ADVANCED COURSES

Chemical and Physical Biology (CPB) and Molecular and Cellular Biology (MCB) Concentrations

Below are 100-level MCB courses, as well as 100-level courses from other disciplines that have been determined to fulfill the advanced course requirement for CPB and MCB.

MCB concentrators must choose two upper-level courses, at least one of which must be a 100-level MCB course. The second (or third, or fourth, …) advanced course can be chosen from among any course listed in this document.

CPB concentrators must choose three upper-level courses in the natural sciences, engineering, and/or mathematics. **Any 100-level Chemistry, Molecular and Cellular Biology, Applied Math, Physics or SCRB course will meet this requirement, as will any course listed in this document.**

****NOTE: This document does not represent an exhaustive list of non-MCB courses.****

If you wish to count a course that is not on this list towards the advanced course requirement, please send a request to Marty and include the course description and syllabus of the course you wish to count.

Please scroll to the end of this document for important information regarding enrolling in courses offered through the Division of Medical Sciences.

MCB advanced courses:

Fall 2016

Catalog #	Course Title	Instructor
MCB 101	Human Genetics	Craig Hunter
MCB 112	Biological Data Analysis *(New Course!)*	Sean Eddy
MCB 115	Cellular Basis of Neuronal Function	Venkatesh Murthy
MCB 121	The Microbes	Karine Gibbs
MCB 129	[The Brain: Development, Plasticity and Decline] *(Likely to be offered in 2018 Fall)*	Sam Kunes
MCB 165	[Interplay between Viruses and their Hosts] *(Likely to be offered in 2017 Fall)*	Victoria D'Souza
MCB 169	Molecular and Cellular Immunology	Shiv Pillai
MCB 176	Biochemistry of Membranes	Guido Guidotti

Spring 2017

Catalog #	Course Title	Instructor
MCB 105	Systems Neuroscience	Florian Engert
MCB 111	Mathematics in Biology	Elena Rivas
MCB 120	Global Health Threats	Richard Losick, Barry Bloom
MCB 125	Molecular Basis of Behavior	Catherine Dulac
MCB 131	Computational Neuroscience	Haim Sompolinsky
MCB 145	Neurobiology of Perception and Decision Making	Naoshige Uchida

MCB 146	Experience-Based Brain Development: Causes and Consequences	Takao Hensch
MCB 148	The Neurobiology of Pain	Ryan Draft
MCB 170	Brain Invaders: Building and Breaking Barriers in the Nervous System	Laura Magnotti
MCB 178	Biochemistry of Protein Complexes	Guido Guidotti
MCB 186	Sleep and Circadian Clocks: from Biology to Public Health	Charles Czeisler
MCB 188	Chromosomes	Nancy Kleckner
MCB 195	Foundations of Systems Biology and Biological Engineering	Philippe Cluzel
MCB 198	Advanced Mathematical Techniques for Modern Biology	Sharad Ramanathan
MCB 199	[Statistical Thermodynamics and Quantitative Biology] *(Likely to be offered in 2018 Spring)*	David Nelson

Developmental and Organismal Biology advanced courses:

Fall 2016

Catalog #	**Course Title**	**Instructor**
HEB 1250	Genetics and Human Evolution	Amanda Lobell
HEB 1310	Hormones and Behavior	Carole Hooven
HEB 1321	Food, Drink and Energy	Noreen Tuross, Linda Reynard
HEB 1418	Research Methods in Endocrinology	Susan Lipson
HEB 1463	[Molecular Evolution of the Primates] *(Likely to be offered in 2018 Fall)*	Mary Ellen Ruvolo
HEB 1480	Human Evolution through Developmental Change	Terence Capellini, Neil Roach
HEB 1610	Genes and Human Adaptations	Maryellen Ruvolo
OEB 101	[Biology of Mammals]	
OEB 105	[Neurobiology of Motor Control]	
OEB 106	[Plant Development and Differentiation]	
OEB 115	The Developmental Basis for Evolutionary Change	Mansi Srivastava
OEB 119	[Deep Sea Biology]	
OEB 125	Molecular Ecology and Evolution	Scott Edwards
OEB 141	Biogeography	Gonzalo Giribet
OEB 145	Genes and Behavior	Yun Zhang
OEB 155R	Biology of Insects	Naomi Pierce, Michael Canfield
OEB 212R	Advanced Topics in Plant Physiology	Noel Holbrook
SCRB 130	Biomedical Entrepreneuring: Turning Ideas into Medicine	Derrick Rossi
SCRB 152	Asking Cells Who They Are: Computational Transcriptomics Using RNA-Seq	Douglas Melton
SCRB 160	[Experimental Embryology: From Stem Cells to Tissues and Back Again] *(Likely to be offered in 2016 Fall)*	Paola Arlotta
SCRB 175	Glucose: From Molecule to Society	Richard Lee
SCRB 180	[Regeneration and Repair in the Mammalian Brain] *(Likely to be offered in 2017 Fall)*	Jeffrey Macklis

