Master List for Spring 2019 Courses

BIOCHEMISTRY:
http://www.biochem.duke.edu

BIOCHEM 301 Introductory Biochemistry I - Introduction to Biochemistry I. Chemistry of the constituents of proteins, lipids, carbohydrates, and nucleic acids and their metabolic interrelationships. Prerequisite: two semesters of organic chemistry. *MWF 1:25 – 2:40 pm; LSRC B101, Coggins & Staff, 3 Units*

BIOCHEM 302 Introductory Biochemistry II - Introduction to Biochemistry II. This second semester of Biochemistry covers the synthesis, structure, and function of important biological molecules. Half of the course will cover carbon and nitrogen fixation and assimilation, and the synthesis of amino acids, nucleotides, DNA, RNA, and protein. The second half covers the structure, biosynthesis and function of important membrane lipids, membrane proteins and membrane-associated carbohydrates. *MWF 10:05 – 11:20 am 147 Nanaline Duke Bldg; Greenleaf & Staff; 3 Units*

First Half Semester:

BIOCHEM 667 Biochemical Genetics I: DNA and Genome Stability - Chromatin and chromosome structure, replication, repair, genetic recombination, mutation and chromosome rearrangement. *Minicourse, 1st half-semester. TuTh 10:05 - 11:20 am; Modrich; 148A Nanaline Duke Bldg; 2 Units*

Second Half Semester:

BIOCHEM 631 (CMB, NEURO, PHARM 631) Membrane Biology: Contemporary topics in membrane biology - This course will highlight modern topics regarding biological membranes and membrane proteins that are important for human physiology and disease. Topics include structure and dynamics of biological membranes, structure and function of membrane proteins that play critical roles in cell signaling, diseases related to dysfunction of membrane and membrane proteins, and current efforts on drug discovery. Major techniques used in membrane research will also be covered. The format will be a combination of lectures and discussion of primary literature. Students will be evaluated based on their class participation and performance at the final presentations. *Minicourse, 2nd half-semester. MWF 10:05 - 11:20 am; Lee; 247 Nanaline Duke Bldg; 2 Units*

BIOCHEM 668 (CELLBIO, UPGEN 268) RNA Biology - The major emphasis will be on reading and discussing primary research papers in depth. The course will explore new concepts in mechanisms of transcription, splicing, catalytic RNA, RNA modification, RNA editing, mRNA stability & translation. Each section of the course will consist of background lecture material and discussion of selected paradigm papers. Students will be asked to prepare presentations and discussions to demonstrate proficiency in the topics. *TuTh 10:05 - 11:20 am; Meyer; 247 Nanaline Duke Bldg; 3 Units*

BIOCHEM 695 Understanding NMR Spectroscopy – (Not offered Spring 2019) Course aimed at graduate students who have some familiarity with high-resolution NMR who wish to deepen their understanding of how NMR experiments actually 'work'. Introduces quantum mechanical tools needed to understand pulse sequences, with emphasis on obtaining good understanding of

how experiments actually work. Course also covers advanced biomolecular NMR experiments that enable structural and dynamic characterization of biomolecules. For roughly half of course, students will be expected to follow online lectures that accompany course textbook, with class meetings emphasizing concepts, group discussion, and problem solving. Instructor consent required. Instructor: Al-Hashimi Prerequisite: undergraduate physical chemistry, undergraduatae biochemistry and one year of calculus. This course will be offered every other spring, alternating with BIOCHEM 696. *TuTh 10:05 – 11:20 am; 252B Nanaline Duke Bldg.; Al-Hashimi and Staff, 4 Units*

BIOCHEM 696 Macromolecular crystallography - Theoretical and practical principles of macromolecular X-ray crystallography. Topics covered include crystal symmetry, space group theory and determination, diffraction theory, a practical understanding of crystallization, X-ray intensity data collection and data processing, phase determination, refinement and model validation. Consent required - contact course director for permission number. This course will be offered every other spring, alternating with BIOCHEM 695. *MW 11:45 am – 1:45 pm; 252B Nanaline Duke Bldg; Schumacher & Staff; 4 Units*

BIOCHEM 622 (SBB 622) Structure of Biological Macromolecules - How to get the most out of experimental and computational 3D structure: a) 3D Molecular Literacy: Computer and physical molecular models of proteins and nucleic acids; worksheets and hands-on exploration. b) Data bases and the data itself: gaining familiarity with the PDB (Protein Data Bank) in general, the EDS (Electron Density Server), and the peculiarities, caveats, and reliabilities of different categories of molecular data. c) Computational methods for studying and depicting macromolecules: Model building in structural biology, Molprobity and all-atom contact analysis, and methodologies for multiple conformations, ensembles, and mobility. d) Student Projects: interactive 3D illustration of some scientific point about macromolecules, using kinemages or other molecular graphics programs often with short non-interactive introduction. Reports given at end of semester, progress shown periodically. Once a week in-class presentations, discussion, and hands-on work with physical and computer molecular models. Homework includes worksheets and individual student projects. *Th 1:25 – 3:25 pm; 132 Nanaline Duke Bldg; Richardson; 3 Units*

BIOCHEM 746S - Biochemistry Seminar - required of all first-, second- and third-year biochemistry students. Credit / No Credit only. *W 4:40 - 5:40 pm; 439 Nanaline Duke Bldg.; Brennan & Staff; 1 Unit*

BIOCHEM 760 (CELLBIO, MOLCAN, PHARM 760) Cellular Signaling – See CELLBIO **760**

BIOLOGY:
https://biology.duke.edu/

BIO 723: Statistical Computing for Biologists
Statistical computing for the biological sciences with an emphasis on common multivariate statistical methods and techniques for exploratory data analysis. Goal of the course is to help graduate students in the biological sciences develop practical insights into methods they are likely to encounter in their research. Provides introductions to "R" statistical computing environment and Python programming language. W 3:05-5:35; French Science 4233; Magwene; 3 units

BIOSTATISTICS:
http://biostat.duke.edu

BIOSTAT 704: Introduction to Statistical Theory and Methods II:
This course provides formal introduction to the basic theory and methods of probability and statistics. It covers topics in statistical inference, including classical and Bayesian methods, and statistical models for discrete, continuous and categorical outcomes. Core concepts are mastered through mathematical exploration, simulations, and linkage with the applied concepts studied in BIOSTAT 705. Prerequisite(s): BIOSTAT 701 or its equivalent Corequisite(s): BIOSTAT 705, BIOSTAT 706 Credits: 3

