

Graduate School Core Service Curriculum

Organization of the Cell (GS-GS-501)

This course covers the principles of cellular organization and communication. The emphasis will be on cellular compartmentation, communication within and among cells, and the maintenance of cellular structure. The general features of proteostasis (i.e., protein homeostasis) in normal disease scenarios will be discussed. Protein import and export will include the endoplasmic reticulum, nucleus, lysosome and peroxisome as well as vesicular transport and secretion. Signaling within the cell will emphasize G-protein coupled signal transduction, calcium signaling and growth factors. The structural maintenance of cellular morphology will discuss the cytoskeleton, myosin, intermediate filaments and junctional complexes.

Credits: 2

Term: 1

Counts for 30 hr. requirement: Y

Director: Dr. Rick Sifers

Molecular Methods (GS-GS-502)

Molecular Methods covers methods for studying and manipulating DNA, RNA, and proteins; these range from the most basic to state-of-the-art technologies available in the Baylor College of Medicine Advanced Technology Cores. Nucleic acid topics include DNA manipulation, cloning, preparation of libraries, sequencing, next generation sequencing, genomic profiling, RNA interference and CRISPR/Cas9. Protein topics include protein expression and purification, antibody generation and applications, flow cytometry, methods to detect/visualize protein-protein interactions, proteomics/mass spectrometry, and high throughput methods to study protein/protein and protein/DNA interactions.

Credits: 3

Term: 1

Counts for 30 hr. requirement: Y

Director: Dr. Nancy Weigel

Genetics A (GS-GS-503)

This course will discuss the general principles of genetics and its implication for inheritance and variation in living organisms. First, the concepts of the gene and mutation will be introduced and their link to phenotype will be discussed. This is followed by linkage, complementation and non-Mendelian inheritance. The use of genetics as a research tool is illustrated by the molecular basis of phenotype, the dissection of genetic pathways, and the use of genetic techniques in bacteria, yeast and Humans.

Credits: 2

Revised: 07.10.2017

Term: 1

Counts for 30 hr. requirement: Y

Director: Dr. Christophe Herman and Dr. Herman Dierick

Genetics B (GS-GS-504)

This course focuses on introducing genetic approaches offered by different model organisms for solving biological problems, understanding how these models can address problems related to human diseases, and learning technical terms and concepts unique to each system. Yeast genetics will be used to demonstrate how to order genes in a genetic pathway. Classical and modern genetic methods for studying gene function in *C. elegans* during development will be discussed, as will use of *Drosophila* genetics to study pattern formation, mutation isolation and mapping and mosaic analysis. Mouse genetics (gene knock-out, generating specific strains by crosses, and the use of transgenic approaches) and human genetics (linkage and pedigree analysis, gene mapping and analysis, and population biology and evolution) will be covered.

Credits: 2

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Zheng Zhou

Cell Division (GS-GS-505)

This course examines the fundamental concepts in cell cycle regulation, DNA, telomeres and chromatin duplication, chromosome segregation as well as cytokinesis. The course presents principals of cellular response to DNA damage, telomere dysfunction, perturbation in DNA replication and chromosome segregation. The molecular mechanisms of various DNA repair pathways including recombination and their regulation in cell cycle will be discussed. The relevance of cell cycle in growth regulation, development and cancer will be presented.

Credits: 2

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Grzegorz Ira and Dr. Eric Chang

Development (GS-GS-506)

The Development of a mature organism from a single cell is one of the most fascinating problems in biology. Understanding development can shed light on fundamental processes such as gene regulation and control of the cell cycle, and on translational problems such as the origins and progression of cancer and the possibility of tissue engineering and regeneration to treat human disease. This course of 12 lectures is designed as an introduction to some of the concepts of modern developmental biology.

Credits: 2

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Andrew K. Groves

Cancer (GS-GS-508)

This is a short course on the biology of cancer. The course objective is to introduce students to basic mechanisms that lead to tumor initiation, progression, and metastasis. A history of oncogenes and tumor suppressor genes and their modern definitions are presented. Current concepts of cancer stem cells, tumor microenvironment, mouse models, and cancer therapeutics are discussed. Class includes lecture and group discussion of key recent papers in which students are expected to participate.