SCRB 182	Got (New) Brain? The Evolution of Brain Regeneration	Paola Arlotta
SCRB 190	Understanding Aging: Degeneration, Regeneration, and the Scientific Search for the Fountain of Youth	Amy Wagers, Lee Rubin
SCRB 192	Principles of Drug Discovery and Development	Gregory Verdine

Spring 2017

Catalog #	**Course Title**	**Instructor**
HEB 1210	Research in Comparative Biomechanics: Seminar	Nicholas Holowka, Neil Roach
HEB 1410	Gut Microbiome and Human Health	Rachel Carmody
HEB 1420	Human Evolutionary Anatomy	Katherine Zink, Neil Roach
HEB 1451	[Primate Functional Genetics and Genomics] *(Likely to be offered in 2018 Spring)*	Terence Capellini
OEB 103	[Plant Systematics and Evolution] *(Likely to be offered in 2017 Spring)*	Charles Davis
OEB 123	[Biology of Symbiosis]	
OEB 126	Vertebrate Evolution	Stephanie Pierce
OEB 130	[Biology of Fishes]	
OEB 131	[Neuroethology]	
OEB 167	[Herpetology]	
OEB 173	[Comparative Biomechanics]	
OEB 190	[Biology and Diversity of Birds]	
OEB 191	[Physiological and Biochemical Adaptation]	
OEB 209	Oxygen and Life	Andrew Knoll
OEB 223	[Topics in Neurogenetics]	
OEB 230	Comparative Genomics	Jim Mallett
SCRB 110	Classic Experiments in Developmental Biology	Douglas Melton
SCRB 140	Developmental and Molecular Basis of Growth and Regeneration	Fernando Camargo
SCRB 145	From Cells to Tissues, in Sickness and in Health	Ya-chieh Hsu
SCRB 155	[Epigenetic Regulation in Development] *(Note: Likely to be offered in 2017 Spring)*	
SCRB 162	[Experimental Regenerative Biology] *(Likely to be offered in 2017 Spring)*	
SCRB 165	Directed Differentiation of Stem Cells	Chad Cowan
SCRB 167	Stem Cells and Regeneration in the Pathobiology and Treatment of Human Disease	George Daley, Leonard Zon
SCRB 178	Immunology: New Tracks and Greatest Hits	Jonathan Hoggatt
SCRB 187	[Brains, Identity, and Moral Agency]	

Chemistry, Physics, and Engineering advanced courses:

Fall 2016

Catalog #	Course Title	Instructor
BIOPHYS 170	Quantitative Genomics *(meets at MIT)*	Leonid Mirny, Shamil Sunyaev
BE 110	Physiological Systems Analysis	Kit Parker
BE 121	Cellular Engineering *(also offered as ENG-SCI 222)*	Neel Joshi
CHEMBIO 207	Molecular Approaches to Drug Action, Discovery, and Design	
CHEM 101	Chemical Biology Towards Precision Medicine	Stuart Schreiber
CHEM 105	Advanced Physical Organic Chemistry	Eric Jacobsen, Eugene Kwan
CHEM 110	Small Molecules and Biological Processes	Matthew Shair
CHEM 115	[Advanced Organic Chemistry: Synthesis of Complex Molecules] *(Likely to be offered in 2017 Fall)*	Andrew Myers
CHEM 145	Experimental Inorganic Chemistry	Austin Scharf, Matthew Shair
CHEM 154	[Advanced Inorganic Chemistry] *(Likely to be offered in 2017 Fall)*	Daniel Nocera
CHEM 155	Advanced Inorganic Chemistry II	Theodore Betley
CHEM 160	The Quantum World	Kang-Kuen Ni
CHEM 163	Frontiers in Biophysics	Xiaoliang Xie
CHEM 170	Chemical Biology	David Liu, Christina Woo
CHEM 171	[Biological Synthesis] *(Likely to be offered in 2017 Fall)*	Emily Balskus
CHEM 190	Statistical Mechanics in Chemistry and Biology	Eugene Shakhnovich
ENG-SCI 115	Mathematical Modeling *(also offered as APMTH 115)*	Zhiming Kuang
ENG-SCI 121	Introduction to Optimization: Models and Methods *(also offered as APMTH 121)*	David Parkes
ENG-SCI 125	Mechanical Systems	Katia Bertoldi
ENG-SCI 158	Feedback Control Systems: Analysis and Design	Na Li
ENG-SCI 173	Introduction to Electronic and Photonic Devices	Evelyn Hu
PHYSICS 123	Laboratory Electronics	Thomas Hayes, Bradley Hubbard-Nelson
PHYSICS 125	Physics for Future Presidential Advisors	John Doyle
PHYSICS 136	[Physics of Medical Imaging] *(Note: Likely to be offered in 2016 Fall)*	
PHYSICS 141	The Physics of Sensory Systems in Biology	Aravinthan Samuel
PHYSICS 143A	Quantum Mechanics I	John Townsend
PHYSICS 143B	Quantum Mechanics II	Girma Hailu
PHYSICS 145	Elementary Particle Physics	Gary Feldman
PHYSICS 151	Mechanics	Arthur Jaffe
SYSTBIO 200	Dynamic & Stochastic Processes in Cells	Jeremy Gunawardena, Johan Paulsson