BIOSTAT 705: Applied Biostatistical Methods II:
This course provides an introduction to general linear models and the concept of experimental designs. Topics include linear regression models, analysis of variance, mixed-effects models, generalized linear models (GLM) including binary, multinomial responses and log-linear models, basic models for survival analysis and regression models for censored survival data, and model assessment, validation and prediction. Core concepts are mastered through statistical methods application and analysis of practical research problems encountered by program faculty and demonstrated in practicum experiences in concert with BIOSTAT 706. Computational examples and exercises will use the SAS and R packages. Prerequisite(s): BIOSTAT 702 or its equivalent Corequisite(s): BIOSTAT 704, BIOSTAT 706, BIOSTAT 722 Credits: 3

BIOSTAT 706: Introduction to the Practice of Biostatistics II:
This course revisits the topics covered in BIOSTAT 703 in the context of high-throughput, high-dimensional studies such as genomics and transcriptomics. The course will be based on reading of both the textbook and research papers. Students will learn the biology and technology underlying the generation of "big data", and the computational and statistical challenges associated with the analysis of such data sets. As with BIOSTAT 703, there will be strong emphasis on the development of communication skills via written and oral presentations. Prerequisite(s): BIOSTAT 703 Corequisite(s): BIOSTAT 704, BIOSTAT 705 Credits: 3

BIOSTAT 709: Observational Studies:
Methods for causal inference, including confounding and selection bias in observational or quasiexperimental research designs, propensity score methodology, instrumental variables, and methods for non-compliance in randomized clinical trials. Prerequisite(s): BIOSTAT 701, 702, 704, 705, and 721 or 722 or their equivalents, or permission of the Director of Graduate Studies Credits: 2

BIOSTAT 710: Statistical Genetics and Genetic Epidemiology:
Topics from current and classical methods for assessing familiality and heritability, linkage analysis of Mendelian and complex traits, family-based and population-based association studies, genetic heterogeneity, epistasis, and gene-environmental interactions. Computational methods and applications in current research areas. The course will include a simple overview of genetic data, terminology, and essential population genetic results. Topics will include sampling designs in human genetics, gene frequency estimation, segregation analysis, linkage analysis, tests of

association, and detection of errors in genetic data. Prerequisite(s): BIOSTAT 701, 702, 704, 705, and 721 or 722 or their equivalents, or permission of the Director of Graduate Studies Credits: 2

BIOSTAT 714: Categorical Data Analysis:

Topics in categorical modeling and data analysis/contingency tables; measures of association and testing; logistic regression; log-linear models; computational methods including iterative proportional fitting; models for sparse data; Poisson regression; models for ordinal categorical data, and longitudinal analysis. Prerequisite(s): BIOSTAT 701, 702, 704, 705, and 721 or 722 or their equivalents, or permission of the Director of Graduate Studies Credits: 2 BIOSTAT 718: Analysis of Correlated and Longitudinal Data: Topics include linear and nonlinear mixed models; generalized estimating equations; subject specific versus population average interpretation; and hierarchical model. Prerequisite(s): BIOSTAT 701, 702, 704, 705, and 721 or 722 or their equivalents, or permission of the Director of Graduate Studies Credits: 2

BIOSTAT 718: Analysis of Correlated and Longitudinal Data:

Topics include linear and nonlinear mixed models; generalized estimating equations; subject specific versus population average interpretation; and hierarchical models. Prerequisite: Biostatistics 701, 702, 704 and 705 or permission of the Director of Graduate Studies. 2 units.

BIOSTAT 720: Master's Project:

Completed during a student's final year of study, the master's project is performed under the direction of a faculty mentor and is intended to demonstrate general mastery of biostatistical practice. Prerequisite(s): BIOSTAT 701 through BIOSTAT 706 Credits: 3 in Fall Semester and 3 in Spring Semester

BIOSTAT 722: Introduction to Statistical Programming II (SAS):

This class is an introduction to programming in SAS, targeted at statistics majors with minimal programming knowledge, which will give them the skills to grasp how statistical software works, tweak it to suit their needs, recombine existing pieces of code, and when needed create their own programs. Students will learn the core of ideas of programming (data step, procedures, macros, ODS, input and output, debugging, and logical design) through writing code to assist in numerical and graphical statistical analyses. Students will learn how to write maintainable code, and to test code for correctness. They will then learn how to set up stochastic simulations and how to work with and filter large data sets. Since code is also an important form of communication among scientists, students will learn how to comment and organize code to achieve reproducibility. Programming techniques and their application will be closely connected with the methods and examples presented in the co-requisite course. The primary programming package focus used in this course will be SAS. Prerequisite(s): None; familiarity with linear algebras is helpful Corequisite(s): BIOSTAT 705 Credits: 2

BIOSTAT 732: Independent Study:

Independent Study is a semester long course focused on mentored research in the practice of biostatistics. Students work with an assigned mentor. This course is only open to students by permission of the Director of Graduate Studies. Credits: 1, 2, or 3

Master List for Spring 2019 Courses

BIOSTAT 740: Continuation:

Continuation is a semester-based, noncredit bearing enrollment status used when a student is continuing scholarly activities with the same mentor. This course is only open to students by permission of the Director of Graduate Studies. Credits: 0

BIOSTAT 802: Biostatistics Career Preparation and Development II:

The purpose of this course is to further develop the student's job seeking ability and the practical aspects of job/internship search or interviewing for a PHD program. The goal is to learn these skills once and use them for a lifetime. Modules that will be covered include: Communication skills both written and oral, interviewing with videotaped practice and review, negotiating techniques, potential career choices in the Biostatistics marketplace, and working on a team. This semester includes writing and interviewing practicum, and a panel of relevant industry speakers. Students will leave this course with the knowledge to manage their careers now and in the future. Prerequisite: BIOSTAT 801 Credit: 1

BIOSTAT 822: R for Data Science:

This course will build on the foundation laid in software tools for data science. The course will explore the flow of a typical data science project from importing, cleaning, transforming and visualizing datasets to modeling and communicating results, within the context of R programming. While the course will include best practices, syntax and idioms specific to R, the focus will be on the process of conducting analysis in a reproducible fashion, writing readable, well-documented code and creating a coherent presentation of results. Prerequisite: Permission of the Director of Graduate Studies Credits: 2

BIOSTAT 824: Case Studies in Biomedical Data Science:

This course will highlight how biomedical data science blends the field of biostatistics with the field of computer science through the introduction of 3 to 5 case studies. Students will be introduced to analytic programs typically encountered in biomedical data science and will implement the data science and statistical skills introduced in their previous course work. Prerequisite(s): BIOSTAT 707, 821, 822, and 823 or permission of the Director of Graduate Studies Credits: 2

BIOSTAT 900: Current Problems in Biostatistics:

Advanced seminar on topics at the research frontiers in biostatistics. Readings of current biostatistical research and presentations by faculty and advanced students of current research in their area of specialization. Instructor: Barnhart. 1 unit.