Credits: 1

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Stephanie Pangas

Gene Regulation (GS-GS-509)

This course focuses on the mechanisms of regulated gene expression with a focus on eukaryotes. The course begins with RNA polymerase and transcriptional regulation through transcription factors, enhancers/repressors, co-transcriptional regulation, and the effects of chromatin structure and histone modification. The details of pre-mRNA processing are covered including the major and minor spliceosomes, polyadenylation, alternative splicing, and RNA editing. Mechanisms of regulation by noncoding RNAs including miRNAs, siRNAs, piRNAs and lncRNAs are also considered. Mechanisms of regulation of translation and protein degradation complete the discussion.

Credits: 3

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Thomas Cooper

Neuroscience (GS-GS-511)

This is an introductory course covering fundamental aspects of modern neuroscience. The lecture series begins with a discussion of neural development, evolution and the resulting organization of the mammalian nervous system, then progresses into the molecular and structural specializations that allow neurons to process and transmit information via electrical current. The course next explores how neurons contribute to autonomic functions that keep us alive and higher brain functions such as learning and memory. The course will close on an examination of how neural dysfunction leads to common neurological disorders such as developmental pathophysiologies, autism, and Alzheimer's disease.

Credits: 1

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Russell Ray

Immunology (GS-GS-512)

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In the field of biology, the immune system is unique in that it crosses all organ boundaries and affects a vast number of processes critical for organismal function and survival. This short course introduces the basic cellular and molecular mechanisms of immunity. These include: the innate immune system (molecular “danger” patterns); the acquired immune system (B and T cell receptor gene rearrangement and their effector functions); the cross-talk between innate and acquired immunity; an overview of the principles of immune tolerance exemplified by mechanisms of transplant rejection and cancer immunity; and a discussion of autoimmune diseases and immunotherapies.

Credits: 1

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Jonathan Levitt

Ethics – Year 1 (GS-GS-514)

Ethics-Year 1 is the first of 4 modules on responsible conduct of research. Sessions will involve students in discussion during lectures, as well as in small groups where case studies will be reviewed. Issues surrounding data collection and documentation, research material and its ownership will be presented, as will responsible authorship, proper citation, plagiarism and copyright. A discussion will also be held for first-year students on what to look for in laboratory rotations goals, selecting mentors and keeping on track towards your degree.

Credits: 0.5

Term: 1 (not offered in AY17)

Counts for 30 hr. requirement: N

Director: Dr. Alison Bertuch

Ethics - Year 2 (GS-GS-515)

Ethics-Year 2 is the second of 4 modules on responsible conduct of research. The course will discuss research misconduct, including College and federal policies and procedures. It will also review safe practices in the laboratory and the ethics of experiments with animals. This will be followed by small group discussion covering cases studies of scientific misconduct and animal research. A discussion will also be held for second-year students and their mentors on matching goals and expectations of the mentor and student, developing communication channels and using the thesis advisory committee as a resource.

Credits: 0.5

Term: 2 (not offered in AY17)

Counts for 30 hr. requirement: N

Director: Dr. Alison Bertuch

Ethics - Year 3 (GS-GS-516)

Ethics-Year 3 is the third of 4 modules on responsible conduct of research. The course will discuss writing and review of scientific manuscripts, how grant applications are reviewed including conflicts of interest in the peer-review, and financial conflicts of interest. Collaborative research

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arrangements, particularly with industry, will be considered along with intellectual property relative to publication and thesis submission. There will be a small group discussion covering case studies associated with these topics. A discussion will also be held for third-year students and their mentors on matching goals and expectations of the mentor and student, evaluating progress towards degree and alternative approaches for risky projects.

Credits: 0.5

Term: 3 (not offered in AY17)

Counts for 30 hr. requirement: N

Director: Dr. Alison Bertuch

Ethics - Year 4 (GS-GS-517)

Ethics-Year 4 is the fourth of 4 modules on responsible conduct of research. The course will discuss ethical considerations in research involving human subjects, including experiments with human derived materials and informed consent. A discussion on contemporary ethics issues and the scientist as a responsible member of society is included. This will be followed by a small group discussion covering case studies associated with these topics. A discussion will also be held for fourth-year students and their mentors on expectations of mentor and student, setting goals and timelines for graduation, career decisions and planning for the next step.

Credits: 0.5

Term: 3 (not offered in AY17)

Counts for 30 hr. requirement: N

Director: Dr. Alison Bertuch

Macromolecules: Structure and Interactions (GS-GS-518)

This course will provide fundamental information on macromolecular structures, techniques used in structure determination, principles of thermodynamics and kinetics, and how this information can be leveraged to design/develop lead compounds to modulate disease targets for clinical relevance with the help of novel cell-based screening techniques.

