Fall 2024
Half Courses

Referred to as "Full Term" in the Academic Calendar

ENROLLMENT DEADLINES

Check-In Opens	**August 13**
Incoming Student Reg. Opens	**August 19**
Returning Student Add/Drop	**August 19**
Check-In Closes	**September 3**
Registration Deadline (incoming & returning students)	**September 3**
Last Day to Add/Drop w/out fee	**September 23**
Full Term	**September 3 – December 4**

ACADEMIC CALENDAR

https://registrar.fas.harvard.edu/calendars#upcoming

REMINDERS

You **cannot register** for courses until all the holds have been lifted from your account. Information about registration holds and how to remove them can be found here: https://registrar.fas.harvard.edu/enrollment#holds.

Incoming Students: meet with your advisor or speak with your Program Admin regarding your course load so that advisors can lift the "Advising Hold" from your cart.

Check-In opens August 19 and closes September 3.
FAS Registrar Info: https://registrar.fas.harvard.edu/check-in
GSAS Info: https://gsas.harvard.edu/policy/check-and-registration-resident-students

Register for **16 credits is required** for full-time student status and health insurance eligibility **by the beginning of the term, Sept. 3.** Register by going to **https://my.harvard.edu/**

For questions, contact: **dms_courses@hms.harvard.edu**

BBS 230 Qualitative and Quantitative Analysis of the Biological Literature
Davie Van Vactor

BCMP 200 Principles of Molecular Biology
Joseph Loparo

BCMP 218 Molecular Medicine
Srinivas Viswanathan, Sagar Koduri

BCMP 228 Macromolecular NMR
Haribabu Arthanari

BCMP 230 Principles & Practice of Drug Development
Stan Neil Finkelstein, Peter Sorger

BMIF 201 Concepts in Genome Analysis
Shamil Sunyaev, Michael Baym, Heng Li, Cheng-Zhong Zhang

BMIF 202 Artificial Intelligence in Medicine I
Arjun Manrai, Isaac Kohane, Chirag Patel

GENETIC 201 Principles of Genetics
Fred Winston, Maxwell Heiman, Thomas Bernhardt, Jenna Galloway, Matthew Warman

HBTM 201 Tumor Microenvironment and Immuno-Oncology: A Systems Biology Approach
Rakesh Jain, Lance Munn

HBTM 235 Principles of Human Disease: Physiology & Pathology
Connie Cepko

IMMUN 201 Advanced Topics in Immunology
Thorsten Mempel, Dan Dwyer

IMMUN 301 Immunology Seminar
Shiv Pillai, Peter Sage

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, 8/26 through 9/10

MICROBI 202 Mechanisms of Bacterial Pathogenesis & Host Immune Response
Marcia Goldberg, Amy Barczak, Sophie Helaine, Jacob Lemieux, Michael Starnbach, Alex Kostic, Lauren Essler

NEUROBIO 215A The Discipline of Neuroscience
Rick Born

SHBT 201 From Sound to Neuron
Sunil Puria

VIROLOGY 200 Introduction to Virology
Jonathan Abraham, Philip Kranzusch

VIROLOGY 202 Proposal Writing
Silvi Rouskin

Biological & Biomedical Sciences

BBS 230 Qualitative and Quantitative Analysis of the Biological Literature

David Van Vactor

4 units. Enrollment limited 70. Instructor consent required.

T/TH, 3:00pm - 5:00pm
Meeting Dates: September 3 – December 15
Meeting Locations: TBD - Instructor to provide location

BBS 230 is a research skills core course required for all BBS first-year graduate students that is designed to build (a) familiarity with the scientific peer review process, (b) a deeper understanding of rigorous experimental design, data presentation, data analysis and data interpretation, and (c) increasing competency in applying effective experimental design principles to future project planning. Our training in literature analysis is comprised of two related components: (1) eight weekly seminar-style, small group paper discussions with pairs of Harvard faculty instructors that will focus on understanding, dissecting, and evaluating a dozen seminal research papers; and (2) parallel weekly sections led by teaching fellows that focus on the process of peer review and revision of two different scientific manuscripts. Multiple workshops on literature management, peer review, study design and data visualization will also help you explore practical approaches to organizing background information, experimental details and data for optimal use or impact.

Course Notes: BBS 230 is open for enrollment only to BBS and BIG students. This course is required for first-year BBS students.

