molecular Medicine

Suneet Agarwal, Srinivas Viswanathan

4 units. Enrollment limited to 25. Instructor consent required

T, 1:00pm - 3:00pm

Meeting Dates: September 6 – November 29

Meeting Location: Tosteson Medical Education Ctr. (TMEC), Rm 250

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. Offered jointly with the Medical School as HT140, which is open to M.D. candidates in the Health Sciences and Technology Program, Harvard Medical School.

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

Course Head: Suneet Agarwal, suneet.agarwal@childrens.harvard.edu; Srinivas Viswanathan, Srinivas.viswanathan@dfci.harvard.edu

Teaching Fellow: William Mannherz, William_mannherz@hms.harvard.edu



BCMP 230 Principles & Practice of Drug Development

Stan Neil Finkelstein, Peter Sorger

4 units

W, 3:00pm - 6:00pm

Meeting Dates: September 7 – December 14

Meeting Location: MIT Building 4, Room 237

Introduction to and critical assessment of the concepts, technologies and practical challenges of developing new medicines and bringing them to market. Pharmacology fundamentals, preclinical drug discovery, clinical trials, manufacturing and regulatory issues, as well as financing and marketing are discussed for small molecule, biologic and cellular therapies.

Course Notes: Suitable for individuals with a wide variety of backgrounds and interests from biology to engineering, business and medicine (undergraduate, graduates in MBA, MD and PhD programs). Taught by MIT and HMS faculty and by industry experts. Emphasizes a high level of student engagement via weekly news updates and projects involving collaboration across interdisciplinary teams.

Prerequisites: No particular course is required. Knowledge of basic biology, biomedicine or bioengineering, and familiarity with basic economic principles will be helpful but not necessary for the course.

Website: <https://www.principlespracticedrugdevelopment.org/>

Course Heads: Stan Finkelstein, finkelst@hcp.med.harvard.edu, Peter Sorger, peter_sorger@hms.harvard.edu

Other Instructors: Han Xu (HMS), GK Raju (MIT), Charles Cooney (HMS), Mike Rosenblatt (Flagship), Birgit Schoeberl (Novartis), Joshua Apgar (Applied Biomath), Ariel Stern (HBS), Elliott Antman (HMS/BWH), Sumit Khedakar (Citi Bank)

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: August 31 – November 30

Meeting Location: Tosteson Medical Education Ctr. (TMEC), Rm 250



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@hms.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, Matthew Warman

4 units

M/W/F, 9:00am – 10:30am

Meeting Dates: August 31 – December 8

Meeting Location: Armenise 125(D)/Tosteson Medical Ed. Ctr. (TMEC) – rooms vary by date

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, Max Heiman, heiman@genetics.med.harvard.edu

Other Instructors: Thomas Bernhardt, Jenna Galloway, Stephanie Mohr, Matthew Warman



Human Biology & Translational Medicine

HBTM 201 Tumor Microenvironment and Immuno-Oncology: A Systems Biology

Approach

Rakesh Jain

4 units

M, 5:00pm - 7:00pm

Meeting Dates: September 9 – December 15

Meeting Location: MIT E25-117

Due to current access restrictions, students should enroll in the MIT version of the course, HST .525

Provides theoretical background to analyze and synthesize the most up-to-date findings from both laboratory and clinical investigations into solid tumor pathophysiology. Covers different topics centered on the critical role that the tumor microenvironment plays in the growth, invasion, metastasis and treatment of solid tumors. Develops a systems-level, quantitative understanding of angiogenesis, extracellular matrix, metastatic process, delivery of drugs and immune cells, and response to conventional and novel therapies, including immunotherapies. Discussions provide critical comments on the challenges and the future opportunities in research on cancer and in establishment of novel therapeutic approaches and biomarkers to guide treatment.

Course Notes Given in alternate years. This course is taught as course in consort with HST.525 at the Massachusetts Institute of Technology.

Course Head Rakesh Jain, jain@steele.mgh.harvard.edu

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: August 31 – December 8



Meeting Location: Lectures: NRB 350, Tutorials: Tosteson Medical Education Ctr. (TMEC) – rooms vary by date

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

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: August 31 – December 1

Meeting Location: Modell 100A

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, Shiv Pillai,



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, Ruaidhri Jackson

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: August 31 – November 30

Meeting Location: Modell 100A

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, Ruaidhri Jackson, Ruaidhri_Jackson@hms.harvard.edu

INDP 300 Writing and Communication for the Biomedical Sciences (CROSS REG.)

