Fall 2019 Graduate Courses

Note - *This is not a full comprehensive list – courses such as advanced journal clubs are not included.*
Always check your Department guidelines and with your department coordinator and thesis advisor.

Course #	*Course Title*	*Faculty Instructor*	*Credit Hrs*	*Semester*
ANAT 7710	**Neuroanatomy**	**DOUGLASS**	**1.5**	**First Half**
	Anatomy of the human nervous system (designed for graduate students). Cross listed with NEUSC 6060			
ANAT 7750	**Developmental Neurobiology**	**WILLIAMS**	**1.5**	**Second Half**
	Cellular and molecular biology of nervous system development. Cross listed with NEUSC 7750.			
ANAT 7770	**Neural Regulation Metabolism**	**CHAN**	**1.5**	**Full Semester**
	This course is intended to be a graduate level course that provides a detailed overview of the central mechanisms that regulate peripheral metabolism and feeding. Topics to be covered include neural circuits involved in the regulation of brain glucose sensing, hypothalamic control of energy balance, the hypothalamic melanocortin system, mesolimbic reward system as well as central connections with liver and adipose tissue and brain energetics. These topics will be discussed in the context of both normal functionality and in the pathophysiology of diseases such as obesity and diabetes.			
BIO C 7100	**Metabolism**	**RUTTER**	**1.0**	**Full Semester**
	Please contact Dr. Rutter for the registration number at rutter@biochem.utah.edu and information concerning the course.			
BIOEN 6002	**Molecular Biophysics**	**HLADY**	**3.0**	**Full Semester**
	This intermediate-level 3 credit-hour course is focused on the application of physical principles to: 1) develop quantitative understanding of biophysical processes in natural and engineered macromolecules, membranes, and tissues, 2) learn about modern biophysical methods capturing single molecule properties, and to 3) apply biophysical principles to the solution of biomedical engineering problems.			

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BIOEN 6081	**Biomedical Device Innovation I**	**BROADHEAD HITCHCOCK PETELENZ**	**4.0**	**Full Semester**
	First semester of a two semester graduate level project based learning class focused on medical device design and documentation within the regulatory framework of FDA QSR, business plan development, and business startup concepts. This course will bring together students in medicine and medical residency, traditional engineering students, business, and law students for a multidisciplinary experience in medical product innovation. The medical device ideas will be produced and refined through a summer clinical immersion course where students are exposed to clinical environments and identify unmet needs through interaction with the environment, clinicians, and patients. During the first semester (design input phase), students will design, prototype, and document a medical device using FDA requirements for design control. To accomplish this goal, all projects will utilize customer driven inputs to motivate the development of product specifications. Prototypes will then be developed based upon these specifications. To provide students with the training in device development, two weekly lab sessions will be held to focus on machine shop tools and prototyping. There will also be two lectures per week to introduce concepts including FDA QSR, design documentation, project management, software and hardware tools, and risk management. Outputs of this phase include design input documentation (project plan, design requirements, design specifications).			
BIOEN 6100	**Biomedical Technology for Applied Research**	**PHILLIPS**	**2.0**	**Full Semester**
	Research projects now often involve expertise and resources beyond individual laboratories. To introduce students to the wide variety of cutting-edge technologies and equipment available on campus for biomedical research, the survey course includes presentations by selected University Health Science Core Facility directors on the services their facilities offer, followed by hands-on interactive demonstrations of how the techniques are applied to achieve research goals. Students will have the opportunity to interact with the Core directors whom are experts in their respective fields and visit the respective core facilities. Students will be required to demonstrate an understanding of the technologies described in written and oral formats. This course alternates between lectures and demonstration laboratories at the SOM Core Facilities.			
BIOEN 6303	**Cell and Tissue Engineering I: Stem Cells in Tissue Engineering**	**DEANS**	**3.0**	**Full Semester**
	This course will teach strategies of tissue engineering. Initial emphasis will be placed on stem cell biology, tissue development and repair to develop a fundamental understanding of the relationships between cells and tissues. Once this is established, the emphasis will shift to exploiting this understanding to rationally design and manipulate cell and tissue properties to alter, restore, maintain, and improve cell and tissue functions. *Undergraduate majors requesting enrollment in this course need to have major status and should have completed AT LEAST TWO of the following courses: BIOL 2020: Cell Biology, BIOEN 4301: Biomaterials and CHEM 3510: Biochemistry OR BIOL 3510: Biochemistry, or their equivalents.			