BIOSTAT 901: Modern Inferential Techniques and Theory:

Stochastic processes, random walks, Markov chains, martingales, counting processes, weak convergence and basic empirical process theory and applications. Hilbert spaces for random vectors, semiparametric models, geometry of efficient score functions and efficient influence functions, construction of semiparametric efficient estimators. Applications include the restricted moment model and the proportional hazards model. The theory for M- and Z- estimators. Methods for dealing with missing data including imputation, inverse probability weighting (IPW) and the likelihood method, doubly robust IPW estimators. Prerequisite: Permission of the Director of Graduate Studies Credits: 3

BIOSTAT 903: Advanced Survival Analysis:

Designed for PhD students in Biostatistics or DSS departments who may be interested in conducting methodological research in the area of Survival Data Analysis. Applications of counting process and martingale theory to right censored survival data. Applications of empirical process theory to more general and possibly more complex statistical models using nonparametric analysis of interval-censored data as illustrating examples. After completion, students are anticipated to understand the statistical method papers on survival analysis appearing in top tier statistical journals. Prerequisites: BIOSTAT 701, 704, and 713, or equivalent, or consent of instructor. Instructor: Wu. 3 units.

BIOSTAT 905: Linear Models and Inference:

Introduction to linear models and linear inference from the coordinate-free viewpoint. Topics: identifiability and estimability, key properties of and results for finite-dimensional vector spaces, linear transformations, self-adjoint transformations, spectral theorem, properties and geometry of orthogonal projectors, Cochran's theorem, estimation and inference for normal models, distributional properties of quadratic forms, minimum variance linear unbiased estimation, Gauss-Markov theorem and estimation, calculus of differentials, analysis of variance and covariance. Prerequisite: Biostatistics 906. Instructor: Owzar. 3 units.

BIOSTAT 908: Independent Study (Rotations):

Faculty directed statistical methodology research. Instructor consent required. Instructor: Barnhart. 1 unit.

BIOSTAT 909: Internship Course:

Student gains practical experience by taking an internship in industry/government and writes a report about this experience. Requires prior consent from the student's advisor and from the Director of Graduate Studies. May be repeated with consent of the advisor and the Director of Graduate Studies. Credit/no credit grading only. Instructor: Barnhart. 1 unit.

CELL & MOLECULAR BIOLOGY:

http://cmb.duke.edu/home.html

CMB 640: Quantitative Approaches to Biological Problems: From Cartoon Models to System Behavior

This class is aimed at biologists who want to gain an appreciation of how mathematical approaches can supplement experimental approaches. We will teach you how to convert cartoon diagrams to differential equations, and re-familiarize you with some basic concepts from math and physics that help us develop a better intuition of how the world works. Then we will discuss how quantitative approaches can yield insights into how control systems behave. The class will use calculus at an elementary level and an occasional computer simulation, but we will focus more on concepts and applications. *T/Th, 2-3:30 pm, Nanaline Duke Room 437; Daniel Lew and Stefano Di Talia; 3 units.*

CMB 733-01, 733-02, 733-03 (BME, PHARM, NEUROBIO, MOLCAN 733-01, 733-02, 733-03) Experimental Design and Biostatistics for Basic Biomedical Scientists - See PHARM 733-01, 733-02, 733-03

Master List for Spring 2019 Courses

CMB 764 Cell and Molecular Biology Colloquium [Student Seminar] - Required of all CMB students. Presentations by upper-year students: one student talks about ongoing dissertation research and another introduces a research paper relevant to that week's seminar. Students attend the Thursday seminar (Cell Structure and Function) and can have lunch with the speaker. Mondays *11:55 am – 12:55 pm, 143 Jones Building; Eroglu; 2 Units*

CELL BIOLOGY:
http://note.cellbio.duke.edu/Graduate/Courses.html

CBI 503 Introduction to Physiology Modern organ physiology; cellular physiology, organ system physiology including cardiovascular, respiratory, renal, gastrointestinal, endocrine, reproductive, muscle and nervous. Prerequisite: elementary biology. *MWF 8:45–9:35 am, Jakoi, Bryan Research Building Room 103, 3 units. Enrollment: max 100*

CBI/MCB 730 Stem Cell Biology Lecture/discussion format designed for first-year graduate students to learn the fundamentals of stem cell biology and to gain familiarity with current research in the field. Prerequisites: undergraduate level cell biology, molecular biology and genetics. *TuTh 10:05–11:20 am; Poss, Hogan; 384 Nanaline, 3 units*

CBI/MCB/BIOCHEM/PHARM 761 Cellular Signaling Module I: GPCR Signaling and Disease. This module will cover the basic mechanism of signal transduction through G protein coupled receptors (GPCR) and how they control a wide array of biological functions from vison to reproduction and are the largest targets of therapeutic interventions. How new concepts in our understanding of their signal transduction mechanisms is leading to the development of new and improved therapies for various disorder. *MWF 8:45-9:35am; Caron; 147 Nanaline, 1 unit*

CBI/MCB/BIOCHEM/PHARM 762 Cellular Signaling Module II: Intracellular Signaling and Disease. This module will cover how ion channels and intracellular nuclear receptors control cellular functions mediated through transcription or calcium signaling to regulate physiological processes in health and disease. *MWF 8:45-9:35am; McDonnell; 147 Nanaline, 1 unit*

CBI/MCB/BIOCHEM/PHARM 763 Cellular Signaling Module III: Growth Factor Pathway in Development and Disease. The focus of this module is on signaling pathways induced by extracellular factors that regulate growth, survival, and development, and their deregulation in disease including cancer. Among the pathways covered are those regulated by ligand-activated Receptor Tyrosine Kinases, Wnt/beta-catenin signaling, Notch signaling, and Hedgehog signaling. *MWF 8:45-9:35am; Pendergast; 147 Nanaline, 1 unit*

CBI 830 Developmental Biology Colloquium This course covers a broad range of problems in developmental biology based on prominent developmental biologists who are invited to speak at Duke University during that particular semester and participate in discussions with the class. *M 5:00-600 pm W 4:00–6:00 pm; Klingensmith/McClay, 3 units*

COMPUTATIONAL BIOLOGY & BIOINFORMATICS:

http://www.genome.duke.edu/CBB/

CBB 510S Computational Biology Seminar - A weekly series of seminars on topics in computational biology presented by invited speakers and Duke faculty. *M 11:30 am – 12:30 pm; 4233 French Science; Magwene; 1 Unit*

CBB 511 Journal Club/Student Seminar - A weekly series of discussions led by students that focus on current topics in computational biology. Topics of discussion may come from recent or seminar publications in computational biology or from research interests currently being pursued by students. *W 11:45am – 12:45pm2pm; Location TBA; Reddy, 1 Unit*