Credits: 3

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. B.V. Venkatar Prasad and Dr. Ming Zhou

Introduction to Scientific Writing (GS-GS-519)

This course will increase student knowledge and skills in effective scientific writing. Students will learn basic principles of scientific writing that they can put into practice immediately such as selecting high impact words, building effective sentences and paragraphs, and structuring individual sections of a scientific manuscript. The course, which centers on the concept of writing with clarity and brevity, includes exercises to build skills.

Credits: 1

Term: 4

Counts for 30 hr. requirement: N

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Director: Dr. Susan Marriott

Research Design (GS-GS-522)

This course is designed to guide the student through the process of identifying a research problem, developing specific hypotheses and designing well-controlled experiments to test them. It will be taught in small groups of ~8 students/class. A faculty mentor helps formalize and organize the process, but students will develop their ideas through literature searches and discussion. The terms and discussion will center around the NIH format for grant applications (Specific Aims, Background and Significance, Experimental Design).

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. B.V. Venkatar Prasad

Method and Logic in Molecular Biology (GS-GS-523)

This course is intended to train students to read and critically interpret the primary literature. Students will learn what constitutes a well-designed experiment with proper controls. Small groups of students (8-10) will meet twice per week to discuss two assigned journal articles. The first meeting will be without faculty participation while the second meeting will be guided by one or two instructors per group. The first meeting will allow students the opportunity to independently address the scientific merit and design of the assigned readings and formulate their own opinions. During the second meeting, instructors will guide a discussion among students to bring out the salient features of the readings pertinent to the goals of the course.

Credits: 3

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Graeme Mardon and Dr. Melissa Suter

Introduction to Intellectual Property (GS-GS-525)

So you now have a great discovery or idea, how can you protect and market it? In this course we will learn about intellectual property law and technology transfer. We will cover different types of intellectual property, such as patents, trademarks, copyrights, etc., with an emphasis on genetic and biotechnology patents, both in the USA and internationally. We will also discuss copyrights: their nature, acquisition, and how to avoid infringing them, with an emphasis in instructional activity and educational settings.

Credits: 1

Term: 4

Counts for 30 hr. requirement: N

Director: Dr. Patrick Turley

ABC-Applications to Biology of Computation (GS-GS-527)

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The course will offer a broad survey of different topics from a computational perspective: genomics, epigenomics, population genetics, transcriptomics, proteomics, structure-function, systems biology, networks, cellular imaging, phylogenomics, pattern discovery, drug design, medical informatics, the microbiome, the cancer genome and neurosystems. The objectives are to become familiar with basic computational challenges in these fields and with the current algorithmic solutions.

Credits: 2

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Olivier Lichtarge

Responsible Conduct of Research – Year 1 (GS-GS- 528)

Sessions will involve students in discussion during lectures, as well as in small groups where case studies will be reviewed. Students will be mentored on this scientific process (accessing the scientific literature, thinking with the scientific method). Issues surrounding rigor, reproducibility, research material and its ownership will be presented, as will responsible authorship, plagiarism and copyright. Classes will also be devoted to the practical aspects of being a student scientist such as what to look for in laboratory rotations, selecting mentors, coping with stress and deadlines, what to do when experiments don't work, and how to go about career decision-making as well as professional aspects of being a scientist such as funding and advocacy.

Credits: 1

Term: 1

Counts for 30 hr. requirement: N

Director: Dr. Alison Bertuch

Responsible Conduct of Research – Year 2 (GS-GS-529)

Sessions will involve students in discussion during three lectures, as well as in one small group session where case studies will be reviewed. Students will be mentored on research misconduct, focusing on topics such as falsification, fabrication, and plagiarism. College and federal policies and procedures for handling misconduct allegations will be reviewed. A session with 2nd year students and their mentors will review expectations between mentor and student. Students will receive training on the ethics of biomedical studies with animals, covering topics such as when can animals be used ethically in research, the importance of avoiding unnecessary pain/suffering and euthanasia, and animal use approval. The final session, which will be held in a small group discussion format with faculty facilitators, will focus on case studies involving scientific misconduct and experiments with animals.

Credits: 0.5

Term: 2

Counts for 30 hr. requirement: N

Director: Dr. Alison Bertuch

Responsible Conduct of Research – Year 3 (GS-GS-530)

Sessions will involve students in discussion during four lectures, as well as in one small group

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session where case studies will be reviewed. Topics covered during this module include authorship and peer review, conflicts of interest and their management, and collaboration, within academia and with industry,. The mentorship lecture will be a meeting with 3rd year students and their mentors. The final large group session will be focused on rigor and reproducibility using interactive case studies, reviewing principles introduced in year 1. Finally, the session conducted in a small group discussion format with faculty facilitator will be utilize case studies to highlight issues relevant to the review of grants and papers, conflicts of interest, and collaboration.

Credits: 0.5

Term: 3

Counts for 30 hr. requirement: N

Director: Dr. Alison Bertuch

Responsible Conduct of Research – Year 4 (GS-GS-531)

Sessions will involve students in discussion during three lectures, as well as in one small group session where case studies will be reviewed. Topics covered during the lecture on research with human subjects will include defining what constitutes research with human subjects versus experiments with human material, confidentiality of medical data, and informed consent. The mentorship session on will be a meeting with 4th year students and their mentors. The lecture on the scientist as a responsible member of society will address contemporary ethical issues in biomedical research and the environmental and societal impacts of scientific research. Finally, the session conducted in a small group discussion format with faculty facilitator will utilize case studies to highlight issues relevant to research with human subjects and societal impact of research, focused on genetics/genomics, stem cells and neuroethics.

Credits: 0.5

Term: 3

Counts for 30 hr. requirement: N

Director: Dr. Alison Bertuch

MSTP Reading (GS-GS-548)

MSTP Reading provides MSTP students early in their combined physician-scientist training with in-depth exposure to critical reading of the current biomedical literature in order to improve their ability to identify and design research strategies for solving current biomedical problems.

Credits: 1.5

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Sharon Plon

Biochemistry and Molecular Biology

Thinking Like A Scientist (GS-BC 400)

This is the first in a series of 4 courses that aim to help first year graduate students develop the

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critical thinking, speaking and writing skills that are necessary for their professional success in graduate school and beyond. In this term, students set short-term professional goals around courses and laboratory rotations and gain strategies to improve their skills in technical writing and critical evaluation of the literature. Learning is achieved through group-based problem solving.

Credits: 1

Terms: 1

Counts for 30 hr. requirement: N

Director: Dr. Anna Sokac

Thinking Like a Scientist - Term 2 (GS-BC 407)

The goal of this term is to develop critical reading skills for evaluating the scientific literature. For a set of assigned papers, student will learn to identify the gap in knowledge and the hypothesis that was tested, and analyze the experimental outcomes in relation to the hypothesis. Students will also develop reasonable future directions in the form of a new set of hypotheses that follow from the results of each paper. Each week one student will present an assigned paper in the style of a journal-club. The other students will write a summary of the same paper, highlighting the logical flow of the paper.

Credits: 2

Terms: 2

Counts for 30 hr. requirement: Y

Director: Dr. Anna Sokac and Dr. Ido Golding

Thinking Like a Scientist - Term 3 (GS-BC 408)

The goal of this term is to build up on the analytical and presentation skills students develop through critical reading of the literature in Term 2. Students will continue to use the concept of the framing funnel to identify an existing gap in knowledge, and formulate a hypothesis/model that makes specific predictions that can be critically tested experimentally. Each student will write an abstract of a research proposal that will be discussed and revised in response from feedback from students and faculty.

Credits: 2

Terms: 3

Counts for 30 hr. requirement: Y

Director: Dr. Shelley Sazer

Thinking Like a Scientist – Term 4 (GS-BC 409)

The goal of this term is to build upon the activities of Term 3 that culminated in writing a proposal abstract. Students will do additional literature-based research to add both depth and breadth to each component of the abstract using the concept of the framing funnel. Each student will write a full research proposal that will be discussed and revised in response from feedback from students and faculty. The student will then present and defend the proposal to other students and faculty.

Credits: 2

Terms: 4

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Counts for 30 hr. requirement: Y

Director: Shelley Sazer

Special Projects (GS-BC 435)

Faculty mentored research for students that have selected their thesis advisor not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. B.V. Venkatar Prasad

Special Topics (GS-BC 463)

Scholarly study directed by a faculty member. Special topics allows a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr. course requirement.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. B.V. Venkatar Prasad

Seminar in Biochemistry (GS-BC-466)

Student Seminar

Credits: 1

Term: 1, 2, 3, 4

Counts for 30 hr. requirement: N

Director: Dr. B.V. Venkatar Prasad

Readings (GS-BC 548)

Faculty directed literature projects that survey a specialized topic of interest.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. B.V. Venkatar Prasad

Research Rotation (GS-BC 549)

Faculty mentored research for students who have not yet selected a faculty advisor

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. B.V. Venkatar Prasad

Dissertation (GS-BC 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. B.V. Venkatar Prasad

Clinical Scientist Training Program

Fundamentals of Clinical Investigation (GS-CT- 400)

The objective of this course is to train students to interpret the results of other clinical investigators and to use the knowledge for providing state-of-the-art care for their patients. The course includes three modules reflecting specific areas relevant to a clinical researcher. These modules are: principles of clinical research; statistical methods in clinical research; special topics.

Credits: 3

Term: 1

Counts for 30 hr. requirement: Y

Director: Dr. Ashok Balasubramanyam

CICS I: Grant Development for Clinical Investigators (GS-CT- 403)

This course provides students with the skills to develop an important research question, formulate strong hypotheses and specific aims, and begin to draft the components of a career development grant proposal.

Credits: 2

Terms: 1

Counts for 30 hr. requirement: Y

Director: Dr. Ashok Balasubramanyam

CICS II: Clinical Trials for Clinical Investigators (GS-CT- 404)

This course provides students with an understanding of the theory and practice of conducting scientifically rigorous clinical trials. Building on the work of the previous CICS I course and from knowledge gained from the Fundamentals in Clinical Investigation course, students will fully develop the hypothesis, specific aims, and experimental design of their projects.

Credits: 3

Terms: 2

Counts for 30 hr. requirement: Y

Director: Dr. Frederick Pereira

Prerequisites: CICS I: Grant Development for Clinical Investigators (GS-CT-403) and Fundamentals

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of Clinical Investigation (GS-CT-400)

CICS III: Translational Research for Clinical Investigators (GS-CT- 405)

This course provides students with an understanding of the theory and practice of conducting bench-to-bedside translational research. Building on the work of the previous term, students will continue the development of a K-type grant proposal, focusing on the career development plan and mentor's letters.

Credits: 3

Terms: 3

Counts for 30 hr. requirement: Y

Director: Dr. Jesus Vallejo

Prerequisites: CICS I: Grant Development for Clinical Investigators (GS-CT-403) and Clinical Trials for Clinical Investigators (GS-CT-404)

CICS IV: Health Services Research for Clinical Investigators (GS-CT- 406)

This course provides students with an understanding of the theory and practice of health services research. Building on the work of the previous term, students will continue the development of a K-type grant proposal.

Credits: 3

Terms: 4

Counts for 30 hr. requirement: Y

Director: Dr. Frederick Pereira

Prerequisites: CICS I: Grant Development for Clinical Investigators (GS-CT-403) and Translational Research for Clinical Investigators (GS-CT-405)

CICS V: Evaluating a Completed Career Development Grant (GS-CT- 407)

This course provides students with an appreciation of the NIH study section review process and a completed career development award.

Credits: 2

Terms: 5

Counts for 30 hr. requirement: Y

Director: Dr. Ashok Balasubramanyam

Prerequisites: CICS I: Grant Development for Clinical Investigators (GS-CT-403) and CICS IV: Health Services Research for Clinical Investigators (GS-CT-406)

Development and Commercialization of Biomedical Innovations (GS-CT- 408)

This course provides a general overview of the steps required to move a biomedical innovation into the marketplace. The course begins with an overview of the ecosystem and a framework to assess opportunities for product development and commercialization. Other lectures take the students through the product development process, and provide insights into strategies for funding

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translational research projects through the “valley of death” gap that exists between basic research funding and commercial funding. Other topics include an introduction to intellectual property basics, and options for commercialization of biomedical assets, licensing and new ventures.

Credits: 1

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Ashok Balasubramanyam

Responsible Conduct of Research for Clinical Investigators (GS-CT- 409)

The RCRCI course is designed for the early career scientist/clinical or translational investigator, and will provide students with a fundamental competency and appreciation for the core topics within the ethical dimensions of biomedical research. During this one-week course, students will receive lectures from faculty with expertise in each of these core topics, to be followed by small group case study discussions illustrating ethics topics from the preceding lecture.