Course Heads: David Van Vactor, davie_vanvactor@hms.harvard.edu
Additional Instructors: Cristina Aguayo-Mazzucato, Ryoji Amamoto, Roby Bhattacharyya, John Seán Clohessy, Steve Elledge, Alejandro Gutierrez, Maria Gutierrez-Arcelus, Tim Hla, Nada Kalaany, Naama Kanarek, William L. Hwang, Julie-Aurore Losman, Margie Oettinger, Nilay Sethi, Richard Sherwood, Marcos Simoes-Costa, Yuyu Song, Alex Soukas, Marc Wein, Xu Zhou, Hans Widlund, Sarah Hill, Srivatsan Raghavan, Jacob Lemieux

Biological Chemistry & Molecular Pharmacology

BCMP 200 Principles of Molecular Biology

Joseph Loparo

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

M/W/F, 11:00am – 12:00pm
Meeting Dates: September 4 – December 4
Meeting Location: TBD - Instructor to provide location

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 Note: This course includes a discussion component. Any additional details about this component will be provided by the course faculty

Course Head: Joseph Loparo, joseph_loparo@hms.harvard.edu
Other Instructors: Dr. Johannes Walter (Johannes_Walter@hms.harvard.edu) , Dr. Karen Adelman (karen_adelman@hms.harvard.edu), Dr. Stirling Churchman (churchman@genetics.med.harvard.edu), Dr. Frank Slack (fslack@bidmc.harvard.edu), Dr. Alan Brown (alan_brown@hms.harvard.edu)

BCMP 218 Molecular Medicine

Srinivas Viswanathan, Sagar Koduri

4 units. Enrollment limited to 25. Instructor consent required

T, 1:00pm - 3:00pm
Meeting Dates: September 3 – December 4
Meeting Location: TBD - Instructor to provide location

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

Course Head: Srinivas Viswanathan, Srinivas.viswanathan@dfci.harvard.edu, Sagar Koduri, vkoduri1@partners.org

BCMP 228 Fundamentals and Applications of NMR Spectroscopy in Mechanistic Biology

Haribabu Arthanari

4 units

T/TH, 2:00pm – 3:30pm
Meeting Dates: September 5 – December 5
Meeting Locations: Folin Wu Room, C-137

This is a comprehensive course that provides a thorough understanding of macromolecular solution NMR, focusing on essential principles and fundamentals. Participants will delve into the intricacies of spin physics, product operator formalism, and spin relaxation theory, equipping them with the knowledge to effectively manipulate nuclear spins and unveil atomistic details of biomolecules. Practical elements of the course include hands-on experience in implementing NMR experiments, pulse sequence programming, sample preparation techniques including isotope labeling strategies, and strategies in data processing. Structured to optimize learning, the course will feature a blend of introductory NMR sessions followed by alternating theory discussions and interactive workshop sessions, ensuring a holistic grasp of the subject matter. The course will also touch upon the use of NMR in drug discovery.

Course Notes: Offered in alternate years.

Course Head: Haribabu Arthanari
Additional Instructors: Gerhard Wagner, Jim Sun, Abhinav Dubey

BCMP 230 Principles & Practice of Drug Development

Stan Neil Finkelstein, Peter Sorger

4 units

W, 3:00pm - 6:00pm
Meeting Dates: September 4 – December 4
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)

Biomedical Informatics

BMIF 201 Concepts in Genome Analysis

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

4 units

M/W, 2:30pm - 4:00pm
Meeting Dates: September 4 – December 4
Meeting Location: TBD - Instructor to provide location

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 Note: This course includes a discussion component. Any additional details about this component will be provided by the course faculty.

Course Head: Shamil Sunyaev, ssunyaev@hms.harvard.edu
Other Instructors: Michael Baym, Heng Li, Cheng-Zhong Zhang

BMIF 202 Artificial Intelligence in Medicine I

Arjun Manrai, Isaac Kohane, Chirag Patel

4 units. Instructor consent required.

W, 2:00pm – 5:00pm
Meeting Dates: September 3 – December 4
Meeting Location: TBD - Instructor to provide location

AI in Medicine I is a graduate-level seminar course at Harvard Medical School that explores the rapidly-growing applications of artificial intelligence in medicine. The goal of this course is to equip students with the skills to appraise both the clinical relevance and methodological novelty of scholarship at the intersection of artificial intelligence and medicine. This discussion-oriented course promotes active engagement through student-led presentations of seminal

papers spanning multiple decades, from early efforts to apply decision analysis and rule-based systems to the powerful deep learning and generative AI models being deployed in medicine today. Students will engage with faculty at HMS and the HMS-affiliated hospitals, editors at leading general medical and medical AI journals, and clinicians driving change at the point of care. Our aim is to bridge the gap between the technical aspects of artificial intelligence and its impact on medicine.

Course Note: Course registration restricted to AIM PhD students. Course enrollment requires instructor permission.