CBB 540 (STA 613) Statistical Methods for Computational Biology - Methods of statistical inference and stochastic modeling with application to functional genomics and computational molecular biology. Topics include: statistical theory underlying sequence analysis and database searching; Markov models; elements of Bayesian and likelihood inference;
multivariate high-dimensional regression models, applied linear regression analysis; discrete data models; multivariate data decomposition methods (PCA, clustering, multi-dimensional scaling); software tools for statistical computing. Prerequisites: multivariate calculus, linear algebra and Statistics 611. C-L: Statistics and Decision Sciences 613. F *8:45am – 12pm Location TBD; Schmidler, Ma; 3 Units*

CBB 561L (BME 561L) Genome Science Technology Lab (Not offered Spring 2019) Hands-on experience on using and developing advanced technology platforms for genomics and proteomics research. Experiments may include nucleic acid amplification and quantification, lab-on-chip, biomolecular separation and detection, DNA sequencing, SNP genotyping, microarrays, and synthetic biology techniques. Laboratory exercises and designing projects are combined with lectures and literature reviews. Prior knowledge in molecular biology and biochemistry is required. Instructor consent required. *TuTh 3:05pm-4:20pm Lcation: TBA; Instructor: Satterwhite; 3 units*

CBB 612 (Genome 612 PUBPOL 634) Responsible Genomics (Not offered Spring 2019 - This course will introduce students to issues that arise in doing, interpreting, or applying genomics research. It includes (1) introduction to ethical reasoning and examination of selected issues calling for such analysis, including potential for conflicts among roles that an individual is expected to fulfill; (2) skills needed in any subsequent career path that involves doing or interpreting bioinformatics or genomics research, including research or professional school; doing presentations, writing a policy memo, and working in a group; (3) understanding why there are special procedures for research involving human participants, and how to respect privacy and confidentiality of genetic information; (4) historical and political background on sources of health research funding, and (5) issues involving public–private research interactions such as intellectual property and conflict of interest. *TuTh 3:05pm – 4:20pm; Location TBD; Chandrasekharan: 3 Units*

CBB 662 (COMPSCI 662) Computational Systems Biology (Not offered Spring 2019) - Provides a systematic introduction to algorithmic and computational issues present in the analysis of biological systems. Emphasizes probabilistic approaches and machine learning methods. Explores modeling basic biological processes (e.g., transcription, splicing, localization and transport, translation, replication, cell cycle, protein complexes, evolution) from a systems biology perspective. Lectures and discussions of primary literature. Prerequisites: basic knowledge of algorithm design (**COMPSCI 330**) or equivalent, probability and statistics (**STA 611)** or equivalent, molecular biology (**BIO 201L, 202L**) or equivalent, and computer programming. Alternatively, consent of instructor. *TuTh 10:05 pm – 11:20 pm; Location TBD; Hartemink; 3 Units*

CBB 561 (COMPSCI 561) Computational Sequence Biology Introduction to algorithmic and computational issues in analysis of biological sequences: DNA, RNA, and protein. Emphasizes probabilistic approaches and machine learning methods, e.g. Hidden Markov models. Explores applications in genome sequence assembly, protein and DNA homology detection, gene and promoter finding, motif identification, models of regulatory regions, comparative genomics and phylogenetics, RNA structure prediction, post-transcriptional regulation. Prerequisites: basic knowledge algorithmic design (**COMPSCI 330**) or equivalent, probability and statistics (**STA 611**) or equivalent), molecular biology (**BIO 201L**) or equivalent. *MW 3:05pm-4:20pm: Location TBD; Gordan; 3 units*

CBB 622 Structure of Biological Macromolecules (Biochem 622) How to get the most out of experimental and computational 3D structure: a) 3D Molecular Literacy: Computer and physical molecular models of proteins and nucleic acids; worksheets and hands-on exploration. b) Data bases and the data itself: gaining familiarity with the PDB (Protein Data Bank) in general, the EDS (Electron Density Server), and the peculiarities, caveats, and reliabilities of different categories of molecular data. c) Computational methods for studying and depicting macromolecules: Model building in structural biology, Molprobity and all-atom contact analysis, and methodologies for multiple conformations, ensembles, and mobility. d) Student Projects: interactive 3D illustration of some scientific point about macromolecules, using kinemages or other molecular graphics programs often with short non-interactive introduction. Reports given at end of semester, progress shown periodically. Once a week in-class presentations, discussion, and hands-on work with physical and computer molecular models. Homework includes worksheets and individual student projects. *Th 1:25 – 3:25 pm; 132 Nanaline Duke Bldg; Richardson; 3 Units*

IMMUNOLOGY:
http://immunology.mc.duke.edu

IMMUNOL 736 Topics in Immunology - Focus on current immunology research, emphasizing emerging research areas and new directions in established areas. Students present recent papers in selected subjects. *Th 8:45 - 10:00 am; 001 MSRB I; He & Hammer; 1 Unit*

IMMUNOL 791B Research in Immunology – This course is the second of two for first year students enrolled in the Immunology Graduate Program designed to introduce bench work in immunology and to expose students to a variety of techniques to increase their proficiency. One to two research rotations will

be conducted in training faculty laboratories for periods of 10-12 weeks. Rotations should be approved by the DGS. The first course was IMMUNOL791A offered in the fall and is a prerequisite. Both courses must be taken in order for the four total credits and grades to post. *2 Units*

IMMUNOL 800 Comprehensive Immunology - An intensive course in the biology of the immune system and the structure and function of its major components. In sectioned lectures, we will have leading experts to discuss with you, in depth, the major challenges, major discoveries, as well as major conflictions in listed areas of immunology. Specifically, we will focus on the evolution of our understandings: what was the original question, how it was approached and what is still missing to complete the picture. These lectures were largely split into three sections: T cell biology, B cell biology, and immune regulation. There will be three individual take-home exams and your final grade will be compiled with results from all three exams. This is a required course for students specializing in immunology. Consent of instructor required for registration. Prerequisite: highly recommended, Immunol 544 or equivalent. Instructor: Li. Prerequisite: IMMUNOL 544 or equivalent course. *MWF 10:20 – 11:10 am; 321 Jones Bldg; Li; 3 Units*

MEDICAL PHYSICS
http://medicalphysics.duke.edu

MEDPHY 507. Radiation Biology - An introduction to radiation biology. This course will cover the biological effects of radiation, including mechanisms of DNA damage, and normal tissue injury. The principle context is with relevance to radiation therapy. *TuTh 11:45 am – 1:45 pm; 1036 Hock Plaza; Dewhirst, Palmer, Oldham; 1 Unit.*

MEDPHY 510 Radiation Protection - Course discusses the principles of radiation protection dealing with major forms of ionizing and non-ionizing radiation, the physics and chemistry of radiation biology, biological effects of ionizing and non-ionizing radiations (lasers, etc.) at cellular and tissue levels, radiation protection quantities and units, medical HP issues in clinical environments, radiation safety regulations, and basic problem solving in radiation safety. *TuTh 10:05– 11:20 am; 1032 Hock Plaza; Yoshizumi; 3 Units*