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BIOEN 6304	**Introduction to Polymers and Biopolymers**	**YU**	**3.0**	**Full Semester**
	This class is designed to provide comprehensive review of synthetic tools for making natural and artificial bioploymers, and, at the same time, give students creative perspective in biopolymer design. This is achieved by reviewing the similarity and difference in chemistry, molecular structures, and high-order structures between synthetic polymers and naturally derived bioploymers.			
BIOEN 6440	**Neural Engineering**	**BUTSON**	**3.0**	**Full Semester**
	Neural Engineering is an interdisciplinary infield that overlaps with many other areas including neuroanatomy, neurophysiology/electrophysiology, electrochemistry, bioelectric field theory, biomedical instrumentation, circuit theory, computational neuroscience, medical devices, neurology, neurosurgery, clinical trials, biomaterials and cellular neuroscience. This course is designed around the central idea that neural engineering is the study of transferring electromagnetic energy into and out of the nervous system. The course is composed of didactic lectures, group discussions and critical reviews of literature. There are also periodic lab sessions with hands-on exercises using medical devices, neural recording systems and computational models.			
BIOEN 6480	**Biomechanics Research**	**TIMMINS**	**3.0**	**Full Semester**
	Discussion of faculty and graduate student research in biomechanical topics. Students present progress on their research projects. Discussions of research in progress; presentation of posters or conference presentations before national meetings; and an opportunity to receive feedback on new ideas or research directions. Some knowledge of or interest in biomechanics is recommended.			
BIOL 5030	**Basic Immunology**	**ROUND**	**3.0**	**Full Semester**
	Meets with PATH 7330. This is a survey course covering the basic principles in Immunology. Students should have some exposure to biochemistry, modern genetics, and cell biology. It meets the requirements for the Medical Technology (B.S.) and Medical Laboratory Science (M.S.) programs, and is designed for other interested undergraduate and graduate students. The final third of the course will feature clinical and experimental topics in Immunology with lectures provided by faculty directly involved in the particular area. Students are encouraged to complete BIOL 2010 prior to enrolling in this course. It is recommended that BIOL 2030, 3205, 3510 are completed prior to taking this course.			

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BIOL 5255	**Prokaryotic Genetics**	**HUGHES**	**3.0**	**Second Half**
	Section 2 belongs to this lecture. This course requires registration for the lab section. Students will automatically be registered for this section when registering for the lab section. In addition to the scheduled lectures, students are expected to spend 9 hrs/wk in JTB 340 (open lab, M-F 12:30PM-4 PM). A project-oriented lecture/laboratory on use of experimental and analytical tools of modern genetics using bacteria and their viruses. It is recommended that BIOL 2020 and BIOL 2030 be completed prior to taking this course.			
BIOL 5275	**Microbial Diversity, Genomics and Evolution**	**DALE**	**4.0**	**Full Semester**
	Prerequisites: "C-" or better in (BIOL 2010 AND BIOL 2030). Microbial Diversity, Genomics and Evolution (MDGE) examines the role of microorganisms and their complex interactions with other living organisms and the environment. The lecture course provides an integrated vision of genome biology and microbial physiology, diversity and ecology and serves as a primer for all students interested in genomics. The integrated laboratory class provides students with an opportunity to collect samples from the environment and examines microbial diversity using modern molecular biological methods and bioinformatic tools.			
BIOL 5475	**Mycology**	**DENTINGER**	**4.0**	**Full Semester**
	Prerequisites: "C-" or better in BIOL 2010. From mushrooms to molds, this course will provide an overview of the enormously diverse Kingdom Fungi, with an emphasis on their ecology and evolution. Through lectures and labs, this course will use a phylogenetic framework to introduce the major groups of fungi, demonstrate how to recognize and document them, and discuss their significance to the environment and human society. The lab will include a field excursion followed by molecular identification of collected samples using DNA sequencing and phylogenetic analysis.			
BIOL 5510	**Evolutionary Developmental Biology**	**SHAPIRO**	**3.0**	**Full Semester**
	Prerequisites: "C-" or better in BIOL 2030. Exploration of the molecular, developmental, and genetic mechanisms underlying evolutionary change, with an emphasis on current research literature in animal biology. Topics include the molecular basis of natural diversity in body plans, limbs, pigmentation, and other adaptive traits. It is recommended that BIOL 3230 is completed prior to taking this course.			