SYSTBIO 204	Biomolecular Engineering and Synthetic Biology	Peng Yin, William Shih

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Catalog #	Course Title	Instructor
BIOPHYS 205	Computational and Functional Genomics	Martha Bulyk
BE 125	Tissue Engineering	David Mooney
BE 191	Introduction to Biomaterials	Jennifer Lewis
CHEM 106	Advanced Organic Chemistry	Eugene Kwan, Eric Jacobsen
CHEM 135	Experimental Synthetic Chemistry	Austin Scharf
CHEM 161	Statistical Thermodynamics	Xiaowei Zhuang
CHEM 165	Experimental Physical Chemistry	
ENG-SCI 111	Introduction to Scientific Computing *(also offered as APMTH 111)*	Thomas Fai
ENG-SCI 112	Thermodynamics by Case Study	Scot Martin
ENG-SCI 115	Mathematical Modeling *(also offered as APMTH 115)*	Lakshminarayanan Mahadevan, Sarah Iams
ENG-SCI 120	Introduction to the Mechanics of Solids	Joost Vlassak
ENG-SCI 123	Introduction to Fluid Mechanics and Transport Processes	Daniel Needleman
ENG-SCI 154	Electronic Devices and Circuits	Gu-Yeon Wei
ENG-SCI 155	Biological Signal Processing	Demba Ba
ENG-SCI 156	Signals and Systems	Vahid Tarokh
PHYSICS 123	Laboratory Electronics	Thomas Hayes
PHYSICS 129	Energy Science	Lene Hau
PHYSICS 140	Introduction to the Physics of Living Systems	Aravinthan Samuel
PHYSICS 143A	Quantum Mechanics I	Matthew Reece
PHYSICS 153	Electrodynamics	Girma Hailu
PHYSICS 175	Laser Physics and Modern Optical Physics	Markus Greiner
PHYSICS 181	[Statistical Mechanics and Thermodynamics]	
SYSTBIO 201	[Principles of Animal Development from a Systems Perspective] *(Likely to be offered in 2017 Spring)*	

<u>Quantitative and Computational advanced courses</u>:

Fall 2016

Catalog #	Course Title	Instructor
APCOMP 274	Computational Physics	Sauro Succi
APMTH 101	Statistical Inference for Scientists and Engineers	Robert Howe
APMTH 104	Series Expansions and Complex Analysis	Yasmine Meroz
APMTH 105	Ordinary and Partial Differential Equations	Margo Levine
APMTH 106	Applied Algebra	Madhu Sudan
APMTH 115	Mathematical Modeling *(also offered as ENG-SCI 115)*	Zhiming Kuang
APMTH 121	Introduction to Optimization: Models and Methods *(also offered as ENG-SCI 121)*	David Parkes
COMPSCI 50	Introduction to Computer Science I	David Malan

