Biological Science Courses for MS/PhD in Bioengineering

- *Please note that not all courses will be offered every year/semester and it is up to the student to confirm they have the appropriate background/prerequisites for the course.
- *Please also note that there may be alternative courses that will meet the requirement, they should be 500-level or greater and should generally be taught outside of SEAS. You should review the available courses found on the Registrar's website:

http://www.upenn.edu/registrar/

- *Please note that not all courses will be offered every year/semester and it is up to the student to confirm they have the appropriate background/prerequisites for the course.
- *Please also note that there may be alternative courses that will meet the requirement, they should be 5000-level or greater and should generally be taught outside of SEAS.
- BE 5260 Immunology for Bioengineers
- BE 5270 Immune Engineering
- BE 5300 Theoretical and Computational Neuroscience
- BE 5400 Principles of Molecular and Cellular Bioengineering
- BE 5530 Principles, Methods, and Applications of Tissue Engineering
- BE 5550 Nanoscale Systems Biology
- BE 5560 Molecular Diagnostics for Precision
- BE 5580 Principles of Biol Fabrication
- BE 5610 Musculoskeletal Biology & Bioengineering
- BE 5630 Advanced Topics in Musculoskeletal Biology & Bioengineering
- BE 5650 Developmental Engineering of Tissues
- BE 5660 Network Neuroscience
- BE 5670 Modeling Biological Systems
- BE 5690 Systems Biology of Cell Signaling and Behavior
- BE 5760 The Cell as a Machine
- BE 5780 Principles of Controlled Release Systems
- BIOL 5010 Advanced Cell Biology
- BIOL 5062 Biological Foundations for Bioengineering and Biotechnology: Cellular and

Molecular Biology

- BIOL 5262 Omics Analysis: From Genomes to Organisms
- BIOL 5110 Neural Systems and Behavior
- **BIOL 5116 Neural Circuits for Survival**
- **BIOL 5210 Molecular Biology and Genetics**
- **BIOL 5220 Human Evolutionary Genomics**
- BIOL 5231 Genome Science and Genomic Medicine
- **BIOL 5234 Epigenetics**
- **BIOL 5240 Genetic Analysis**
- BIOL 5262 Biological Foundations for Bioengineering and Biotechnology: Genomics and Omics Technologies
- BIOL 5318 Systems Biology: Integrative physiology and biomechanics of the muscular system

BIOL 5820 Biological Foundations: Exploring Groundbreaking Research

BIOL 5825 Biochemistry and Molecular Genetics Superlab

BIOM 5010 Mechanisms of Disease and Therapeutics

BIOM 6000 Cell Biology

BIOM 5020 Mechanisms of Disease

BIOM 5100 Case Studies in Translational Research

BMB 5080 Molecular Biophysics I

BMB 5090 Macromolecular Biophysics II

BMB 5100 Data Analysis and Scientific Inference

BMB 5670 Bioinorganic Chemistry

BMB 5850/BBCB 5850 Wistar Institute Cancer Biology Course: Signaling Pathways in Cancer

BMB 5900 Biological Physics

BMB 6140 Membrane Structural Biology

BMB 6160 Medical Problems in Modern Biochemistry

BMB 6220 Physical Principles of Mechano-Enzymes

BMB 6240 Ion Channels and Pumps

BMB 6250 Optical Methods in Cell Physiology

BMB 6260 Mass Spectrometry and Proteomics

BMIN 5010 Introduction to Biomedical and Health Informatics

BSTA 5090 Introduction to Epidemiology

BSTA 5100 Introduction to Anatomy and Physiology

BSTA 7510 Statistical Methods for Neuroimaging

CAMB 5100 Immunology

CAMB 5110 Principles of Development

CAMB 5220 Human Evolutionary Genomics

CAMB 5260 Experimental Principles in Cell and Molecular Biology

CAMB 5320 Human Physiology

CAMB 5500 Genetic Principles

CAMB 5970 Neural Development, Regeneration and Repair

CAMB 6090 Vaccines and Immunization Therapy

CAMB 6100 Molecular Basis of Gene Therapy

CAMB 6330 Advanced Seminar in Gene Therapy

CAMB 6380 Advanced Seminar in Cell Death and Survival

CAMB 6970 Biology of Stem Cells

CAMB 7520 Genomicscis

CBE 5170 Principles of Genome Engineering

CIS 5350 Introduction to Bioinformatics (also offered as GCB 5350 and MTR 5350)