MEDPHY 520 Radiation Therapy Physics - This introductory course has a clinical orientation, and reviews the rationale, basic science, methods, instrumentation techniques and applications of radiation therapy to the treatment of a wide range of human diseases. Major radiation modalities are covered including low and high energy photon therapy, electron and proton therapy, and low and high-dose rate brachytherapy. The clinical process of treatment, methods of calculating dose to patient, and the role of the medical physicist in radiation oncology clinic, are covered in detail. *MoTuW 10:05 – 11:20 am; 1032 Hock Plaza; Oldham, Adamson; 3 Units*

MEDPHY 714 Clinical Dosimetry Measurements - This course covers advanced topics in clinical radiation dosimetry that is pertinent to both KV and MV energy range. Initially we will offer as 1 credit hour course in the spring of 2011, but plans to offer as 3-credit course in the future. Prerequisites: MP500, MP505. *W 1:35 – 2:40 pm; Radiation Safety Dep; Yoshizumi; 1 Unit*

Master List for Spring 2019 Courses

MEDPHY 715 Advanced Topics in Radiation Detection and Dosimetry - This series of lectures covers the topics in radiation detectors, measurements and signal processing. The basics of various types of radiation detectors used in nuclear, medical and health physics and their usage are discussed in detail. Prerequisites: MP500, MP505. *W 10:05 - 11:20 qm; 1036, Hock Plaza; Gunasingha; 1 Unit*

MEDPHY 718 Clinical Practicum and Shadowing (Medical Health Physics) - This practicum course provides hands-on experiences in various hospital health physics functions, in RAM lab oversight, in X-Ray room shielding and verification, and in license preparation experience under NRC/States oversight. The course includes shadowing a clinician, technologist, or physicist, while performing their routine clinical tasks. *Tu 1:25 – 4:25 pm; Radiation Safety Dep; Yoshizumi; 3 Units*

MEDPHY 723-01, 723-02, 723-03 Advanced Radiation Therapy Topics and Procedures - This course will cover advanced LDR and HDR brachytherapy, and other selected special procedures and special topics. Prerequisite: MP 520. *MW 3:05 – 4:20 pm; Duke South; Yin, Craciunescu, Chang, Wu; 1 Unit each*

MEDPHY 728 Clinical Practicum and Shadowing (Radiation Therapy) - The course gives hands on experience in practical aspects of medical physics as applied to radiation therapy. Special emphasis is given to the operation of various therapy units and dose measuring devices, techniques of measuring the characteristics of radiation beams, commissioning and quality assurance checks for radiation producing devices in the clinic. The course includes shadowing a clinician, technologist, or physicist, while performing their routine clinical tasks. *Th 5:00 - 8:00 pm; Z. Wang et al; South Hospital; 3 Units*

MEDPHY 732 Advanced Topics of Ionizing-based Imaging Modalities - This course covers advanced topics in ionizing-based imaging modalities such as X-ray and CT imaging, including linear system theory, image quality metrology, digital radiography and mammography. Instruction will consist of didactic lectures accompanied by hands-on laboratory exercises (practicum). *MW 8:30 – 9:45 am, 1032 Hock Plaza; Dobbins, Badea; 3 Units*

MEDPHY 745 Advanced Topics of Radionuclide Imaging and Therapeutic Applications - This course covers advanced topics in radionuclide-based imaging modalities such as PET and SPECT, including image acquisition, image reconstruction, detector and detection theory, radionuclides, etc. and therapeutic applications of radionuclides. Instruction will consist of didactic lectures accompanied by hands-on laboratory exercises (practicum). *MW 5 8:30– 9:45 am; Turkington, Tornai; 1032 Hock Plaza; 3 Units*

MEDPHY 743 Basic Concepts of Internal Radiation Dosimetry - This course covers the physical and anatomical/physiological foundations of internal radiation dosimetry. Topics covered include definition of dose, absorbed fractions, residence times and methods to determine them, the and the MIRD methodology. Strategies to convert small animal radiopharmaceutical biodistribution data to humans will also be covered. Prerequisites: MP500, MP505. *Tu 10:05 - 11:20 am; 1036 Hock Plaza; Reiman; 1 Unit*

MEDPHY 746 Radiopharmaceutical Chemistry. The course will cover radiochemistry and production of various radiopharmaceuticals. The course will be conducted with lecture but may include some practical demonstrations. Prerequisite: Medical Physics 500 and 505. *MW 1:25 - 2:40 pm; 162 Bryan Res; Vaidyanatha;. 1 unit.*

MEDPHY 751-2 Academic Development Skills for Medical Physicists - This seminar prepares students for academic and research work through a series of presentations on academic skills that include literature reading, scientific writing and presentation, maintaining scientific records, etc. *M 1:25 – 2:40 pm; 1032 Hock Plaza; Kapadia; 1 Unit*

MEDPHY 751-4 Frontiers of Biomedical Science - This seminar provides a series of presentations on cutting-edge / frontier research topics in the field of medical physics, focusing on the most state-of-the-art medical physics techniques and their clinical applications. Designed for second year Medical Physics students. *Tu 11:45 am – 1 pm; 1032 Hock Plaza; Tornai; 1 Unit*

MEDPHY 762 Data Science - This course provides an introduction to methods underlying many biomedical informatics applications including information retrieval, probability, and statistical inference, medical decision making, machine learning concepts, and algorithms with a focus on biomedical decision making and discovery. Emphasis will be placed on learning the language of biomedical informatics and the art of statistical investigation as applied in the clinical field. *MW 11:45 am -1 pm; 1032 Hock Plaza; Mazurowski; 3 Units*

MOLECULAR GENETICS & MICROBIOLOGY:
http://mgm.duke.edu/graduate/

MGM 520 FC-Mediated AB Fundations - Topics covered will include how the genetic and functional properties of the antibody Fc regions and their counterpart Fc-receptors can impact and be exploited to treat and prevent infections or cancer. The course will also cover design strategies to improve the Fc-mediated functions of monoclonal antibodies used for passive protection and treatment, as well as for vaccines to induce Fc-mediated antibody functions in active immuniczation strategies. The course is targeted for post-prelim students interested in state-of-the-art studies in immune respones to pathogens and malignancy.
Mondays, 3:20 - 4:10pm, TBD; Ferrari, Moody, Pollara; 1 unit

MGM 522 (UPGEN 522) Critical Readings in Genetics and Genomics – Classical and molecular genetic approaches to understanding eukaryotic cell function using unicellular organisms such as yeasts. Experimental approaches as well as illustrative studies of secretion, cell cycle, signal transduction, and cytoskeleton. Discussion of current literature and student presentations.
TuThu, 4:40 – 5:55 pm, TBD; Robertson; 3 units; (crosslisted with UPGEN 522)

MGM 732 (UPGEN 732) Human Genetics – Topics include genetic mechanisms of disease (rare and common genetic risk variants, multi-factorial inheritance, epigenetics, cytogenetics), as well as disease-specific examples including neurogenetics, cancer genetics, pharmacogenetics, complex diseases and gene therapy. Lectures plus weekly discussion of assigned papers from the research

literature. Prerequisites; University Program in Genetics 778 or equivalent, and graduate status or consent of instructor. *TuThu, 8:30 – 9:45 am, ,TBD; Marchuk and Ashley-Koch; 3 units graded credit; (cross listed with UPGEN 732) SPRING*

MGM 552 Virology - Molecular biology of mammalian viruses, with emphasis on mechanisms of replication, virus-host interactions, viral pathogenicity, and the relationship of virus infection to neoplasia. *MWF 3:20 – 4:10 pm; 0010 CARL Bldg; Cullen; 3 Units*

MGM 582 Microbial Pathogenesis - Modern molecular genetic approaches to understanding the pathogenic bacteria and fungi. Underlying mechanisms of pathogenesis and host- parasite relationships that contribute to the infectious disease process. *MWF 1:30 – 2:30 pm; 415 Jones; Tobin; 3 Units*

MGM 790s Topics in Molecular Genetics & Microbiology - This is a student seminar with two upper classmen students presenting each seminar. Refreshments are provided by first year students. *F 4:15 - 5:30 pm; 001 MSRB1; Tobin; 1 Unit*

MOLECULAR CANCER BIOLOGY:
http://pharmacology.mc.duke.edu/grad/mcb.html

MOLCAN 730 (CELLBIO) Stem Cell Course - See CELLBIO 730

MOLCAN 733-01, 733-02, 733-03 (BME, CMB, PHARM, NEUROBIO 733-01, 733-02, 733-03) Experimental Design and Biostatistics for Basic Biomedical Scientists – See PHARM 733-01, 733-02, 733-03

MOLCAN 761 (BIOCHEM, CELLBIO, PHARM 761) Cellular Signaling Module I: GPCR Signaling and Disease – See CELLBIO 761

MOLCAN 762 (BIOCHEM, CELLBIO, PHARM 762) Cellular Signaling Module II: Intracellular Signaling and Disease – See CELLBIO 761

MOLCAN 763 (BIOCHEM, CELLBIO, PHARM 763) Cellular Signaling Module III: Growth Factor Pathway in Development and Disease – See CELLBIO 761

MOLCAN 780 (PHARM 780) Graduate Student Seminar – See PHARM 780

MOLCAN 819 Cancer as a Disease - This course looks at cancer from the point of view of the patient, the doctor and the scientist. Faculty from around the medical center will discuss diagnosis, detection and prediction of cancer, the molecular basis of the disease, and new approaches to therapy. The object is to give students a deeper appreciation for the clinical aspects of cancer and how molecular biology can contribute to improved understanding and treatment of the disease. This course is mandatory for all MCB students, and would be suitable for second year students with a solid background in molecular biology. Permission is required to participate, class limit is 15. *M 1:25 – 2:40 pm; C335 LSRC; Alvarez and Mathey-Prevot; 2 Units*

NEUROBIOLOGY:
http://neurobiology.mc.duke.edu/graduate/curriculum.html

NEUROBIO 702 Basic Neurobiology – Medical neuroscience, clinical neuroanatomy, and biological psychiatry for first-year medical students. Also available to graduate students, who will be integrated into small-group teams of medical students. Instructional approach: team-based learning methods, with frequent readiness assessments, application exercises, neuroanatomy laboratories, patient-interviews, and clinical problem-solving sessions. Permission of instructor required. ***January 2-28, 2013, MTuWThF 8:45 am – 5:00 pm; TSCHE Learning Hall, Labs; White; 4 Units***

NEUROBIO 720 Concepts in Neuroscience II: Principles of Organization of Neuronal Systems
The principles of organization of neurons into functional circuits will be examined through a series of 5 distinct modules, listed below. All five modules required for first-year neurobiology students. Prerequisites: NBI 719. Consent of instructor required. ***MWF 9:00 am – 11:00am; 301 Bryan Research Bldg;Franks; 5 Units – 4 credits (course will begin February 4)***

NEUROBIO 720A- Neurobiology of Disease Course (NBI 762) ***James McNamara; MWF 9:00am-11:00am; 1/7/19 – 2/1/19; 301 Bryan Research Building; 1 unit, 2 credits***

NEUROBIO 720B – Circuits and Computation: Computational neuroscience seeks to describe brains and nervous systems as information processing units that have evolved to perform the complex computations needed to solve the difficult problem humans and animals face on a daily basis. In 1976, David Marr and Tomaso Poggio summarized the computational approach to neuroscience as consisting of three complimentary levels of analysis: the computational level, the algorithmic level, and the physical level. The computational level is concerned with identifying a specific problem that an animal is trying to solve. The algorithmic level is concerned with generating an understanding of how the animal represents the problem and how the solution to that problem is generated. The physical level is concerned with the precise means by which neurons and neural circuits implement the solution in order to generate behavior. In this module, we will explore computational approach to neuroscience and introduce the information theoretic tools upon which it is based. Emphasis will be placed on models of neural encoding and decoding, signal detection theory, decision theory, and model neural circuits that perform evidence integration, object tracking, and binary choice. ***Jeff Beck/Greg Field; Feb. 4 – Feb. 22.***

NEUROBIO 720C- Sensory Processing: Representations and Computations: A major function of the nervous system is to generate perceptions based on input from sensory organs. This module will explore how populations of neurons represent sensory information and perform computations on those signals. This question will be considered at a variety of levels of the visual and auditory pathways, and will span domains of inquiry from circuits to cognition. ***Lindsey Glickfield/Jenni Groh; Feb. 25 – March 15***

NEUROBIO720D – Sensory-motor integration: Much of our motor activity is directed by sensory inputs. In this module, we will cover the basic principles of how the brain processes and transforms sensory inputs in the service of the planning and coordination of movements. We will consider the function of both cortical and subcortical areas in motor control. Topics will include the roles of the parietal and frontal cortices, movement coordination by the cerebellum, and the principles of motor skill learning. Examples will be drawn heavily from eye movements while drawing parallels to other motor

effector systems. Course sessions will include some lecture material, but also will include class discussion of strategically-chosen historical and current papers. ***Steve Lisberger/Marc Sommer; March 18 – April 5.***