Jason Silverstein, Naomi Hein

PLEASE NOTE: PhD students to follow CROSS-REGISTRATION deadlines for this course, 8/15 through 9/19

2 units

T (Section 1: In-Person), 10:00am – 12:00pm

W (Section 2: Online - Zoom), 9:00am – 11:00am

Meeting Dates: August 31 – December 17

Meeting Location: Section 1: Countway 403



Course Notes: There are two sections of this course. Students are only required to enroll in one section. **PhD students must enroll in the in-person section.**

This course prepares students for the demands of writing and communicating in the medical sciences. The class has two linked agendas: students will learn how to turn raw research into polished academic argument, and students will practice specific lessons through exercises that allow them to think about their own developing scholarship. The course is divided into three units. In the first unit we examine the main components of academic argument (structure, evidence, and analysis). In this section, students will learn how to write with sources. In the second unit, we focus on framing insights, entering the scholarly conversation, and crafting and responding to sophisticated critiques. In this section, students will learn how to frame both the human health and scholarly significance of their work. In the final unit, students will learn how to communicate their work in various forms, including writing an abstract, grant, blog, before turning to presentation skills, such as crafting an elevator pitch and how to present at a conference or thesis defense. Students will have frequent opportunities for feedback on issues of grammar and syntax. By the end of the course, students will have learned how to communicate their research in a variety of ways to academic and professional audiences.

Course Heads: Jason Silverstein, jason_silverstein@hms.harvard.edu, Naomi Hein, naomi_hein@hms.harvard.edu

Medical Sciences

MED-SCI 250AB Human Functional Anatomy

Trudy Van Houten

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

M/W/F, 1:30pm – 6:00pm

Meeting Dates: September 7 – December 14

Meeting Location: Tosteson Medical Education Ctr. (TMEC) – rooms vary by date

Lectures, human anatomic dissections, prosections, and small group activities 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 by



May 1 of the preceding spring. 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: Trudy Van Houten PhD, trudy_vanhouten@hms.harvard.edu

Other Instructors: Richard Mitchell, MD, PhD; Mohini Lutchman Ph.D.; Michael Cahalane, MD

Microbiology & Immunobiology

MICROBI 202 Mechanisms of Bacterial Pathogenesis & Host Immune Response

Marcia Goldberg, Amy Barczak, Sophie Helaine, Jonathan Kagan, Michael Starnbach, Lauren Essler

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

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

Meeting Dates: September 1 – December 1

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, 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

Curriculum Fellow: Lauren Essler, lauren_essler@hms.harvard.edu

Other Instructors: Amy Barczak, Sophie Helaine, Jonathan Kagan, Michael Starnbach

MICROBI 205 Mechanisms of Microbial Pathogenesis

Sanjat Kanjilal, Kristen Hysell

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

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

Meeting Dates: September 5 – December 19

Meeting Location: Tosteson Medical Education Ctr. (TMEC), Rm 227

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 HT040, which is open to M.D. candidates in the Health Sciences and Technology Program, Harvard Medical School.

Prerequisites: A background course in molecular biology is strongly encouraged

Course Head: Sanjat Kanjilal, SKANJILAL@BWH.HARVARD.EDU, Kristen Hysell, khysell@mgh.harvard.edu



Neurobiology

NEUROBIO 212 Mathematical Tools for Neuroscience

Eleanor R. Batty

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

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

Meeting Dates: September 6 – December 8

Meeting Location: Tosteson Medical Education Ctr. (TMEC), Rm 338 and Rm 304 (on 9/6)

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

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: September 6 – December 1

Meeting Location: Warren Alpert Building (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 instructional materials 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 an experimental proposal. 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. Students must complete the fall semester (NB215A) to enroll in the spring semester (NB215B).

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

Speech & Hearing Bioscience and Technology

SHBT 200 Acoustics, Production & Perception of Speech

Satrajit Ghosh, Sunil Puria, Heidi Nakajima

4 units. Instructor consent required

T/W/TH

W, 11:00am – 12:00pm (recitations), **T/TH**, 3:00pm – 4:30pm (lectures)

Meeting Dates: September 7 – December 14

Meeting Location: MIT 46-5056

Due to current access restrictions, students should enroll in the MIT version of the course, HST .714

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.714 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, ssghosh@fas.harvard.edu, Sunil Puria, sunil_puria@meei.harvard.edu, Heidi Nakajima, 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 - 10:30am

Meeting Dates: September 1 – December 13

Meeting Location: Massachusetts Eye and Ear, 4th floor Library

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, Stéphane Maison, 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: September 7 – December 12

Meeting Location: Tosteson Medical Education Ctr. (TMEC) 446

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, Philip Kranzusch, philip_kranzusch@dfci.harvard.edu

VIROLOGY 202 Proposal Writing

Todd Allen, Smita Gopinath, Sizun Jiang, Max Nibert, Silvi Rouskin

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

T, 2:00pm – 4:00pm

Meeting Dates and Times: September 6 – November 1

Meeting Locations: Tosteson Medical Education Ctr. (TMEC) – rooms vary by date

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: Todd Allen, tallen2@partners.org

Additional Instructors: Smita Gopinath, Sizun Jiang, Max Nibert, Silvi Rouskin