Course Head: Arjun Manrai, Arjun_Manrai@hms.harvard.edu
Other Instructors: Chirag Patel, Isaac Kohane

Genetics

GENETIC 201 Principles of Genetics

Fred Winston, Maxwell Heiman, Thomas Bernhardt, Jenna Galloway, Matthew Warman

4 units

M/W/F, 9:10am – 10:40am
Meeting Dates: September 4 – December 4 (Final Date December 12)
Meeting Location: TBD - Instructor to provide location

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, Matthew Warman

Human Biology & Translational Medicine

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

Rakesh Jain, Lance Munn

4 units

M, 5:00pm - 7:00pm
Meeting Dates: September 4 – December 11
Meeting Location: TBD - Instructor to provide location

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.525J/10.548J at the Massachusetts Institute of Technology.
Course Heads Rakesh Jain, jain@steele.mgh.harvard.edu, Lance Munn, lmunn@mgh.harvard.edu

HBTM 235 Principles of Human Disease: Physiology & Pathology

Connie Cepko, Jonathan Carlson

4 units

M/W/F, 9:00am – 10:30am
Breakdown (subject to change): M/F – lectures, W – tutorials
Meeting Dates: September 4 – December 4
Meeting Location:
Lectures: NRB 350
Tutorials: TBD - Instructor to provide location

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 applications of stem cells, 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 for undergraduates).

Course Head: Connie Cepko, cepko@genetics.med.harvard.edu, Jonathan Carlson, jccarlson@partners.org

Immunology

IMMUN 201 Advanced Topics in Immunology

Thorsten Mempel, Dan Dwyer

4 units. Enrollment limited to 40. Instructor consent required

T/Th, 2:00pm – 4:30pm EST
Meeting Dates: September 3 – December 3
Meeting Location: TBD - Instructor to provide location

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, Dan Dwyer, dfdwyer@bwh.harvard.edu
Other Instructors: TBD

IMMUN 301 Immunology Seminar

Shiv Pillai, Peter Sage

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

W.
Speaker Meet and Greet: 12:00pm - 1:00pm
Discussion Class: 2:00pm - 3:30pm
301 Seminars: 4:00pm – 5:15pm
Reception: 5:15pm – 6:15pm
Meeting Dates: September 4 – December 4

Meeting Location:
Meet and Greet/Discussion Class: TBD - Instructor to provide location
301 Seminars: TBD - Instructor to provide location

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, Peter Sage, peter_sage@hms.harvard.edu

CROSS REGISTRATION COURSE

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, 8/26 through 9/10

2 units

Meeting Dates: September 3 – December 3

Section 1: Online - Zoom
Tuesdays, 11:00am – 1:00pm
Meeting Link: Zoom link to be provided by course instructor

Section 2: In-person
Mondays, 1:00pm – 3:00pm
Meeting Location: Room location to be provided by course Instructor

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

Microbiology & Immunobiology

MICROBI 202 Mechanisms of Bacterial Pathogenesis & Host Immune Response

Marcia Goldberg, Amy Barczak, Sophie Helaine, Jacob Lemieux, Michael Starnbach, Alex Kostic, Lauren Essler

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

T/ Th, 9:30am – 11:30am
Meeting Dates: September 3 – December 4
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: Marcia Goldberg, Amy Barczak, Sophie Helaine, Jacob Lemieux, Michael Starnbach

Neurobiology

NEUROBIO 215A The Discipline of Neuroscience

Rick Born

4 units. Enrollment limited to 30. Instructor consent required.

T/Th, 9:00am – 12:00pm
Meeting Dates: September 3 – November 26
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 Head: Rick Born, richard_born@hms.harvard.edu
Other Instructors: Lisa Goodrich, Lisa_Goodrich@hms.harvard.edu; Gary Yellen, Gary_Yellen@hms.harvard.edu; Bruce Bean, Bruce_Bean@hms.harvard.edu; Tom Schwarz, Thomas.Schwarz@childrens.harvard.edu; Pascal Kaeser, Pascal_Kaeser@hms.harvard.edu; Wade Regehr, Wade_Regehr@hms.harvard.edu; Josh Kaplan,

Kaplan@molbio.mgh.harvard.edu; Beth Stevens, Beth.Stevens@childrens.harvard.edu; Tari Tan, Taralyn_Tan@hms.harvard.edu; Chinfei Chen, chinfei.chen@childrens.harvard.edu

Speech & Hearing Bioscience and Technology

SHBT 201 From Sound to Neuron

Sunil Puria

4 units

Lectures: T/ Th, 3:00pm – 5:00pm, Cambridge campus – TBD - Instructor to provide location
Recitation: M, 3:00pm – 5:00pm, Cambridge campus – TBD - Instructor to provide location
Meeting Dates: September 3 – December 4
(Note: if applicable, breakout rooms vary by date - instructor to provide details)

Acoustics, anatomy, normal biology, biophysics, physiology and morphology of the middle ear and inner ear, its sensory innervation and efferent control systems, and the mechanisms underlying sensorineural hearing loss and medical devices used to treat pathology. Material is presented through lectures, laboratory exercises, discussions of the primary literature, and textbooks.

Course Notes: Lecture notes will be available online.
Course Heads: Sunil Puria, sunil_puria@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 4 – December 9
Meeting Location: TBD - Instructor to provide location

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

Silvi Rouskin

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

T, 1:00pm – 3:00pm
Meeting Dates and Times: September 3 – October 31
Meeting Location: TBD - Instructor to provide location

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: Silvi Rouskin, silvi@hms.harvard.edu
Additional Instructors: TBD