BIOL	**Advanced Statistical Modeling for Biologist**	**FEENER**	**3.0**	**Full**

6500				**Semester**
	This course is designed for life science graduate students with a perhaps rusty background in mathematics and statistics who wish to become real practitioners of the art of modern statistics. The course is based on the R programming language.			
BIOL 7406	**Core Seminar: Ecology and Evolution**	**BUSH**	**1.0**	**Second Half**
	Techniques of seminar presentation and data analysis, and communication of scientific information per se in area of ecology and evolution.			
BLCHM 6400	**Genetic Engineering**	**CARROLL VILLANUEVA**	**2.0**	**First Half**
	Non-program students should contact Bioscience program office at bioscience@genetics.utah.edu This course covers essential techniques used in genetic engineering. Assuming modest background in biology, the course introduces fundamental aspects of molecular biology including mechanisms for storage of information in DNA and transfer of this information to RNA and protein molecules. Manipulations of DNA molecules to rearrange or remodel genetic information ("cloning") are described from both theoretical and practical viewpoints. Topics covered include the use of restriction endonucleases, amplification of DNA sequences using the polymerase chain reaction (PCR), detection of DNA and RNA using hybridization (Southern and Northern blotting), properties of cloning vectors and their use in constructing genomic and cDNA libraries, DNA sequencing and sequence analysis, creating and detecting mutations in DNA and introducing these mutations into a genome, and expression and characterization of proteins.			
BLCHM 6410	**Protein & Nucleic Acid Biochemistry**	**SIGALA BASS**	**2.0**	**First Half**
	Non-program students should contact Bioscience program office at bioscience@genetics.utah.edu The Biochemistry course covers the structure and function of nucleic acids and proteins, as well as the thermodynamics and kinetics of their interactions with each other and with other biologically important molecules. It is expected that all students have taken an undergraduate course in Biochemistry, and you may find it useful to review chapters discussing the above-mentioned subjects in an undergraduate Biochemistry textbook. You will also need to have a basic working knowledge of kinetics and thermodynamics. (So, if you are not comfortable working with equilibrium constants, free energies, and rate constants, please review these topics in an undergraduate chemistry text.) There are no required texts for this class; readings from various texts will be made available to the class. Some professors may administer a pre-quiz at the start of their lectures to make sure you are adequately prepared for the material to be covered. To receive further details and updates, please contact bioscience@genetics.utah.edu. For more information please go to: http://www.bioscience.utah.edu/curriculum/corecourses.html Cross listed with MBIOL 6410			
BLCHM	**Biophysical Chemistry**	**KOEHNTOP**	**2.0**	**Second**