NEUROBIO 720E – Learning and Memory: Our capacity to form memories and learn new behaviors is critical to survival, in part because these processes permit rapid adaptation and behavioral flexibility in the face of environmental change. In this module, we will examine memory and learning by considering processes ranging from classical conditioning to spatial navigation to the cultural transmission of behaviors such as speech. These complex phenomena will be viewed from cellular, circuit and systems perspectives. ***Rich Mooney/Rebecca Yang; April 8 – April 26.***

NEUROBIO 726S.001 Neurobiology Journal Club (Seminar) – Once a month, first and second year neurobiology graduate students meet to hold a student-run journal club to discuss the work of an invited seminar speaker from an outside institution. On the following Tuesday, the students attend the seminar then have lunch with the speaker. *Tu 11:45 am – 2:00 pm; West; Bryan 301; 1 Unit*

NEUROBIO 733-01, 733-02, 733-03 (BME, CMB, PHARM, MOLCAN 733-01, 733-02, 733-03) Experimental Design and Biostatistics for Basic Biomedical Scientists - See PHARM 733-01, -02, -03

NEUROBIO 735.01 Quantitative Neurobiology- Through lectures and hands-on problem solving, this course will provide students with a working, practicable background in coding in Python, theoretical and computational neuroscience. The material will be oriented strongly towards the needs of working neurobiologists, and will require considerable independent work. Course starts ***January 10, 2019, Tues/Thurs 3:00pm-4:30pm, Bryan Research Building, Room 301, Instructors: Dr. Nicolas Brunel, Dr. John Pearson***

NEUROBIO 755 (PHARM 755) Neurotoxicology – See PHARM 755

NEUROBIO 762 Neurobiology of Disease: This course is a month-long (January) series of 3 weekly two-hour sessions, each centered on a given disease of the nervous system. One or two students working with a designated faculty member are responsible for an introduction (20-25 minutes) followed by a discussion of key primary papers on the subject. Two or three articles provided in advance provide a framework for discussion. Diseases to be covered currently include: ALS, Alzheimer's, Epilepsy, bipolar disease, autism, addiction, Parkinson's disease, retinitis pigmentosa, and stroke. The idea is to describe the key features of the disease, current insight into etiology and pathogenetic mechanisms of the disease, models available and the evidence (if any) establishing the validity of the models, therapies available and envisioned. The topic "Neuroengineering: Approach to Restorative Neurology" will also be addressed. Students are expected to have a background in fundamentals of neuroscience and cell and molecular biology. Permission of instructor required to register. ***MWF 9:00am-11:00am; 1/7/19 – 2/1/19; 301 Bryan Research Building; McNamara; 2 units***

NEUROBIO 790 Student Seminar – Preparation and presentation of seminars to students and faculty on topics of broad interest in neurobiology. Required of all first – and second-year students. ***W 12:00 – 2:00 pm; Rebecca Yang/Jeremy Kay; Bryan 301***

NEUROBIO 793 Research in Neurobiology (Independent Study)- This course acquaints students with research in neuroscience and allows them to become proficient in a variety of techniques. It is an

independent study in one of the laboratories of the training faculty. Students are expected to do three rotations in three semesters. *(Laboratory Rotations) (up to 12 Units)*

PATHOLOGY:
http://pathology.mc.duke.edu

PATHOL 750 General Pathology - Lectures deal with broad concepts of disease and underlying molecular mechanisms. Laboratory sessions familiarize the student with how to identify common disease processes in histologic sections. PTH 225 (histology) or an equivalent course is a prerequisite. *MWF 3:05 – 4:15 pm; TBD; Hale; 4 Units*

PATHOL 785 Molecular Aspects of Disease - This course is based upon the study of the background, investigative method and recent advances in understanding the molecular basis of selected diseases, with an in-depth focus on a small number of diseases where defects are known at genetic or molecular levels. *TuTh 8:30 – 10:25 am; TBD; Bachelder and He; 3 Units*

PATHOL 786. Translational Aspects of Pathobiology. -Translational Research in Pathobiology is an integrated multidisciplinary course designed to provide students with the necessary tools to understand the principle components of the research processes involving patients or materials obtained from a human source. This course reflects the Department of Pathology's unique I ntegration of traditional pathology research with experimental therapeutics in an environment that seeks to bridge the basic sciences and clinical medicine. Instructor: *Weds 1:00-2:30 pm; TBD; Devi. 3 units.*

PATHOL 855S Graduate Seminar in Pathology - Discussions outlining the scope of modern pathology. This will include reports of original research by graduate students, members of staff and visitors. *Th 4:00 – 5:00 pm; Markee Lecture Hal (M224 Davison Bldg); Multiple Staff; 3 Units*

PATHOL 735S Animal Models - The goal of this course is to give students a working knowledge of the use of animal models in research, types of models and how to choose for translational relevance. Topics include the regulations governing the use of animals in research, principles of in vivo experimental design, as well as best practices for data collection, interpretation and reporting during animal study conduct. Students will be exposed to the principle elements that impart variability and bias in the generation of animal study data, and will learn best practices for the conduct of high quality animal studies that lead to reproducible data. *MW 11:45am – 1:00pm ; TBD; Everitt, Norton; 3 Units*

PHARMACOLOGY:
https://pharmacology.duke.edu/training/graduate

PHARM 534 Interdisciplinary Approach to Pharmacology - Several model systems (cancer, immunological, cardiovascular, reproductive, neurological and infective diseases) will be used to explore the molecular, biochemical, and physiologic basis of drug action**.** *MWF 3:20 - 4:10 pm; Kuhn, MacIver and Wang ; C144 LSRC; 4 Units*

PHARM 733-01, 733-02, 733-03 (BME, CMB, NEUROBIO, MOLCAN 733-01,733-02, 733-03) Experimental Design and Biostatistics for Basic Biomedical Scientists - The use and importance of

statistical methods in laboratory science, with an emphasis on the 'nuts and bolts" of experimental design, hypothesis testing, and statistical inference. Central tendency and dispersion, Gaussian and Non-Gaussian distribution, parametric and non-parametric tests, uni- and multivariate, ANOVA and regression procedures are covered. Students will present their own data and literature examples in addition to lectures. Consent of Instructor required. ***Section 01:*** *Tu 8:30 – 10:15 am; C144 LSRC; Slotkin; 2 Units.* ***Section 02:*** *W 8:30 – 10:15 am; C144 LSRC; Slotkin; 2 Units.* ***Section 03:*** *Th 8:30 – 10:15 am; C144 LSRC; Slotkin; 2 Units*

PHARM 755 (NEUROBIO 755) Neurotoxicology - Adverse effects of drugs and toxicants on the central and peripheral nervous system; target sites and pathophysiological aspects of neurotoxicity; factors affecting neurotoxicity, screening and assessment of neurotoxicity in humans; experimental methodology for detection and screening of chemicals for neurotoxicity. W *1:25 -3:15pm; C144 LSRC; Abou-Donia; 3 Units*

PHARM 761 (BIOCHEM, CELLBIO, MOLCAN 761) Cellular Signaling Module I: GPCR Signaling and Disease – See CELLBIO 761

PHARM 762 (BIOCHEM, CELLBIO, MOLCAN 762) Cellular Signaling Module II: Intracellular Signaling and Disease – See CELLBIO 761

PHARM 763 (BIOCHEM, CELLBIO, MOLCAN 763) Cellular Signaling Module III: Growth Factor Pathway in Development and Disease – See CELLBIO 761

PHARM 780 (MOLCAN 780) Graduate Student Seminar - A presentation and discussion course in which program faculty and graduate students review recent progress in contemporary areas of Pharmacology and Cancer Biology. Provides an important avenue for evaluation and feedback for graduate student research and communication skills and is required for all students pursuing their Ph.D. degree in Pharmacology and Molecular Cancer Biology. *Th 3:20 - 4:30 pm; C144 LSRC; Hirschey and Thiele; 2 Units*

PHARM 814 Case Studies Toxicology - Students are assigned topics relative to their chosen research discipline in toxicology and are asked to develop case studies to present at a roundtable workshop. Emphasis on review and analysis of toxicological problems from a holistic (multidisciplinary) viewpoint. Offered on demand. *T 1:25-3:15pm; C144 LSRC; Abou-Donia; 1 Unit*

PHARM 815 (ENVIRON 815) Focused Topics in Toxicology - A contemporary advanced toxicology research area will be covered with readings from the current primary literature. An integrative review of the topic will be prepared as a collaborative effort. Prerequisites: Consent of instructor required. *M 11:45-1:00pm; A312 LSRC; Levin; 1 Unit*

PHARM 835 (I&E 835) Innovations in Drug Development – Introduction to major issues in developing a drug to treat a disease in an interdisciplinary lecture-based and team-based learning environment. Translation of principles in biomedical sciences, biomedical engineering, and chemistry along with innovative approaches to develop a hypothetical drug for treating a disease of choice. Hypothetical development of model compounds, target analysis, and in vitro and in vivo models to test drug efficacy. *MW 3:05-4:20 pm; C335 LSRC; Yao (Course requires one of the following (or equivalent): Pharm 533, Chem 518, or BME 577) 4 unit.*

STRUCTURAL BIOLOGY AND BIOPHYSICS:

http://sbb.duke.edu/index.php

SBB 546S Structural Bio and Biophysics Seminar - Weekly seminars are presented by program students beyond their first year, faculty members or guest speakers. (Required of all SBB Students) *M 4:15 – 5:15 pm; 437 Nanaline Duke Building; Oas; 1 Unit*

SBB 682T Advanced Physical Biochemistry - Transient kinetics, computational methods, multidimensional NMR, x-ray crystallography, thermodynamics of association. Prerequisite: Structural Biology and Biophysics or consent of instructor. *Oas; Tutorial – contact Course Director for time & location; 3 Units*

UNIVERSITY PROGRAM IN GENETICS:

http://upg.duke.edu/home.html

UPGEN 522 (MGM 522) Critical Readings in Genetics and Genomics – Classical and molecular genetic approaches to understanding eukaryotic cell function using unicellular organisms such as yeasts. Experimental approaches as well as illustrative studies of secretion, cell cycle, signaltransduction, and cytoskeleton. Discussion of current literature and student presentations. *TuThu, 4:40pm – 5:55pm, Location TBA; Robertson; 3 units; (cross-listed with* MGM 522*)*

UPGEN 732 (MGM 732) Human Genetics – Topics include segregation, genetic linkage, population genetics, mulifactorial inheritance, biochemical genetics, cytogenetics, somatic cell genetics, neurogenetics, cancer genetics, clinical genetics, positional cloning, and complex diseases. Lectures plus weekly discussion of assigned papers from the research literature. Prerequisites; University Program in Genetics 278 or equivalent, and graduate status or consent of instructor. *TuThu 8:30-9:45a, Location TBA Marchuk&Ashley-Koch; 3 units; (cross-listed with* MGM 532*)*

UPGEN 640: Quantitative Approaches to Biological Problems: From Cartoon Models to System Behavior

This class is aimed at biologists who want to gain an appreciation of how mathematical approaches can supplement experimental approaches. We will teach you how to convert cartoon diagrams to differential equations, and re-familiarize you with some basic concepts from math and physics that help us develop a better intuition of how the world works. Then we will discuss how quantitative approaches can yield insights into how control systems behave. The class will use calculus at an elementary level and an occasional computer simulation, but we will focus more on concepts and applications. *T/Th, 2-3:30 pm, Location TBA; Daniel Lew and Stefano Di Talia;*

UPGEN 668 (BIOCHEM 668) Biochemical Genetics II - Mechanisms of transcription, splicing, catalytic RNA, RNA editing, mRNA stability and translation. *TuTh 10:05 – 11:20 am; Location TBA; Meyer Kathryn; 3 Units.*

UPGEN 701 Advanced Topics in Genetics and Genomics - This course is only open to first year UPGG graduate students. It is a weekly discussion of current literature in genetics (Fall semester) and genomics (Spring semester). The course has two objectives. The first is to

ground each of the members of the UPGG first year class, regardless of areas of interest, in the two areas of focus of the program – namely genetics and genomics. The second objective is to facilitate interactions among the diverse student body by bringing the class together once a week for discussion. *W 4:00 – 6:00 pm; GSRB I Room 2029; Lowe 2 Units*

UPGEN 716 Genetics Student Research - This is a student seminar with two advanced students presenting each seminar. Refreshments are provided by first year students. *F 4:00 – 5:00 pm; 001 MSRB I; Silva,Yan; 1 Unit*

UPGEN 750 Genetics Colloquium - Sponsored by the UPGG Program Seminar Series. *T 12:30 – 1:30 pm; Room 147 Nanaline Duke Bldg; Haase; 1 Unit*

UPGEN 787 (BIO 787) Evolutionary Genetics (Not Offered Spring 2019) - An introduction to the principles of evolutionary genetics, with discussion of the current literature and hands-on exercises. Genetic variation, neutral theory, natural selection, human population genetics, phylogenetic reconstruction, evolutionary genomics and evolutionary bioinformatics. This course is paired with BIO 111. Note from instructor: This course is split with undergrads and focuses on undergrads in class. As a result, the course will require more work that other graduate courses. If graduate students are looking for a lighter introduction to evolutionary genetics, they should consider taking Dr. Mitchell-Olds Solutions module. *TuTh3:05 – 4:20 p.m.; Bio Sciences 113 Mitchell-Olds, Tom; 3 Units*