COMPSCI 61	Systems Programming and Machine Organization	Margo Seltzer, Eddie Kohler
COMPSCI 108	Intelligent Systems: Design and Ethical Challenges	Barbara Grosz
COMPSCI 109A	Data Science 1: Introduction to Data Science	Pavlos Protopapas, Kevin Rader, Weiwei Pan
COMPSCI 121	Introduction to the Theory of Computation	Harry Lewis
COMPSCI 125	Algorithms and Complexity	Jelani Nelson
COMPSCI 165	Data Systems	Stratos Idreos
COMPSCI 171	Visualization	Hanspeter Pfister
COMPSCI 182	Artificial Intelligence	Scott Kuindersma
MATH 101	Sets, Groups and Knots	Curtis McMullen
MATH 114	Analysis II: Measure, Integration and Banach Spaces	Fabian Haiden
MATH 116	Real Analysis, Convexity, and Optimization	Paul Bamberg
MATH 121	Linear Algebra and Applications	Brooke Ullery
MATH 122	Algebra I: Theory of Groups and Vector Spaces	Michael Hopkins
MATH 124	Number Theory	TBD
MATH 131	Topology I: Topological Spaces and the Fundamental Group	Joseph Harris
MATH 136	Differential Geometry	Cliff Taubes
MATH 141	[Introduction to Mathematical Logic] *(Likely to be offered in 2017 Fall)*	
MATH 142	[Descriptive Set Theory] *(Likely to be offered in 2017 Fall)*	
MATH 145A	Set Theory I	William Boney
MATH 152	Discrete Mathematics	Paul Bamberg
MATH 153	Mathematical Biology-Evolutionary Dynamics	Martin Nowak
STAT 110	Introduction to Probability	Joseph Blitzstein
STAT 120	Introduction to Bayesian Inference and Applications	Edoardo Airoldi
STAT 121A	Data Science 1: Introduction to Data Science *(also offered as CS 109a and AC 209a)*	Kevin Rader, Weiwei Pan
STAT 131	Time Series & Prediction	Pierre Jacob
STAT 139	Statistical Sleuthing Through Linear Models	Kevin Rader
STAT 140	Design of Experiments	Tirthankar Dasgupta, Donald Rubin
STAT 151	Multilevel and Longitudinal Models	Luke Miratrix

Spring 2017

Catalog #	**Course Title**	**Instructor**
APMTH 107	Graph Theory and Combinatorics	Salil Vadhan
APMTH 108	Nonlinear Dynamical Systems *(formerly APMTH 147)*	Sarah Iams
APMTH 111	Introduction to Scientific Computing *(also offered as ENG-SCI 111)*	Thomas Fai
APMTH 115	Mathematical Modeling *(also offered as ENG-SCI 115)*	Lakshminarayanan Mahadevan, Sarah Iams

APMTH 120	Applied Linear Algebra and Big Data	Eli Tziperman
COMPSCI 51	Introduction to Computer Science II	Stuart Shieber
COMPSCI 109B	Data Science 2: Advanced Topics in Data Science	Hanspeter Pfister, Mark Glickman, Verena Kaynig-Fittkau
COMPSCI 124	Data Structures and Algorithms	Michael Mitzenmacher
COMPSCI 181	Machine Learning	Alexander Rush, David Parkes
MATH 101	Sets, Groups and Topology	Dusty Grundmeier
MATH 110	Vector Space Methods for Differential Equations	Brendan McLellan
MATH 112	Introductory Real Analysis	Fabian Haiden
MATH 113	Analysis I: Complex Function Theory	Yum Tong Siu
MATH 115	Methods of Analysis	TBD
MATH 118R	Dynamical Systems	John Cain
MATH 123	Algebra II: Theory of Rings and Fields	Barry Mazur
MATH 129	Number Fields	Mark Kisin
MATH 130	Classical Geometry	Michael Hopkins
MATH 132	Topology II: Smooth Manifolds	George Melvin
MATH 137	Algebraic Geometry	Peter Kronheimer
MATH 144	[Model Theory] *(Likely to be offered in 2018 Spring)*	
MATH 154	Probability Theory	Cliff Taubes
MATH 155R	Combinatorics	Joseph Harris
MATH 157	Mathematics in the World	Joseph Harris
STAT 111	Introduction to Theoretical Statistics	Kevin Rader
STAT 115	Introduction to Computational Biology and Bioinformatics	Xiaole (Shirley) Liu
STAT 121B	Data Science 2: Advanced Topics in Data Science	Mark Glickman, Verena Kaynig-Fittkau, Hanspeter Pfister
STAT 139	Statistical Sleuthing Through Linear Models	Michael Parzen
STAT 149	Statistical Sleuthing through Generalized Linear Models	Mark Glickman
STAT 171	Introduction to Stochastic Processes	S. C. Samuel Kou
STAT 186	Statistical Methods for Evaluating Causal Effects	Donald Rubin

Courses in the Division of Medical Sciences at HMS:

Ordinarily, courses above the 200-level listed by the Division of Medical Sciences in the departments of Biological Chemistry and Molecular Pharmacology, Cell Biology, Genetics, Immunology, Microbiology, and Molecular Genetics, Neurobiology, Pathology and Virology count as advanced courses for CPB and MCB concentrators. Please note, however, that those courses are primarily intended for graduate students and it is therefore essential that you obtain permission to take the course from the instructor. You should also contact Marty Samuels to ensure that the course you wish to take will count for your concentration.

Fall 2016

Catalog #	Course Title	Instructor
BCMP 200	Principles of Molecular Biology	Joseph John Loparo, Melissa Leger-Abraham, Timur Yusufzai, Johannes Walter, Stirling Churchman, Dipanjan Chowdhury
BCMP 218	Molecular Medicine	Irving London, George Daley, Vijay Sankaran
BCMP 228	Macromolecular NMR	Gerhard Wagner, James Chou, Haribabu Arthanari
BCMP 230	Principles and Practice of Drug Development	Stan Finkelstein
CELLBIO 226	Concepts in Development, Self-Renewal, and Repair	Iain Drummond, Amar Sahay
GENETIC 201	Principles of Genetics	Fred Winston, Thomas Bernhardt, Maxwell Heiman, Mitzi Kuroda, Steven McCarroll, Jenna Galloway
IMMUN 201	Principles of Immunology	Thorsten Mempel, Michael Carroll, Ulrich von Andrian
MICROBI 205	Mechanisms of Microbial Pathogenesis	Clyde Crumpacker
MICROBI 214	Mechanisms of Bacterial Pathogenesis and Host Immune Response	Marcia Goldberg, Jonathan Kagan, Michael Starnbach, Darren Higgins
NEUROBIO 200	Neurobiology	John Assad, Matthew Frosch
NEUROBIO 220	Cellular Neurophysiology	Bruce Bean, Wade Regehr, Bernardo Sabatini, Gary Yellen
NEUROBIO 230	Visual Recognition: Computational and biophysical perspective	Gabriel Kreiman
VIROLOGY 200	Introduction to Virology	Max Nibert, David Knipe, Priscilla Yang, Elliott Kieff, Karl Munger
VIROLOGY 202	Proposal Writing	Benjamin Gewurz, Galit Alter, James DeCaprio, Frederick Wang
HBTM 235	Principles of Human Disease: Physiology and Pathology	Connie Cepko

Spring 2017

Catalog #	Course Title	Instructor
BCMP 213	Behavioral Pharmacology	Jack Bergman, Brian Kangas
BCMP 234	Cellular Metabolism and Human Disease	Thomas Michel
BCMP 236	Modern Drug Discovery: from principles to patients	TBD
CELLBIO 201	Principles of Cell Biology	

CELLBIO 207	Vertebrate Developmental and Regenerative Biology	Andrew Lassar, John Flanagan, Jordan Kreidberg, Sean Megason, Jessica Whited, Olivier Pourquie, Jayaraj Rajagopal, Yingzi Yang
CELLBIO 211	[Molecular and Systems Level Cancer Cell Biology] *(Likely to be offered in 2018 Spring)*	Peter Sicinski, Jarrod Marto
CELLBIO 212	Biology of the Cancer Cell: From Molecular Mechanisms to Therapeutic Implications	David Frank, Jean Zhao
CELLBIO 304qc	Introduction to Human Gross Anatomy	Gerald Greenhouse, Everett Anderson, Mohini Lutchman, Giorgio Giatsidis, David Cardozo
CELLBIO 308qc	Introduction to Histology for Graduate Students	Gerald Greenhouse, Everett Anderson, Stephen Liberles, Adrian Salic
GENETIC 202	[Human Genetics] *(Likely to be offered in 2018 Spring)*	Matthew Warman
GENETIC 216	Advanced Topics in Gene Expression	Robert Kingston, Fred Winston, Stephen Buratowski
GENETIC 228	Genetics in Medicine - From Bench to Bedside (note: meets at MGH)	TBD
IMMUN 202	Immune and Inflammatory Diseases	Filip Swirski, Mikael Pittet
IMMUN 204	Critical Readings for Immunology	Duane Wesemann
MICROBI 201	Molecular Biology of the Bacterial Cell	David Rudner, Thomas Bernhardt, Simon Dove, Ann Hochschild
MICROBI 210	Microbial Sciences: Chemistry, Ecology, and Evolution	Michael Gilmore
MICROBI 213	Social Issues in Biology	Jonathan Beckwith, Louis Guenin
NEUROBIO 204	Systems Neuroscience	TBD
NEUROBIO 211	Molecular and Developmental Neurobiology	Lisa Goodrich, Sandeep Datta, Michela Fagiolini, Chenghua Gu, Pascal Kaeser, Joshua Kaplan, Maria Lehtinen, Beth Stevens
VIROLOGY 201	Virology	TBD
HBTM 200	Principles and Practice of Human Pathology	Scott Lovitch