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6450				**Half**
	Topics covered include: Basics of thermodynamics and statistical mechanics, with applications in biochemistry; transport phenomena; enzyme kinetics and inhibition; kinetic isotope effects; principles and applications of absorbance, fluorescence, and CD spectroscopies. Cross listed with CHEM 7450			
BLCHM 6460	**Protein Chemistry**	**BANDARIAN**	**2.0**	**First Half**
	This course focuses on the mechanisms of chemical reactions involving peptides and proteins and methods for their study. Subject matter includes enzyme mechanisms, chemical modification of proteins and cofactor chemistry. Prerequisite: organic chemistry. Cross listed with CHEM 7460			
BMI 6102	**Human Systems Interactions**	**DEL FIOL** **GIBSON** **GUO** **WEIR**	**2.0**	**Full Semester**
	In this class, students will be exposed to socio-technical perspectives regarding human-computer interactions across various healthcare contexts. Cognitive models, theories, and methods pertinent to human-systems interactions frame the course. Specific cognitive and social psychology content will be covered, including introductions to perception, motivation, judgement and reasoning. The over-all perspective of dual process models will provide the theoretical foundation. Relevant research will be presented, ranging from design to implementation. Usability principles in human-computer interaction will be taught, concentrating on user-centered design and principles of user satisfaction.			
CHEM 6740	**Bioanalytical Chemistry**	**SHUMAKER-PARRY**	**2.0**	**Second Half**
	This course is intended to provide an overview of the methods of chemical analysis used to characterize biological samples. Topics will include a discussion of separations techniques, the spectroscopy of biological molecules, immunological and enzymatic assays, and surface analytical methods.			
CHEM 7040	**Statistical Thermodynamics**	**GRUENWALD**	**2.0**	**First Half**
	This course introduces the statistical machinery used to connect molecular behavior with thermodynamic principles. Covered topics are useful for chemists, physicists, biologists, and engineers.			

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CHEM 7100	**Principles of Inorganic Chemistry**	**ERNST**	**2.0**	**First Half**
	This course is intended for graduate students in Chemistry, Biology, Physics, and Engineering, and covers a broad overview of properties and trends of all of the element with emphasis on coordination compounds. Structure and bonding using symmetry, crystal field theory, valence bond and molecular orbital concepts are focused upon. The structure and bonding of boron hydrides are described.			
CHEM 7130	**Solid-State Chemistry**	**WHITTAKER-BROOKS**	**2.0**	**Second Half**
	This course is intended for graduate students in Chemistry, Physics, and Material Science & Engineering with a need to understand the fundamental aspects of solid-state materials and their properties. A broad overview covering the unique aspect of the synthesis, characterization, structure and properties with respect to solids are provided. Cross listed with CHEM 3130.			
CHEM 7200	**Contemporary Organic Synthesis I**	**RAINER**	**2.0**	**Second Half**
	This course surveys various modern methods for bond construction. Chemical factors that influence reactivity and selectivity are introduced. Examples of application in historical and modern-day syntheses are given.			
CHEM 7240	**Physical Organic Chemistry I**	**SIGMAN**	**2.0**	**First Half**
	Physical organic chemistry studies the approaches to deciphering the mechanisms of organic reactions and the principles that govern host-guest binding. The topics include stereochemistry, conformational analysis, thermochemistry, acidity, tools to decipher reaction mechanisms, rate laws, kinetic isotope effects, linear free energy relationships.			
CHEM 7250	**Physical Organic Chemistry II**	**LOOPER**	**2.0**	**First Half**
	Course examines organic reaction mechanisms involving all fundamental reaction types. Included will be complex mechanisms as combinations of fundamental steps, orbital symmetry controlled reactions (with Woodward-Hoffman, Fukul, and Zimmerman treatments), trajectory analysis and radical reactions.			