GCB 5270 Genetics for Computational Biology

IMUN 5060 Immune Mechanisms

IMUN 5080 Immune Responses

IMUN 6090 Vaccines and Immune Therapeutics

INSC 5750 Neurobiology of Learning and Memory

MEAM 5550 Nanoscale Systems Biology

MPHY 6030 Image- Based Anatomy

MPHY 6070 Radiation Biology MSE 5180 Structure and Function of Biological Materials NGG 5720 Neuroscience Core li NGG 5730 Neuroscience Core III NGG 5750 Neurobiology of Learning and Memory NGG 5870 Neurobiology of Disease NGG 5880 Topics in Translational Neuroscience NGG 5920 Cognitive Neuroscience of Memory NGG 5930 Structural Neurobiology NGG 5940 Theoretical and Computational Neuroscience NGG 5970 Neural Development, Regeneration and Repair NGG 5980 Advanced Systems Neuroscience NGG 6180 Recovery after Neural Injury NGG 6310 Cognitive Neuroscience Affect NGG 6320 Cognitive Neuroscience Vision PHRM 5310 Intro to Genome Science PHRM 5700 Principles of Cardiovascular Biology PHRM 6000 Medical Pharmacology PHRM 6230 Fundamentals of Pharmacology PSYC 5470 Foundations of Social, Cognitive, and Affective Neuroscience PSYC 5490 A Neuroscience Perspective of Artificial Intelligence REG 6210/CAMB 7070/MTR 6210 Cell and Gene Therapy **ANAT 5150** Human Anatomy: Musculoskeletal System BE 5300 Theoretical and Computational Neuroscience BE 5400 Biomolecular and Cellular Engineering BE 5550 Nanoscale Systems Biology BE 5740 Special Topics: Applied Neurophysiology. Principles of Controlled Release Systems BE 5780 **BIOL 5062** Biological Foundations for Bioengineering and Biotechnology: Cellular and Molecular Biology **BIOL 5210** Molecular Biology and Genetics **BIOL 526** Experimental Principles in Cell and Molecular Biology **BIOL 527** Genetics for Computational Biology Molecular Genetics of Development **BIOL 5250 BIOL 5262** Bioengineering and Biotechnology: Genomics and Omics Technologies **BIOL 540 Genetic Analysis BIOL 5318** Systems Biology: Integrative physiology and biomechanics of the muscular system **BIOM 501** Mechanisms of Disease and Therapeutics **BIOM 600** Cell Biology **BIOM 502** Mechanisms of Disease **BIOM 510** Case Studies in Translational Research BMB 508 Molecular Biophysics I BMB 509 Macromolecular Biophysics II

BMB 567	Bioinorganic Chemistry
BMB 585	Macromolecular Biophysics: Principles and Methods
BMB 590	Biological Physics
BMB 614	Membrane Structural Biology
BMB 616	Medical Problems in Modern Biochemistry
BMB 622	Physical Principles of Mechano-Enzymes
BMB 624	Ion Channels and Pumps
BMB 625	Optical Methods in Cell Physiology
BMB 626	Mass Spectrometry and Proteomics
BMIN 5030	Data Science for Biomedical Informatics
BSTA 509	Introduction to Epidemiology
BSTA 510	Introduction to Anatomy and Physiology
CAMB 511	Principles of Development
CAMB 526	Experimental Principles in Cell and Molecular Biology
CAMB 5300 (The Cell Cycle, Genome Integrity and Cancer)
CAMB 532	Human Physiology
CAMB 550	Genetic Principles
CAMB 597	Developmental Neuroscience
CAMB 609	Vaccines and Immunization Therapy
CAMB 610	Molecular Basis of Gene Therapy
CAMB 638	Advanced Seminar in Cell Death and Survival
CAMB 752	Genomics
CAMB 609	Vaccines and Immune Therapeutics
CAMB 692 – A	Advanced Topics in Cell Biology, Physiology, and Metabolism II:Cell Signaling and
Metabolism	
CBE 5170	Principles of Genome Engineering
CIS 535	Introduction to Bioinformatics
GCB 527	Genetics for Computational Biology
GCB 5350	Bioinformatics
IMUN 506	Immune Mechanisms
IMUN 508	Immune Responses
IMUN 609	Vaccines and Immune Therapeutics
INSC 575	Neurobiology of Learning and Memory
MEAM 555	Nanoscale Systems Biology
MPHY 5000	Introduction to Global Oncology
MPHY 6030	Image- Based Anatomy
MPHY 6070	Radiation Biology
NGG 572	Neuroscience Core li
NGG 573	Neuroscience Core III
NGG 575	Neurobiology of Learning and Memory
NGG 587	Neurobiology of Disease
NGG 592	Cognitive Neuroscience of Memory
NGG 593	Structural Neurobiology
NGG 594	Theoretical and Computational Neuroscience

NGG 598	Advanced Systems Neuroscience
NGG 618	Recovery after Neural Injury
NGG 631	Cognitive Neuroscience Affect
NGG 632	Cognitive Neuroscience Vision
PHRM 531	Intro to Genome Science
PHRM 570	Principles of Cardiovascular Biology
PHRM 600	Medical Pharmacology
PHRM 623	Fundamentals of Pharmacology
PSYC 5470	Foundations of Social, Cognitive, and Affective Neuroscience
PSYC 5490,	A Neuroscience Perspective of Artificial Intelligence: