Fall 25 Basic & Biomedical Sciences Courses

BIOCHEMISTRY:

http://www.biochem.duke.edu/ **Fall 25 Basic & Biomedical Sciences Courses**

First Half Semester:

BIOCHEM 658 (SBB 658) Structural Biochemistry I – [Structure of Macromolecules] Principles of modern structural biology. Protein-nucleic acid recognition, enzymatic reactions, viruses, immunoglobulins, signal transduction, and structure-based drug design described in terms of the atomic properties of biological macromolecules. Discussion of methods of structure determination with particular emphasis on macromolecular X-ray crystallography NMR methods, homology modeling, and bioinformatics. Students use molecular graphics tutorials and Internet databases to view and analyze structures. Prerequisites: organic chemistry and introductory biochemistry. *Minicourse, 1st half-semester. MWF 3:20-4:10 pm; Beese; 439 Nanaline Duke Bldg; 2 Units*

Second Half Semester:

BIOCHEM 659 (CELLBIO, IMMUNOL, SBB, UPGEN 659) Structural Biochemistry II – [Molecular Biology I] Continuation of BIOCHEM 658. Structure/function analysis of proteins as enzymes, kinetics of binding, catalysis and allostery, protein folding, stability and design protein-protein interactions. Prerequisite: Biochemistry 658, organic chemistry, physical chemistry, and introductory biochemistry. This is an introductory course to learn how to use quantitative methods to understand biological structure and function. *Minicourse, 2nd half-semester. MWF 3:20-4:10 pm; Zhou; 439 Nanaline Duke Bldg; 2 Units*

BIOCHEM 681 (SBB 681) Biophysical Methods – This course provides an overview of nine prominent methods used in biochemistry, cell biology and structural biology. They are: optical spectroscopy, fluorescence, light microscopy, ligand binding, kinetics, mass spectrometry, magnetic resonance, electrophysiology and cryoelectron microscopy. The goal is to provide students with sufficient background knowledge to allow them to read and understand papers in the primary literature that employ one or more of these methods. Each method is taught by an instructor who employs the method in their own research. Grade is based on problem sets, quizzes and a final presentation to the class of a paper that uses a method of the student's choice. *TuTh, 10:05-11:20 am; Oas; 147 Nanaline Duke Bldg; 3 Units*

BIOCHEM 745S Biochemistry Seminar – This course is a requirement of all first-, second-, and third-year biochemistry graduate students to learn how to clearly and concisely present the background, data, conclusions, and future prospects of your research in both oral and written formats. First-year students will present their rotation projects. Second and third-year students will annually present their research. All students will provide feedback so each presenter can improve presentation content and style. W 4:30-5:30 pm; Brennan; 252B Nanaline Duke Bldg; 1 Unit

BIOCHEM 790S Seminar (Topics) - This is a discussion-based course that includes introductory lectures and the critical reading of select topics in Biochemistry literature. Topics and instructors are announced each semester. MW 10:05-11:20 am; Kuehn; 247 Nanaline Duke Bldg; 2 Units

BIOLOGY

https://biology.duke.edu/courses/2020-fall

BIOSTATISTICS:

http://biostat.duke.edu

BIOSTAT 701. Introduction to Statistical Theory and Methods I. This course provides a formal introduction to the basic theory and methods of probability and statistics. It covers topics in probability theory with an emphasis on those needed in statistics, including probability and sample spaces, independence, conditional probability, random variables, parametric families of distributions, and sampling distributions. Core concepts are mastered through mathematical exploration and linkage with the applied concepts studied in BIOSTAT 704. Prerequisite(s): 2 semesters of calculus or its equivalent (multivariate calculus preferred). Familiarity with linear algebras is helpful. Corequisite(s): BIOSTAT 702, BIOSTAT 703. *Instructor: Lynn Lin. Meets: MW 8:30am-9:45am, Hock 10089. Credits: 3.*

BIOSTAT 702. Applied Biostatistical Methods I. This course provides an introduction to study design, descriptive statistics, and analysis of statistical models with one or two predictor variables. Topics include principles of study design, basic study designs, descriptive statistics, sampling, contingency tables, one- and two-way analysis of variance, simple linear regression, and analysis of covariance. Both parametric and non-parametric techniques are explored. Core concepts are mastered through team-based case studies and analysis of authentic research problems encountered by program faculty and demonstrated in practicum experiences in concert with BIOSTAT 703. Computational exercises will use the R and SAS packages. Prerequisite(s): 2 semesters of calculus or its equivalent (multivariate calculus preferred). Familiarity with linear algebras is helpful. Corequisites(s): BIOSTAT 701, BIOSTAT 703, BIOSTAT 721. *Instructor: Marissa Ashner. Meets: TTH 8:30am-9:45am, Hock 10089. Credits: 3.*

BIOSTAT 703. Introduction to the Practice of Biostatistics I. This course provides an introduction to biology at a level suitable for practicing biostatisticians and directed practice in techniques of statistical collaboration and communication. With an emphasis on the connection between biomedical content and statistical approach, this course helps unify the statistical concepts and applications learned in BIOSTAT 701 and BIOSTAT 702. In addition to didactic sessions on biomedical issues, students are introduced to different areas of biostatistical practice at Duke University Medical Center. Biomedical topics are organized around the fundamental mechanisms of disease from both evolutionary and mechanistic perspectives, illustrated using examples from infectious disease, cancer and chronic/degenerative disease. In addition, students learn how to read and interpret research and clinical trial papers. Core concepts and skills are mastered through individual reading and class discussion of selected biomedical papers, team-based case studies and practical sessions introducing the art of collaborative statistics. Corequisite(s): BIOSTAT 701, BIOSTAT 702. *Instructors: Jesse Troy and Josh Granek. Meets: TTh 10:05am-11:20am, Hock 10089. Credits: 3.*

BIOSTAT 703L. Introduction to the Practice of Biostatistics I Lab. The lab is an extension of the course. The lab is run like a journal club. The lab instructs students how to dissect a research article from a statistical and scientific perspective. The lab provides students the opportunity to present on material covered in the co-requisite course and to practice the communication skills that are a core tenant of the program. Corequisite(s): BIOSTAT 703 or permission of the director of graduate studies. *Instructors: Jesse Troy and Josh Granek. Meets: Section 1- T 3:05pm-4:20pm, Hock 214. Section 2- TH 3:05pm-4:20pm, Hock 214. Credit: 0.*

BIOSTAT 707. Statistical Methods for Learning and Discovery. This course surveys a number of techniques for high dimensional data analysis useful for data mining, machine learning and genomic applications, among others. Topics include principal and independent component analysis, multidimensional scaling, tree-based classifiers, clustering techniques, support vector machines and networks, and techniques for model validation. Core concepts are mastered through the analysis and interpretation of several actual high dimensional genomics datasets. Prerequisite(s): BIOSTAT 701, 702, 704, 705, and 721 or 722/821 or their equivalents, or permission of the director of graduate studies. *Instructor: Chuan Hong. Meets: MW 10:05am-11:20am, Hock 10089. Credits: 3.*

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 722/821 or their equivalents, or permission of the director of graduate studies. *Instructor: Andrew Allen. Meets: MW 11:45am-1:00pm, Hock 10089. Credits: 3.*

BIOSTAT 713. Survival Analysis. Introduction to concepts and techniques used in the analysis of time to event data, including censoring, hazard rates, estimation of survival curves, regression techniques, applications to clinical trials. Interval censoring, informative censoring, competing risks, multiple events and multiple endpoints, time dependent covariates; nonparametric and semi- parametric methods. Prerequisite(s): BIOSTAT 701, 702, 704, 705, and 721 or 722/821 or their equivalents, or permission of the director of graduate studies. *Instructor: Marissa Ashner. Meets: MW 3:05pm-4:20pm, Hock 10089. Credits: 3.*

BIOSTAT 719. Generalized Linear Models. The class introduces the concept of exponential family of distributions and link function, and their use in generalizing the standard linear regression to accommodate various outcome types. Theoretical framework will be presented but detailed practical analyses will be performed as well, including logistic regression and Poisson regression with extensions. Majority of the course will deal with the independent observations framework. However, there will be substantial discussion of longitudinal/clustered data where correlations within clusters are expected. To deal with such data the Generalized Estimating Equations and the Generalized Linear Mixed models will be introduced. An introduction to a Bayesian analysis approach will be presented, time permitting. Prerequisite(s): BIOSTAT 701, 702, 704, 705, and 721 or 722/821 or their equivalents, or permission of the director of graduate studies. *Instructor: Hwanhee Hong. Meets: TTH 1:25pm-2:40pm, Hock 10089. Credits: 3.*

BIOSTAT 721. Introduction to Statistical Programming I (R). This class is an introduction to programming in R, 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 (functions, objects, data structures, 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 used in this course will be R. Prerequisite(s): None; familiarity with linear algebras is helpful. Corequisite(s): BIOSTAT 702. *Instructor: Brooke Alhanti. Meets: TTH 11:45am-1:00pm, Hock 214. Credits: 3.*

BIOSTAT 801. Biostatistics Career Preparation and Development I. Students gain a holistic view of career options and the tools they will need to succeed as professionals in the world of work. The course will focus on resume development, cover letters, creating and maintaining a professional digital presence, and successfully conducting informational interviews. Corequisite(s): BIOSTAT 701 through BIOSTAT 703. *Instructor: Laura Coutts. Meets: W 1:25pm-2:40pm, Hock 10089. Credit: 1.*

BIOSTAT 825. Foundation of Reinforcement Learning. This course focuses on theoretical and algorithmic foundations of bandits and reinforcement learning, involving topics including upper confidence bound methods, Thompson sampling, linear and deep contextual bandits, Markov decision process, Q-learning, policy gradient methods, etc. The course targets graduate-level students with a solid mathematical background (linear algebra, probability and statistics, and basic calculus), and a strong research interest in bandits and reinforcement learning. Prerequisite(s): linear algebra, probability and statistics, and basic calculus, or consent of the instructor and director of graduate studies. *Instructor: Pan Xu. Meets: MW 1:25pm-2:40pm, Hock 10089. Credits: 3*

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: Sean O'Brien. Meets: F 11:00am-12:15pm, Hock 10089. Credit: 1.*

BIOSTAT 906. Statistical Inference. Introduce decision theory and optimality criteria, sufficiency, methods for point estimation, confidence interval and hypothesis testing methods and theory. Prerequisite: Biostatistics 704 or equivalent. Instructor consent required. Prerequisite: Permission of the Director of Graduate Studies. *Instructor: Ethan Fang. Meets: TTH 10:05am-11:20am, Hock 11025. Credits: 3.*

BIOSTAT 907: Phase II Clinical Trials. Introduction to diverse statistical design and analytical methods for randomized phase II clinical trials. Topics: Minimax, optimal, and admissible clinical trials Inference methods for phase II clinical trials; clinical trials with a survival endpoint; clinical trials with heterogeneous patient populations; and randomized phase II clinical trials. Instructor consent required. *Instructor: Sin-Ho Jung. Meets: MW 10:05am-11:20am, Hock 11025. Credits: 3.*

BIOSTAT 908: Independent Study (Research Rotations). Faculty directed statistical methodology research. Instructor consent required. *Instructor: Sean O'Brien. Credit: 1.*

BIOSTAT 910. Career Development and Prep I. Students gain a holistic view of what skills they need to be successful graduate students and academic scholars. The curriculum focuses on the unique challenges of PhD students and the tools needed for long-term success in academia or industry. *Instructor: Laura Coutts. Meets: T 11:45am-1:00pm, Hock 11025. Credit: 1*

BIOSTAT 915. High-Dimensional Statistics and Machine Learning. The goal of this course is to provide motivated Ph.D. and master's students with background knowledge of high-dimensional statistics/machine learning for their research, especially in their methodology and theory development. Discussions cover theory, methodology, and applications. Selected topics in this course include the basics of high-dimensional statistics, matrix and tensor modeling, concentration inequity, nonconvex optimization, applications in genomics, and biomedical informatics. Prerequisite: Knowledge in probability, inference, and basic algebra are required. *Instructor: Anru Zhang. Meets: F 8:30am-11:00am, Hock 10089. Credits: 3*

BIOSTAT 917. Quantitative Methods for Biomedical Studies. Quantitative methods for analyzing biomedical data. Data generation and related domain knowledge, data visualization and pre-processing tools, scientific problem formulation and data modeling, quantitative methods selection and application, pipeline programming and coding, and result checking and visualization. The interdisciplinary approach prepares students in math, statistics, biostatistics, computer science, and engineering for careers in biomedical data science. Recommended prerequisites: Multivariate calculus, linear algebra, undergraduate-level probability, undergraduate-level statistics, and R programming. *Instructor: Jichun Xie. Meets: W 1:25pm-3:55pm. Credits: 3*

BIOSTAT 920. Probability. This course provides an introduction to measure theoretic foundations of probability theory focusing on properties of random variables, modes of convergence and their relationships, stochastic order, law of large numbers, central limit theorems, classical expectation and concentration inequalities, and characteristic functions and conditional expectations. Students seeking a more abstract or advanced coverage of concepts introduced in this course are encouraged to register for MATH631 (Measure and Integration) or MATH641 (Probability). Prerequisites: Students are expected to have completed a theoretically focused course in probability theory at the advanced undergraduate level (e.g., at the level of STA230/MATH230 or preferably at the level of STAT231/MATH340). Students are also expected to have a solid understanding of advanced undergraduate-level real analysis (e.g., at the level of MATH431 or preferably at the level of MATH531). *Instructor: Kouros Owzar. Meets: TTH 3:05pm-4:20pm, Hock 11025. Credits: 3*

BIOTRAIN:

BIOTRAIN 701: Foundations in Professionalism for Biomedical Scientists. This course equips 1st year School of Medicine (SoM) biomedical PhD students with professionalism skills, including but not limited to stress management, effective communication, and mentor-mentee relationships. The course is team-taught by National Research Mentoring

Curriculum-trained faculty members and Leadership and Management in Action Program-trained PhD students from diverse SoM PhD programs. Content includes interactive lectures that provide fundamental knowledge of key professional skills, and small group active learning sessions ("Gateway Groups") during which students discuss and practice professionalism skills and receive feedback from faculty mentors, peer mentors, and peers. Instructors: Sullivan, Telzrow. *TH 8:30 AM-9:30 AM*.

BIOTRAIN 720: Grant Writing for Biomedical Scientists. Introduction to scientific grant writing for second- (or third-) year PhD students. This course contains lecture-based and active learning sessions. Content includes lectures combined with class discussions on grant agencies, format and structure of grant applications, concepts in peer review, best practices in articulating study design and data outcomes, rigor and reproducibility in a research plan, and crafting biological significance and training statements. Students write an NIH-style proposal and actively participate in topical study sections to receive oral and written critiques of their proposals and to provide constructive feedback of others' proposals. Open only to second- or third-year students in biomedical PhD programs. Instructors: Sullivan, Marchuk, Telzrow, and staff. *MWF 8:30 AM - 9:30 AM*.

BIOTRAIN 898: Gateway to Internship and Experiential Learning. This internship preparation course will serve as a companion course to BIOTRAIN 899 Internship and Experiential Learning to begin the process of allowing Biomedical PhD students to explore specializations and career paths outside academia and prepare them to make more informed career path decisions. The course will encourage students to plan a practical path for pursuing a career outside of academia, address benefits and challenges of participating in an internship during the PhD, and provide tools and skills to navigate the process of finding and successfully completing an internship as part of the PhD course of study. Instructor: Telzrow. *TH 8:30 AM-10:00 AM*

CELL AND MOLECULAR BIOLOGY:

http://medschool.duke.edu/cmb

CMB 710 A-F - Cell & Molecular Biology Modules

Modules in the CMB 710 series (A – F) are required for all CMB students. Modules are offered sequentially during the Fall semester. These are the core offerings of the Cell & Molecular Biology Program. Topics reflect the expertise of the corresponding faculty and emphasize either in-depth critical discussion of the primary literature or quantitative/mathematical approaches to addressing biological questions. Each module lasts for 2 weeks, with 3 meetings per week. Students entering through CMB are required to take 6 modules in fall semester of their first year with a minimum of 4 modules in the CMB 710 series. The other two may be from the UPGEN 778 series. A total of 12 modules are required for CMB, with a total of 8 from CMB710. To help you prepare for each module, the instructors have included a summary with any required reading that should be completed prior to the start of each module, and prerequisites.

Note: The Drop/Add deadline for Fall 2025, applies to **all modules**. CHECK for any prerequisites. *MWF 10:20 – 11:40 am;* Lowe (Course Director); *1 Unit each*

CMB 733.01 (NEUROBIO, PHARM) – Experimental Design and Biostatistics for Basic Biomedical Scientists – See PHARM 333.01

CMB 733.02 (NEUROBIO, PHARM) – Experimental Design and Biostatistics for Basic Biomedical Scientists – See PHARM 333.02

CMB 733.03 (NEUROBIO, PHARM) – Experimental Design and Biostatistics for Basic Biomedical Scientists Statistics – See PHARM 333.03

CMB 764 Cell and Molecular Biology Colloquium – [Student Seminar] required of all CMB students. Each Monday at noon, 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 and can have lunch with the speaker. Credit is based on attendance. *M 11:45-1:00 pm;* Boyce & Di Talia; *2 Units*

CMB 797 Modern Techniques in Molecular Biology - This course introduces the fundamental laboratory techniques used in basic research. It is divided into two sections. One section covers techniques used for protein purification, analysis, and the study of protein-protein interactions. The second covers nucleic acid based techniques, including a review of basic nucleic acid chemistry, enzymatic modification, qualitative and quantitative PCR, nucleic acid sequencing, cloning strategies, vectors, and measurement of transcript expression including microarray techniques. This course is built around a team-based learning model. Course reading material and recorded lectures are provided to students to review before class and class time is spent reinforcing the material through problem sets and group discussion. *8:45-9:45 am; Madan Kwatra; 3 Units*

CELL BIOLOGY:

http://www.cellbio.duke.edu

CHEMISTRY: For a complete listing, please go to: http://www.chem.duke.edu/graduates/courses.php

COMPUTATIONAL BIOLOGY & BIOINFORMATICS:

https://medschool.duke.edu/education/biomedical-phd-programs/computational-biology-and-bioinformatics-program

CBB 510S Computational Biology & Bioinformatics Seminar - A weekly series of seminars on selected topics of current interest in computational biology & bioinformatics. Required of all 1st and 2nd year CBB students. Mon 12p-1p; Instructor: Hauser; 1 unit (credit/no credit)

CBB 511 Journal Club - A weekly series of discussions led by students that focus on current topics in computational biology. Topics of discussion may come from recent or seminal publications in computational biology or from research interests currently being pursued by students. Th 3:30p-4:30p; Instructor: Hauser; 1 unit

CBB 520 Genome Tools and Technologies - The course introduces the laboratory and computational methodologies for genetic and protein sequencing, mapping and expression measurement. Prerequisites: Students are expected to have some background course work in genetics, molecular biology, biochemistry, and a modern programming language. TuTh 10:05a-11:20a; Instructor: Dietrich; 3 Units

CBB 526 Data Science - Data science is 'the science of planning for, acquisition, management, analysis of, and inference from data'. This course systematically covers the concepts, ideas, tools, and example applications of data science in an end-to-end manner. We emphasize data-driven thinking, data processing and analytics, and extracting actionable values from data. We focus on the interactions between data and applications, data modeling, and data processing, data analytics, and the essential algorithms and tools. Prerequisites: A statistics course (Statistics 111 or higher), data structures and algorithms (Computer Science 201), and relational databases (Computer Science 216 or 316). TuTh 3:05p-4:20p; Instructor: Songdechakraiwut; 3 units

CBB 562 High-Resolution Cryo-Electron Microscope - Cryo-electron microscopy (EM) is a Nobel Prize winning technique to determine the structure of proteins and protein complexes at molecular resolution. Computational imaging aspects of cryo-EM, including image enhancement, reconstruction, classification and burst movie processing used to determine the

high-resolution structure of proteins in 3D. Overview of the structure determination pipeline, focusing primarily on the data analysis aspects of the technique including the application of machine learning and deep learning strategies to extract atomic resolution information from millions of noisy images of proteins. Recommended prerequisite: Programming experience. MoWe 8:30a - 9:45a; Instructor: Bartesaghi; 3 units

CBB 574 Modeling and Engineering Gene Circuits - This course discusses modeling and engineering gene circuits, such as prokaryotic gene expression, cell signaling dynamics, cell-cell communication, pattern formation, stochastic dynamics in cellular networks and its control by feedback or feedforward regulation, and cellular information processing. The theme is the application of modeling to explore "design principles" of cellular networks, and strategies to engineer such networks. Students need to define an appropriate modeling project. At the end of the course, they're required to write up their results and interpretation in a research-paper style report and give an oral presentation. Prerequisites: Biomedical Engineering 260L or consent of instructor. MW 1:45p-3:00p; Instructor You; 3 units

CBB 575 Quantitative Methods for Biomedical Studies - Quantitative methods for analyzing biomedical data. Data generation and related domain knowledge, data visualization and pre-processing tools, scientific problem formulation and data modeling, quantitative methods selection and application, pipeline programming and coding, and result checking and visualization. The interdisciplinary approach prepares students in math, statistics, biostatistics, computer science, and engineering for careers in biomedical data science. Recommended prerequisites: Multivariate calculus, linear algebra, undergraduate-level probability, undergraduate-level statistics, and R programming. W 1:25p – 3:55p; Instructor: Xie; 3 units

CBB 591 Independent Study - Faculty directed experimental or theoretical research. Instructor: Hauser; 1-9 units (credit/no credit)

CBB 634 Geometric Algorithms - Models of computation and lower-bound techniques; storing and manipulating orthogonal objects; orthogonal and simplex range searching, convex hulls, planar point location, proximity problems, arrangements, linear programming and parametric search technique, probabilistic and incremental algorithms. Prerequisite: Computer Science 532 or equivalent. TuTh 3:05p - 4:20p; Instructor: Agarwal; 3 units

CBB 658 Structural Biochemistry I - Principles of modern structural biology. Protein-nucleic acid recognition, enzymatic reactions, viruses, immunoglobulins, signal transduction, and structure-based drug design described in terms of the atomic properties of biological macromolecules. Discussion of methods of structure determination with particular emphasis on macromolecular X-ray crystallography NMR methods, homology modeling, and bioinformatics. Students use molecular graphics tutorials and Internet databases to view and analyze structures. Prerequisites: organic chemistry and introductory biochemistry. MoWeFr 3:20p - 4:10p; 08/25/2025 - 10/08/2025; Instructor: Beese; 2 units

CBB 659 Structural Biochemistry II - Continuation of Biochemistry 658. Structure/function analysis of proteins as enzymes, multiple ligand binding, protein folding and stability, allostery, protein-protein interactions. Prerequisites: Biochemistry 658, organic chemistry, physical chemistry, and introductory biochemistry. MoWeFr 3:20p - 4:10p; 10/10/2025 - 11/24/2025; Instructor: Zhou; 2 units

CBB 700 Internship - Student gains practical experience by taking an internship in industry 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. Instructor: Hauser; 1 unit (credit/no credit)

CBB 910 Career Development and Prep I - Students gain a holistic view of what skills they will need to be successful graduate students and academic scholars. The curriculum focuses on the unique challenges doctoral students face and the tools needed for long-term success in academia or industry. Tu 11:45a - 1:00p; Instructor: Coutts; 1 unit (credit/no credit)

COGNITIVE NEUROSCIENCE

751. Neuroscience Bootcamp. Neuroscience Bootcamp is a one week immersive lecture, discussion and laboratory course for graduate students in the Neurobiology Graduate Program and the Cognitive Neuroscience Admitting Program, and graduate students in allied programs at the discretion of the instructors. The Duke Neuroscience Bootcamp is designed to (1) provide a common knowledge base of neuroscience fundamentals; (2) demystify the tools of the discipline—providing hands-on experience with techniques that are commonly used to explore cellular/molecular, circuits and cognitive neuroscience; and (3) introduce new students to a wide variety of Duke faculty and helpful resources for ensuring a successful graduate career. Instructor: Glickfeld, Grandl, Egner. 2 units. C-L: Neurobiology 751; Online Only

DEVELOPMENTAL & STEM CELL BIOLOGY:

https://sites.duke.edu/dscb/

DSCB 700 Classic Papers in Development - The goal of this Fall seminar course is to deepen understanding of the class findings and advances in the field of Development, Stem Cell, and Regenerative Biology and to provide a historical view of how these findings affect our approaches in the field today. The course will consist of both first and second year DSCB students and 20 faculty members who will select papers and facilitate group discussions. MWF (9/10-9/22 1:00 pm – 2:30 pm); Lechler, 1 Unit

DSCB 730 Hands on Development Mini Course - This class is required for **first year DSCB students only**, will expose students to basic principles and techniques in development and stem cell biology. This year the class will be held virtually and students will meet with individual faculty to learn about different model systems. MWF (8/25 - 9/8 afternoon only); Lechler, 1 Unit

IMMUNOLOGY:

https://immunology.duke.edu/

IMMUNOL 544 Principles of Immunology - This is a graduate level course that is open to both graduate students and advanced undergraduates. It is an introduction to the molecular and cellular basis of the immune response. Topics include anatomy of the lymphoid system, lymphocyte biology, antigen-antibody interactions, humoral and cellular effector mechanisms, and control of immune responses. The last third of the course focuses on special topics and application such as transplantation, autoimmunity, immunodeficiency, and tumor immunity. On selected days, the class is broken down into small discussion groups of approximately 15 students to discuss material introduced in the lectures or to work on problem sets. Graduate students in the Department of Immunology lead these sections. *MWF 1:40-2:30 pm; Miao; 3 Units.*

IMMUNOL 601 Immunology of Human Disease - This advanced course will cover the immune aspect of various human diseases, including autoimmune diseases, allergy, tumor, inflammation, and infectious diseases. Required course for all students specializing in immunology. Prior course requirement: IMM544. Tues 10:05-*11:20 am; Kirk; 1 Unit.*

IMMUNOL 701D Pillars of Immunology – This course will cover discoveries of historical importance in the field of immunology through student presentations and discussions of classical papers. Intended for students seeking a PhD in Immunology. *F 10:15-11:30 am; Krangel; 1 Unit.*

IMMUNOL 731S Immunology Seminar--Work in progress seminar in which students and postdoctoral trainees give 30 min to 1 hour presentations of their research. Considered a showcase of current research in the Department of Immunology. All students enrolled in IMM programs are required to give a presentation once per year. Informal

questions and discussion are encouraged throughout presentation. First and second year Immunology graduate students should register for Immunology 731S which is graded credit. Third through sixth year Immunology students, along with non-Immunology majors should register for Immunology 732S which is non- graded credit. Attendance is essential for both spring and fall terms. *M 4:20-5:10 pm; Shinohara; 1 Unit.*

IMMUNOL 732S Immunology Seminar--Work in progress seminar in which students and postdoctoral trainees give 30min to 1 hour presentations of their research. Considered a showcase of current research in the Department of Immunology. All students enrolled in IMM programs are required to give a presentation once per year. Informal questions and discussion are encouraged throughout presentation. First and second year Immunology graduate students should register for Immunology 731S for graded credit. Third through sixth year Immunology students, along with non-Immunology majors should register for Immunology 732S which is non-graded credit. Attendance is essential for both spring and fall terms. *M 4:20-5:10 pm; Shinohara; 1 Unit.*

IMMUNOL 735 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. Required course for all students specializing in immunology. *Th 9-10 am; Moseman; Credit/no credit grading only; 1 Unit.*

IMMUNOL 791A Research in Immunology – This course is the first 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 6 weeks. Rotations should be approved by the DGS. The second course is IMMUNOL791B offered in the spring. Both courses must be taken in order for the four total credits and grades to post. 2 Units

Second Half Semester:

IMMUNOL 659 / BIOCHEM 659 Structural Biochemistry II - See BIOCHEM 659

INTEGRATED TOXICOLOGY AND ENVIRONMENTAL HEALTH (CERTIFICATE):

http://sites.nicholas.duke.edu/envhealth/

ENVIRON 501 Environmental Toxicology – (required) Study of environmental contaminants from a broad perspective encompassing biochemical, ecological, and toxicological principles and methodologies. Discussion of sources, environmental transport and transformation phenomena, accumulation in biota and ecosystems. Impacts at various levels of organization, particularly biochemical and physiological effects. Prerequisites: organic chemistry and vertebrate physiology or consent of instructor.

TuTh 10:05-11:20 am LSRC A158; 3 units; Instructor: Meyer

ENVIRON 540 Chemical Fate of Organic Compounds – This course will review the basics of environmental organic chemistry with a focus on contaminant chemistry. During this course we will discuss quantitative processes used in predicting the fate and distribution of organic chemicals in the environment with regards to equilibrium/thermodynamics and some kinetic considerations. Topics will include equilibrium partitioning among air, water, sediments and biological tissues, including bioaccumulation and biomagnification. The processes influencing the transport and ultimate fate of organic contaminants in rivers and lakes will be discussed in addition to processes influencing global transport. Prerequisites: university-level general chemistry and organic chemistry within last four years.

TuTh 3:05-4:20pm GH 1101; 3 units; Instructor: Stapleton

ENVIRON 847S Seminar in Toxicology – (required) Cross-listed with PHARM 847S-01. A weekly research seminar throughout the year is required of participants in the Toxicology Program, but open to students in related fields as

well. Students, faculty and invited national speakers present their latest research findings concerning neurotoxicology, molecular biology, teratology, environmental toxicology, public policy of environmental regulation and related fields.

F 12:00-1:15 pm GH 1112 or ONLINE; 1 Unit; Instructor: Meyer.

PHARM 533 Essentials of Pharmacology and Toxicology - (required) See PHARM 533

PHARM 733 Experimental Design and Biostatistics for Basic Biomedical Scientists - (required) See PHARM 733

MEDICAL PHYSICS

http://medicalphysics.duke.edu

MEDPHY 500 Radiation Physics - A course covering the basics of ionizing and non-ionizing radiation, atomic and nuclear structure, basic nuclear and atomic physics, radioactive decay, interaction of radiation with matter, and radiation detection and dosimetry. *MW 10:15 am -11:30 am; Turkington; 1032 Hock Plaza; 3 units.*

MEDPHY 505 Anatomy and Physiology for Medical Physicists - A course focused on medical terminology, biochemistry pertaining to MP, basic Anatomy and physiology, elementary tumor and cancer biology, and overview of disease in general. Upon completion, the student should: (a) understand anatomic structures, their relationships, their cross-sectional and planar projections, and how they are modified by attenuation and artifacts in the final images; (b) understand the physiology underlying radionuclide images, (c) understand how (a) – (b) are modified by disease, (d) identify anatomical entities in medical images (different modalities), and (e).identify basic disease features in medical images (e.g., Pneumothorax in chest radiographs, microcalcoifications in mammograms). *MW 8:30 am – 9:45 am; Reiman; 1032 Hock Plaza; 3 units.*

MEDPHY 530 Modern Medical Diagnostic Imaging System - A course describing basics of imaging science, x-ray imaging modalities including basic principles, detectors, scattered radiation, planar imaging, CT, fluoroscopic imaging, nuclear medicine imaging, US and MRI, and computers in imaging. *TUTH 10:15 am - 11:30 pm; Macdonald, Solomon; 1032 Hock Plaza; 3 units.*

MEDPHY 716 Shielding Design for Medical X-ray Imaging Facilities - This course provides an advanced level education in shielding design for medical x-ray imaging facilities. Competency in this area is required by professional certification boards such as the American Board of Medical Physics (ABMP) in the MHP Specialty and the American Board of Health Physics (ABHP). This course will also be useful for Diagnostic Imaging (DI) track students as the topic will give extra preparation to the students before DI residency training. Competency is this area is required by the American Board of Radiology in the DI Specialty. *TH 1:25 pm – 2:40 pm; Omenya; 1032 Hock Plaza; 1 unit.*

MEDPHY 717 Techniques in Mathematical Oncology - Advancements in applied mathematics and high-performance scientific computing are increasingly shaping modern medicine and biology, particularly in cancer research. This course addresses a growing need for interdisciplinary training that bridges mathematical modeling, computational methods, and biomedical applications. By integrating mechanistic and data-driven approaches, students will develop the skills necessary to analyze and simulate complex biological systems, with a focus on tumor dynamics, treatment resistance, and medical imaging. The course is particularly valuable for students in medical physics, computational biology, biophysics, and/or biomedical engineering who seek to apply mathematical and computational frameworks to real-world challenges in oncology and beyond. *TUTH 11:45 am – 1:00 pm; Lafata; 1032 Hock Plaza; 3 units.*

MEDPHY 722 Advanced Photon Beam Radiation Therapy - This course will cover the physics and clinical application of advanced external beam photon therapies with special emphasis on IMRT. Prerequisite: MP 220*. TUTH 8:30 am - 9:45 am; Q. Wu; 1032 Hock Plaza; 3 units.*

MEDPHY 725 Physics and Clinical Applications of Brachytherapy - The course is designed to combine traditional lectures and clinical physics practicum on the topic of LDR (low dose rate) and HDR (high dose rate) brachytherapy. Prerequisite: Medical Physics 520. *MTH 3:30 pm - 4:30 pm; Lee, Meltsner*; *clinics; 2 units.*

MEDPHY 726 Practicum on Monte Carlo method in Medical Physics - This course focuses on the fundamentals of Monte-Carlo simulations and provides hands-on experience with clinical Monte-Carlo codes used in medical dosimetry. The course will introduce software such as MCNP, EGS, FLUKA, GEANT and Penelope and companion data analysis software ROOT, PAW and CERNLIB. Students will study at least one major code and will perform two or more projects based on a clinically relevant task. Prerequisites: Calculus, modern physics, and programming. Knowledge of C, C++, or Fortran would be a plus. W *3:05 pm –4:20 pm, Kapadia, 1032 Hock Plaza; 3 units.*

728 Clinical Practicum and Shadowing (RT) - 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 5:15 pm - 8:15 pm, Sheng, clinics; 3 units.*

MEDPHY 734 Advanced Topics of Non-ionizing-based Imaging Modalities - This course covers advanced topics in non-ionizing Imaging modalities such as Ultrasound and MR imaging, including speckle statistics, Doppler imaging, advanced MR pulse sequences, MR angiography, flow and diffusion etc. Instruction will consist of didactic lectures accompanied by hands-on laboratory exercises (practicum). *MW 1:25 pm – 2:40 pm; Robertson; 1032 Hock Plaza; 3 units.*

MEDPHY 751 Medical Physics Seminar - Medical physics is the application of the concepts and methods of physics to the diagnosis and treatment of human disease. This course consists of weekly lectures covering broad topics in medical physics including diagnostic imaging, radiation oncology, radiation safety, and nuclear medicine. Lectures will be given by invited speakers drawn from many university and medical center departments, including radiology, physics, radiation safety, and radiation oncology. Prerequisites: background in engineering or physics. *TU 3:00 pm – 4:00 pm; Rodrigues, Wilson; Bryan Research Building; 1 unit.*

MEDPHY 763 Advanced Radiation Biology in Medical Physics - This course will teach students about cutting-edge topics in the field of radiobiology that have relevance to medical physicists. The teaching will be through the format of a Journal Club. Journal Club Format. We will provide an outline for how to perform a manuscript review, prior to any student presentations. At the beginning of the semester, groups of students will select papers that they wish to present to the class. Each student assigned to a particular paper will prepare a written review and discuss their assessments with the class during one of the scheduled class dates. Class and group participation is required. Detailed report on selected subject. Students will select a topic from either the reviewed manuscripts or an approved subject of their own choosing (must contain both biology and physics components). The student will write a detailed report on this subject. We will provide a format for the report. Grading will be based upon quality of manuscript review presentations and the detailed final written report. *M 12:00 pm – 1:00 pm; Dewhirst, Palmer, Lafata; 1032 Hock Plaza, 1 unit.*

MEDPHY 781-01 Clinical shadowing of medical physicists (RT) - This course provides an opportunity to shadow clinical medical physicists in a wide range of clinical tasks that include quality assurance of imaging and radiotherapy machines, treatment planning, radiation measurement, patient treatment, etc. *TU 4:55 pm – 7:25 pm; Ginn; clinic; 1 unit.*

MEDPHY 781-02 Clinical shadowing of medical physicists (DI) - This course provides an opportunity to shadow clinical medical physicists in a wide range of clinical tasks that include quality assurance of imaging and radiotherapy machines, treatment planning, radiation measurement, patient treatment, etc. *W 4:55 pm – 7:25 pm; Robertson; clinic; 1 unit.*

MEDPHY 782 Advanced Practicum for Clinical Development in Medical Physics - This course provides an opportunity to participate in the creation of clinical learning experiences geared to individual students' needs, interests, aptitudes and desired outcomes. The student will work closely with a faculty instructor to develop a personalized project on a clinical topic. *TU 4:55 pm – 7:25 pm; Turkington; clinic; 1 unit.*

MOLECULAR CANCER BIOLOGY

https://pcb.duke.edu/education-training/molecular-cancer-biology-phd-program

MOLCAN 533 (PHARM 533) Essentials of Pharmacology and Toxicology – [Lecture] Drug absorption, distribution, excretion, and metabolism. Structure and activity relationships; drug and hormone receptors and target cell responses. Instructor consent required. Prerequisite: introductory biology; Chemistry 201DL; Mathematics 21 and 122. Slotkin; LSRC C144; *MWF 3:05 pm – 4:20 pm*

MOLCAN 733-01 (PHARM 733.01) Experimental Design and Biostatistics for Basic Biomedical Scientists - [Lecture] 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 distributions, parametric and nonparametric tests, uni- and multivariate designs, ANOVA and regression procedures. Ethical issues in data handling and presentation. Student presentations in addition to formal lectures. **Intended for third-year graduate students. Instructor consent required.** Slotkin; LSRC C144; *Tu 8:30 am – 10:15 am*

MOLCAN 733-02 (PHARM 733.02) Experimental Design and Biostatistics for Basic Biomedical Scientists - [Lecture] 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 distributions, parametric and nonparametric tests, uni- and multivariate designs, ANOVA and regression procedures. Ethical issues in data handling and presentation. Student presentations in addition to formal lectures. **Intended for third-year graduate students. Instructor consent required.** Slotkin; LSRC C144; *Wed 8:30 am – 10:15 am*

MOLCAN 733-03 (PHARM 733.03) Experimental Design and Biostatistics for Basic Biomedical Scientists - [Lecture] 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 distributions, parametric and nonparametric tests, uni- and multivariate designs, ANOVA and regression procedures. Ethical issues in data handling and presentation. Student presentations in addition to formal lectures. **Intended for third-year graduate students. Instructor consent required.** Slotkin; LSRC C144; *Th 8:30 am – 10:15 am*

MOLCAN 780 (PHARM 780) Advances in Cancer Research - [Student Seminar] A presentation and discussion course in which program faculty and graduate students review the recent progress in areas of cancer research being investigated at Duke University. Provides an important avenue for evaluation and feedback for graduate student research and is required each year for all students pursuing their Ph.D. degree in molecular cancer biology. *Th 3:30-4:40pm; Wingler/Zhao; LSRC C144, 2 Units*

MOLCAN 793 (PHARM 793) Advances in Cancer Research - [Independent Study] Laboratory investigation in various areas of pharmacology.

MOLCAN 818 (PHARM 818) Molecular Mechanisms of Oncogenesis - [Lecture] This course is a lecture presentation and discussion course on the molecular mechanisms underlying cancer development in which students complete periodic tests, present a paper, and work in a group to write and defend a grant proposal. The objective of the course is to provide an opportunity for in-depth discussions of molecular mechanisms underlying the development of human cancers. The course is intended for second-year students. *TuTh 10:15-11:30 am; Wood; LSRC C335, 3 Units*

MOLECULAR GENETICS & MICROBIOLOGY

http://mgm.duke.edu

MGM 701 Foundations of MGM – This core course is open to MGM first year students with exposure to research interests in the department. MGM faculty will provide an overview of their research along with important historical context. Credit grading only. *Tu (every other Tuesday) 4:00-5:30pm; Heaton; TBD; 1 unit*

MGM 720 Computational Tools in Next Generation Genomic Analysis – This course is an intensive, one semester course in computer skills necessary to carry out analysis of next generation genomic data. The philosophy for this course is that we are training PhD students, and they should have a fairly in-depth understanding of how this analysis is carried out. This course offers that understanding. The course will involve only a small amount of lecture, and be primarily a hands-on laboratory with extensive discussion. Permission number from Instructor required for registration. Class size is limited to 6 students. *TuTh 1:25-2:40pm and lab of 3:05-4:20pm; Dietrich; 415 Jones, 3 units*

MGM 778 (CMB, UPGEN 778) - Genetic Approaches to the Solution of Biological Problems – See UPGEN 778

MGM 790S - Topics in Molecular Genetics and Microbiology - Required course for all graduate students receiving their degree through MGM through third year of PhD program. Instructor: Scaglione and staff. 1 unit. *F (every other Friday) 4:00pm-5:30pm*

MGM 793 Research for Graduate Students - Laboratory investigation for Graduate students. Various labs within the department of molecular genetics and microbiology. Credits to be arranged. Instructor consent is required. Instructor: Scaglione. 2 units.

NEUROBIOLOGY

http://www.neuro.duke.edu

NEUROBIO 719-01 Concepts in Neuroscience I: Cellular and Molecular Neurobiology - The goal of this course is for students to gain in depth knowledge of cellular and molecular neurobiology and to learn to critically evaluate the associated primary scientific literature. This is a required core course for Neurobiology program graduate students. The course is also frequently taken by other graduate students with research interests in neuroscience including (but not limited to) those in Cognitive Neuroscience, Cell Biology, Developmental Biology, Pharmacology, Genetics, Biology, Psychology, and Biomedical Engineering.

Sep 6 – Dec 8; MWF 10:15am - 11:30am; Grandl/West; Bryan Research, room 301; 5 Units.

NEUROBIO 726S.001 Neurobiology Journal Club (Seminar): First and second year Neurobiology graduate students attend the weekly Neurobiology Invited Seminar Series. Once a month, students will meet to hold a student-run journal club to discuss the work of a speaker from an outside institution.

Weekly Tu 12:00 pm – 1:15 pm; Monthly Fri 3:30pm-4:45pm; West; Bryan Research, rooms 101 and 301; 1 Unit.

NEUROBIO 730.01 Neurostatistics: Introduction to applied probability theory and statistical methods in commonly used neuroscience.

Oct 5 – Nov 23; T Th 10:00am - 11:30am; Beck; Bryan Research, room 301; 1 Unit.

NEUROBIO 733.01 (CMB, PHARM 733.01) Experimental Design and Biostatistics for Basic Biomedical Scientists - See PHARM 733.01

NEUROBIO 751 (NEUROSCI 751) Neuroscience Boot Camp: Neuroscience Bootcamp is a two-week immersive lecture, discussion and laboratory course for graduate students in the Neurobiology Graduate Program and the Cognitive Neuroscience Admitting Program, and graduate students in allied programs at the discretion of the instructors. The Duke Neuroscience Bootcamp is designed to (1) provide a common knowledge base of neuroscience fundamentals; (2) demystify the tools of the discipline - providing hands-on experience with techniques that are commonly used to explore cellular/molecular, circuits and cognitive neuroscience.

Aug 26 - Sep 19, TWThF; 9:00am – 5:00pm; Glickfeld/Grandl/Samanez-Larkin; Bryan Research, room 301; 2 Units.

NEUROBIO 759S (PSY 759S, PHIL 753S) Principles in Cognitive Neuroscience I- Introduction to the cognitive neuroscience of emotion, social cognition, executive function, development, and consciousness. Topics also include cognitive disorders, and computer modeling. Highlights current theories, methodological advances, and controversies. Students evaluate and synthesize findings across a variety of research techniques. Consent of instructor required. *T Th 12:00pm-1:15 pm; Cabeza; 3 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 – 2:30 pm; Rebecca Yang/Jeremy Kay; 1 unit*

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)*

NEUROSCIENCE

http://www.dibs.duke.edu/education/graduate

PATHOLOGY

https://patholgy.duke.edu/education/phd-graduate-program/curriculum

PATHOL 725 Introduction to Systemic Histology The purpose of this course is to teach students how to identify a variety of normal tissues and cell types in standard histologic sections. Structure/function relationships will be emphasized, using an organ system approach. The scheduled class time includes both lecture and laboratory using "virtual microscopy", where scanned glass slides are viewed on the screen of your laptop/tablet computer. The course is open to graduate students and advanced undergraduates and is recommended for students whose research requires examination of tissue sections. *MWF 10:20-11:35 am, Hale; 3 Units*

PATHOL 735S Animal Models in Translational Research 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 principal 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, Landon, 3 Units, location TBD*

PATHOL 787 Basic Biology of Cells as a Function of Age: Implication for Disease The objective of this course is to review the fundamentals of cell biology as a function of age and their contribution to pathologies associated with age-related diseases. This course will cover a wide range of principles, including concepts and theories of aging, impact of aging on

cell regulation and signaling, metabolism and epigenetics, relevant in vitro and in vivo experimental models, and potential anti-aging therapies. The course format will involve a combination of lectures and journal club style sessions, in which students will have the opportunity to hone their analytical and critical thinking skills while evaluating current literature. *MW 9:30am-11:00am, Liton 3 Units, location TBD*

PATHOL 855 Graduate Seminar, Pathology Graduate Students only**,** This is a year-long course where each graduate student gives a presentation on his/her research in a formal setting to their peers and Pathology Graduate faculty. All Pathology graduate students are required to register for this course each semester throughout their training. Typically, 1st and 2nd year graduate students get 30 min time slots but more senior students are given 1 hr. time slots. Different aspects of presentations by the students (e.g. introduction, significance, quality and rigor of data, validity of conclusions, quality of slides, delivery style, etc.) are anonymously assessed by everyone in the audience, using critique sheets that are provided to the graduate student's mentor for review with students. As a result of the strong emphasis on the importance of oral presentation of research, and peer review, remarkable improvements in the quality and contents of student presentations have been observed each year. *Th 4:00pm-5:00pm, Abraham, 3 Units, MSRB1 001*

PHARMACOLOGY

https://pcb.duke.edu/education-training/pharmacology-phd-program

PHARM 350 Drug Actions & Reactions – [Lecture] Mechanisms of drug action, concepts of drug toxicity, resistance, tolerance, and drug interactions. Examples of how drugs affect the autonomic and central nervous systems, the cardiovascular and endocrine systems, and how drugs treat infection and cancer. This course is designed for both science and nonscience majors, but preference will be given to junior biology majors concentrating in pharmacology. Recommended prerequisite: introductory biology (Biology 201L, 203L, or equivalent) and chemistry (Chemistry 101DL or 110DL). *Sawyer; LSRC A247; TuTh 10:05 am – 11:20 am*

PHARM 393 Research – [Independent Study] Individual research in a pharmacology-related area under the supervision of a faculty member, resulting in a substantive paper or written report containing significant analysis and interpretation of the study results. Open to first-year students and sophomores with consent of supervising instructor. *Roper*

PHARM 493 Research – [Independent Study] Individual research in a pharmacology-related area under the supervision of a faculty member, resulting in a substantive paper or written report containing significant analysis and interpretation of the study results. Open to first-year students and sophomores with consent of supervising instructor. *Haystead*

PHARM 533 Essentials of Pharmacology & Toxicology - Drug absorption, distribution, excretion and metabolism. Structure and activity relationships; drug and hormone receptors and target cell responses. Consent of instructor required. *Prerequisite: introductory biology; Chemistry 151L; Mathematics 31 and 32. Instructor: Slotkin and staff, MWF 3:05-4:20 pm; LSRC C144; 4 Units*. ***NOTE:*** **CMB Students in Pharmacology are currently required to take PHR 533 Essentials in Pharmacology & Toxicology. This is also a core course for the Environmental Health Certificate.**

PHARM 733.01 (CMB, NEUROBIO, BME, MOLCAN 733.01) 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 distributions, parametric and nonparametric tests, uni- and multivariate designs, ANOVA and regression procedures. Student presentations in addition to formal lectures. Consent of instructor required. *T 8:30-10:15 am; LSRC C144; Slotkin (Runs concurrently with Section 733.02 & 733.03) 2 Units.*

PHARM 733.02 (CMB, NEUROBIO, BME, MOLCAN 733.02) 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 distributions, parametric and nonparametric tests, uni- and multivariate designs, ANOVA and regression

procedures. Student presentations in addition to formal lectures. Consent of instructor required. *W 8:30-10:15 am; LSRC C144; Slotkin (Runs concurrently with Section 733.02 & 733.03) 2 Units.*

PHARM 733.03 (CMB, NEUROBIO, BME, MOLCAN 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 distributions, parametric and nonparametric tests, uni- and multivariate designs, ANOVA and regression procedures. Student presentations in addition to formal lectures. Consent of instructor required. *Th 8:30-10:15 am; LSRC C144; Slotkin (Runs concurrently with Section 733.02 & 733.03) 2 Units.*

PHARM 780 (MOLCAN 780) Advances in Cancer Research – [Student Seminar] A presentation and discussion course in which program faculty and graduate students review the recent progress in areas of cancer research being investigated at Duke University. Provides an important avenue for evaluation and feedback for graduate student research and is required each year for all students pursuing their Ph.D. degree in molecular cancer biology. *Th 3:30-4:40pm; Wingler/Zhao; LSRC C144, 2 Units*

PHARM 793 (MOLCAN 793) Advances in Cancer Research - [Independent Study] Laboratory investigation in various areas of pharmacology.

PHARM 818 (MOLCAN 818) Molecular Mechanisms of Oncogenesis - - [Lecture] This course is a lecture presentation and discussion course on the molecular mechanisms underlying cancer development in which students complete periodic tests, present a paper, and work in a group to write and defend a grant proposal. The objective of the course is to provide an opportunity for in-depth discussions of molecular mechanisms underlying the development of human cancers. The course is intended for second-year students. *TuTh 10:15-11:30 am; Wood; LSRC C335, 3 Units*

PHARM 847S Seminar in Toxicology - [Seminar] A weekly research seminar throughout the year is required of participants in the Toxicology Program. Students, faculty, and invited speakers present their findings. *Fr 11:45-1:00 pm; Meyer; LSRC B101*

POPULATION HEALTH SCIENCES

https://populationhealth.duke.edu/education

PHS 811 Pragmatic Health Policy Research
3 hours

This course covers the foundational principles of health policy and policy science, and continues on to consider practical examples of research being used to change policy at various levels.

This course bridges the divide between analysis/methods courses (generating evidence) and policy courses (understanding specific policy areas, process and stakeholders) to help students build foundational knowledge and focused skills in framing/communicating timely, policy-relevant evidence, applicable to many population health-related career paths.

Students will increase knowledge and mastery of theoretical and substantive foundations of pragmatic policy analysis, specific policy areas and issues (e.g. SNAP, Medicaid, opioid use disorder, infant mortality, etc). *M 3:00-6:00 PM, Sandoe, 2nd Floor Imperial Building, Classroom A; 3 Units; Open to both Master's and PhD students*

PHS 813 Improving Population Health through Implementation Science
3 Hours

Implementation science addresses the translation of evidence-based practices, programs and policies into real world settings. This course will include didactic lectures, with case studies, applied group work, and a culminating real-world, hands-on implementation, dissemination, de-implementation, or QI science project. W *3:00-6:00 PM, Zullig, 2nd Floor Imperial Building, Classroom B; 3 units; Open to both Master's and PhD students*

PHS 815 Fundamentals of qualitative research implementation
3 Hours

This course prepares learners for serving as a research assistant on qualitative research studies. Learners will gain competency in 1) conducting qualitative research studies, with an emphasis on study coordination and interviewing skills, and 2) managing data and conducting applied thematic analysis.

Learners will have competency in 1) coordinating qualitative studies (e.g., screening, recruitment, regulatory, scheduling), 2) conducting qualitative interviews (e.g., demonstrable skills in leading in-depth interviews and focus groups), 3) managing study data, and 4) conducting qualitative analysis (e.g., demonstrable skills in analysis steps, use of software). *T TH, 8:30-10:00 AM, Bosworth, 2nd Floor Imperial Building, Classroom B; 3 Units; Open to both Master's and PhD students*

POPHS 890 Minicourses in Population Health: Topics Vary
1 Hour Each

Each of the POPHS 890 minicourses are worth 1 credit each. Areas covered in each minicourse will span a range of population health topics such as Climate Change & Health, Social Entrepreneurship in Population Health and Methods for Health Preference Measurement. *Fall/Spring Instructor: Varies, Schedules Vary, 2nd Floor Imperial Building, Room 204, Open to both MS and PhD students.*

UNIVERSITY PROGRAM IN GENETICS AND GENOMICS

http://upg.duke.edu

UPGEN 659 / BIOCHEM 659 Structural Biochemistry II - See BIOCHEM 659

UPGEN 658/ BIOHEM 658 Structural Biochemistry 1-See BIOCHEM 658

UPGEN 701 Advanced Topics in Genetics and Genomics - This course is open only to first year UPGG graduate class. Weekly discussion of current literature in genetics (Fall semester) and genomics (Spring Semester). This is course is meant to fill two objectives. The first objective is to ground each of the members of the UPGG first year class, regardless of their interest, in the two areas of focus of the program - namely, genetics and genomics. The second objective is to facilitate interactions among the student body by bringing the class together once a week for discussion. *T 3:45p-5:15; 2 Units.*

UPGEN 711 (BIOLOGY 701) - Succeeding in Graduate School in the Biological 0Sciences- Weekly lecture and Q&A on choosing a thesis advisor, the grant proposal and scientific manuscript peer review processes, and other topics related to succeeding in graduate school. Also counts for RCR credit. Minicourse, 1st half-semester. *W 12:00p-1:00PM; Noor;*

Online; 0.5 Units

UPGEN 716 Genetics Student Research - Presentations by genetics students on their current research. Required course for all graduate students specializing in genetics. Credit grading only. *Wednesday 4:30p-6:00 pm; John Perfect, Rytas Vilgalys; 1 Unit*

UPGEN 750 Genetics Colloquium - Lectures, and seminars on selected topics of current interest in genetics. Required of all students specializing in genetics. *Tu 12:30-1:30; Ashley-Koch; Online; 1 Unit*

UPGEN 778A-F Genetic Approaches to the Solution of Biological Problems (MGM 778) UPGEN 778A-F are six mini-courses offered sequentially during the fall semester and together cover 24 topics. These courses are part of the core offerings of the University Program in Genetics and Genomics and allow maximum flexibility for a student-designed curriculum. Multiple topics are available during each mini-course and students choose one. The topics address everything from fundamentals of genetics to modern molecular genetic and genomic strategies for the analysis of a variety of biological systems. Each mini-course consists of six classes. *MWF 2:00-3:30 pm; Ashley-Koch; Full list of topics available at* UPGG Courses; 1 *Unit per module.*