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CHEM 7730	**Fundamentals of Electrochemistry**	**WHITE**	**2.0**	**First Half**
	This course will provide an overview of the fundamental concepts of electrochemical science. The course is devoted to the basic principles underlying chemical reactions at the electrode/electrolyte interface. Section 2 belongs to this lecture. This course requires registration for a lab and/or discussion section. Students will be automatically registered for this lecture section when registering for the pertinent lab and/or discussion section.			
EAS 6040	**Spoken English Skills for Graduate Students**	**WASON**	**3.0**	**Full Semester**
	The goal of this course is to improve the comprehensibility of your spoken English pronunciation, idiomatic expressions, and developing the fluency necessary for effective interactions on campus and in the community. It will provide you with a set of skills that you can use during the semester as well as after the course is over. Cross-cultural communication, including cultural differences in educational setting will also be addressed on a limited basis, as these topics are further explored in the next course in this series.			
EAS 6150	**Introduction to Graduate Writing 1**	**CHRISTIENSEN**	**3.0**	**Full Semester**
	Focus on the development of the writing process for specific fields of study and research skills. This course has a heavy emphasis on writing in a U.S. University and the practices and assumptions made about research, citation, style and form.			
H GEN 7380	**Biochemical Genetics**	**LONGO PASQUALI**	**3.0**	**Full Semester**
	Prerequisite: College level biochemistry. This course will educate physicians and graduate students on the fundamentals of biochemical genetics. Includes inborn errors of metabolism and several common disorders, such as diabetes and hypertension, which have biochemical bases correctable by diet or other medical intervention. Provides overview of biochemical pathways, practical experience on how the biochemical pathways can be studied in vivo and in vitro, the molecular bases of common metabolic problems, the mechanism of inheritance including recurrence risk, and how to rationally treat metabolic blocks.			

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MATH 6770	**Mathematical Biology I: Modeling Cancer**	**KEENER**	**3.0**	**Full Semester**
	Cancer is the failure of regulation of cell replication in multicellular organisms. Understanding and treating cancer thus requires linking processes within individual cells with their environment, including non-cancerous cells, physical barriers, resources, and the immune system. It is through a sick, twisted version of evolution that the barriers inhibiting growth and spread are overcome. Treatment seeks to halt or reverse this process without causing undue damage to the host. This multiscale problem demands a wide array of mathematical models, and this course will use weekly case studies to examine a representative set of such models. Each week we will read and discuss an interesting paper, and work as a group to understand, challenge, and extend it. Each student will pick one topic for a bit of further investigation as a project.			
MBIOL 6410	**Protein & Nucleic Acid Biochemistry**	**SIGALA BASS**	**2.0**	**First Half**
	The Biochemistry course covers the structure and function of nucleic acids and proteins, as well as the thermodynamics and kinetics of their interactions with each other and with other biologically important molecules. It is expected that all students have taken an undergraduate course in Biochemistry, and you may find it useful to review chapters discussing the above-mentioned subjects in an undergraduate Biochemistry textbook. You will also need to have a basic working knowledge of kinetics and thermodynamics. (So, if you are not comfortable working with equilibrium constants, free energies, and rate constants, please review these topics in an undergraduate chemistry text.) There are no required texts for this class; readings from various texts will be made available to the class. Some professors may administer a pre-quiz at the start of their lectures to make sure you are adequately prepared for the material to be covered. To receive further details and updates, please contact bioscience@genetics.utah.edu. Information: http://www.bioscience.utah.edu/curriculum/corecourses.html Cross listed with BLCHM 6410			

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MBIOL 6420	**G3: Genetics, Genomes, and Gene Expression**	**LETSOU**	**3.0**	**Full Semester**
	Non-program students should contact Bioscience program office at bioscience@genetics.utah.edu This course covers transmission genetics, methods of genetic and genome analysis in model systems and humans, as well as transcriptional and post-transcriptional mechanisms of gene regulation. Lectures cover both classical achievements and recent advances in these fields, with readings based chiefly in the primary literature. Grades are based on exams and problem sets. A passing grade on an entrance exam covering basic concepts in Genetics serves as a prerequisite for registration in this class. Some of the Molecular Biology Program students have not had adequate preparation in Genetics (such as a comprehensive undergraduate course in Genetics), and have struggled in the graduate course. To prevent such problems, all students will be given a simple exam the week before the semester begins. This entrance exam will cover basic concepts in Genetics. You should have no problem with this entrance exam if you review the CD-Rom/Booklet entitled Interactive Genetics. This review should include all of the problems on the CD. If you have any questions, please contact bioscience@genetics.utah.edu **The entrance exam will be Thursday, August 16, 2018 at 9:00 a.m. in 210 ASB.**			
MBIOL 6480	**Cell Biology**	**HUGHES ROH-JOHNSON**	**1.5**	**Second Half**
	Non-program students should contact Bioscience program office at bioscience@genetics.utah.edu This course covers basic and advanced topics related to cell structure and function including cytoskeleton, membrane trafficking, protein targeting/modification and degradation, cell cycle regulation, and signal transduction.			
MBIOL 7570	**Scientific Integrity & Ethics of Science Research**	**TBD**	**1.0**	**Sept 12 – Nov 14**
	Non-program students should contact Bioscience program office at bioscience@genetics.utah.edu An examination of research integrity and other ethical issues involved in scientific research. Topics may include scientific fraud, conflicts of interest, plagiarism and authorship designation, and the role of science in formulating social policy. This course is designed for graduate students, post-docs and regular faculty in the sciences. Aug 31 – Nov 2. Cross listed with PHIL 7570			
MDCRC 6050	**Biostatistics for Basic Science**	**STODDARD**	**1 - 2.0**	**Full Semester**
	Applied statistical methods in basic science. Problems will be solved using the Stata statistical software. Topics include: descriptive statistics, significance testing, multiple comparison adjustment, data management using Stata, computer graphics, sample size determination, and analysis of clustered data (multiple observations in same animal). Animal and bench experiment datasets will be used in lectures and homework.			

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MDCRC 6270	**Methods in Comparative Effectiveness Research**	**BISKUPIAK**	**2.0**	**Full Semester**
	Prerequisite: MDCRC 6110 and 6210. This course will focus on randomized and observational designs used for comparative effectiveness research. Design and statistical analysis will be framed in terms of counterfactual outcomes and required assumptions for causal inference.			
MDCRC 6450	**Grant Writing**	**MURTAUGH**	**3.0**	**Full Semester**
	Prerequisites: MDCRC 6000, 6010, and 6430. This course covers the entire preparation of an NIH grant, including aims and hypotheses, significance and innovation and research plan, bio sketches, and supporting appendices. Students will write a grant using NIH format and critique classmates' grants using the NIH CRS review templates. Note: Students should ideally be in the process of writing a health-related research grant during the semester-long course.			
MDCRC 6521	**Computational and Mathematical Principles of Biomedical Informatics**	**CHAPMAN**	**1.0-5.0**	**Full Semester**
	Prerequisite A basic programming course, such as Coursera's Introduction to "Programming with Python" or CodeAcademy's Python Course Computation and mathematics form the core of modern biomedical informatics. This course will help students with basic programming and mathematical skills to develop computational and mathematical literacy relevant to biomedical informatics and other computationally oriented biomedical sciences. Mathematical principles will be taught by showing how they apply to computational problems centered on real biomedical data drawn from clinical and biological domains. Emphasis will be on programming and mathematical skills related to biomedical data science. Algorithmic details with be deferred to subsequent courses (e.g. BMI "Computational Methods" and "Data Science Foundations") Learning Objectives Upon completing this course students will be able to: • Use basic mathematical principles (e.g. set theory, first order logic, calculus, linear algebra, probability, and graph theory) to motivate and inform computational problems in biomedicine. • Follow software engineering principles such as version control, documentation, and testing while developing biomedical software • Develop biomedical software applications in the Python programming language • Develop pipelines for manipulating, analyzing, and visualizing biomedical data.			

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NEUSC 6040	**Cellular and Molecular Neuroscience**	**SHEPHERD**	**4.0**	**Full Semester**
	The bulk of this course will focus on the cellular mechanisms of signaling. The topics to be covered include basic neuronal/glial morphology and cell biology; neurostructural mapping and identification; basic neural development; cytoskeleton-structure and biochemistry; basic membrane biophysics; cable properties; ion channel biophysics and molecular biology; synaptic transmission; neurotransmitter gated ionotropic systems; and neurotransmitter gated metabotropic systems.			
NEUSC 6060	**Neuroanatomy**	**DOUGLASS**	**3.0**	**First Half**
	Anatomy of the human nervous system (designed for graduate students). Cross listed with ANAT 7710			
NEUSC 7750	**Developmental Neurobiology**	**WILLIAMS**	**1.5**	**Second Half**
	Cellular and molecular biology of nervous system development. Meets with ANAT 7750			
ONCSC 6700	**Cancer Genomics**	**GERTZ/VARLEY**	**2.0**	**Second Half**
	Prerequisite: This course is designed for graduate students that have completed their first year. Genomic assays have revolutionized our understanding of the molecular defects that occur in cancer genomes. This knowledge has shaped our understanding of how tumors arise, revealed extensive heterogeneity within and between patients' tumors, influenced our treatment strategies, and led to new insights about the basic biology of transcription regulation. This course will introduce students to genomic assays that can be used to study cancer. Emphasis will be placed on understanding the capabilities and limitations of different genomic methods and exploring how the techniques can be applied to address new questions. This is an advanced seminar course with a focus on primary literature, student presentations, and project-based learning.			
PATH 6900	**Techniques of Biochemical Analysis in Laboratory Medicine**	**DE BIASE**	**4.0**	**Full Semester**
	Current and future technologies used in research and diagnostic medicine are covered, including basic principles, instrumentation, and clinical applications. Topics include electrophoresis, flow cytometry, DNA technologies, chromatography, immunologic techniques.			

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PATH 7330	**Basic Immunology**	**ROUND**	**3.0**	**Full Semester**
	Meets with PATH 5030 & BIOL 5030. Basic Immunology, PATH 7330, is designed to survey major topics in immunology, and is appropriate for Ph.D. students needing a survey course in immunology.			
PH TX 7113	**Essentials of Pharmacology and Toxicology**	**TANDON**	**2.0**	**Full Semester**
	This goal of this course is to introduce graduate students to the basic principles of pharmacology and toxicology. The first half of the course will focus on the role of drug molecule structure, receptor physiology, ion channels, transporter functions, ligand binding kinetics, intracellular signaling and epigenetics in relation to biological effects of drugs. The second half of the course will introduce the basic principles of pharmacokinetics including physiochemical factors and individual variations that affect the absorption, distribution, metabolism and excretion of drugs. This course will also introduce the students to drug development principles including strategies used by pharmaceutical companies for drug screening, the role of regulatory agencies, designing of clinical trials and issues related to risk assessment during drug development including adverse drug reactions and the role of pharmacogenetics. Different professors from the pharmtox department will be delivering the lectures.			
PHCEU 7010	**Molecular Biology for Pharmaceutical Scientists**	**LIM**	**1.5**	**Second Half**
	This course will review fundamental aspects of genetic engineering and molecular biology.			
PHCEU 7021	**Formulations**	**CHEN**	**2.0**	**Second Half**
	Meets with PHCEU 5125. Design principles and compositions involved in pharmaceutical formulations for traditional dosage forms including tablets, capsules, suspensions, emulsions, creams, ointments, and also for more advanced delivery systems. This class meets with PHARM 5120-001 in HSEB 2680 for the second half session.			
PHCEU 7030	**Macromolecular Therapeutics and Drug Delivery**	**BAE**	**4.0**	**Full Semester**
	Prerequisite: Graduate student status or instructor consent and CHEM 7050. Introduction to polymer in Pharmaceutics and drug delivery. Transport phenomena in drug delivery systems. Macromolecular and vesicular carriers. Biorecognition and drug targeting. Protein, oligonucleotide, and gene delivery systems.			
PHCEU 7031	**Lipid-based Drug Delivery Systems**	**CROMMELIN HERRON**	**2.0**	**Misc**
	Introduction to lipid systems in Pharmaceutics and drug delivery. Emulsions, micellar and vesicular carriers. Biorecognition and drug targeting of small molecule, protein, and nucleic acid therapeutics.			