Credits: 1

Term: 1

Counts for 30 hr. requirement: N

Director: Dr. Maria Gramatges

Special Projects (GS-CT- 435)

Faculty mentored research for MS students or PhD students that have selected their thesis advisor but have not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Ashok Balasubramanyam

Seminar in Clinical Sciences (GS-CT- 466)

The purpose of this course is to provide a forum for students to improve their knowledge and skills in planning, preparing and effectively presenting their research to an inter-disciplinary audience.

Credits: 1

Term: 1, 2, 3, 4, 5 (not offered in AY17)

Counts for 30 hr. requirement: N

Director: Dr. Ashok Balasubramanyam

Reading – CSTP (GS-CT- 548)

Faculty directed literature reading projects that survey a specialized topic of interest to the student.

Credits: 1

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Ashok Balasubramanyam

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Research Rotation (GS-CT- 549)

Faculty mentored research for students who have not yet selected a faculty advisor

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Ashok Balasubramanyam

Dissertation (GS-CT- 550)

Thesis research directed by a faculty mentor and thesis advisory committee. Open only to candidates for the PhD degree.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Ashok Balasubramanyam

Developmental Biology

Preparing for Your Developmental Biology Qualifying Exam (GS-DB-400)

This course will explain the requirements and expectations of the Developmental Biology qualifying exam. The course is geared specially towards second year students who have successfully completed their first year coursework and several months' work in their chosen thesis lab. The course will cover the format of the written and oral exams, tips for structuring the aims and scope of the written proposal, and provide students with opportunity to develop and deliver their oral presentation for feedback from the group. The goal of the course is to help students begin thinking about their work independently and to present their research problem and experimental goals clearly. Ultimately, this course is intended to encourage independent NRSA or other fellowship applications from those students who qualify.

Credits: 1

Term: 2

Counts for 30 hr. requirement: N

Directors: Dr. Melanie Samuel and Dr. Benjamin Arenkiel

Classical Developmental Biology (GS-DB- 402)

This course provides introductory information related to major questions in developmental biology. It also provides an introduction to classical experimental methods and examples are provided which highlight how developmental principles have been tested. These examples will allow the students to grasp how earlier investigations presaged present areas of inquiry for each organism. The course introduces the anatomy and histology of most organs and cells during development with a particular emphasis on *C. elegans*, *Drosophila*, mouse, chick, zebrafish, and *Xenopus*. The development of each organism is described in lectures and observed by the students in lab settings so that students can readily grasp the complex issues of modern developmental biology and begin to see how

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questions might be approached.

Credits: 2

Term: 1

Counts for 30 hr. requirement: Y

Directors: Dr. Ross Poché and Dr. Michael Lewis

Neural Development (GS-DB- 403)

This advanced graduate course in developmental neurobiology provides students with a more detailed background of neural development that will serve as conceptual framework for future studies. It particularly focuses on molecular genetic studies that have helped us elucidate the mechanisms underlying the development of the nervous system. This course integrates knowledge about molecular patterning of the nervous system using a cross-species approach that also emphasizes evolutionary relationships. The role of genes and mechanisms that play a role in the selection of neuroblasts and neuronal differentiation, in the specification and function of glial cells, in growth cone guidance and synapse formation are covered in detail.

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Directors: Dr. Benjamin Arenkiel and Dr. Roy Sillitoe

Molecular & Developmental Biology of Vision Research (GS-DB- 404)

This course provides graduate students and postdoctoral fellows with broad exposure to the molecular genetics underlying normal and abnormal visual system development and function. This course offers an in-depth analysis of normal vertebrate and invertebrate development, genetic causes of disease, as well as the use of animal models for genetic analysis of normal and abnormal development and function.

Credits: 1

Terms: 4

Counts for 30 hr. requirement: Y

Director: Dr. Graeme Mardon

Evolutionary Conservation of Developmental Mechanisms (GS-DB- 422)

This course focuses on the similarities and differences of developmental mechanisms between vertebrates and invertebrates. Invertebrates, such as *Drosophila* and *C. elegans*, have allowed scientists to isolate many genes that are required for proper development through genetic screens. Vertebrate homologs of many of these genes have been identified, and their role is being studied through a variety of approaches, including manipulations in chick and zebrafish as well as through mouse knockouts. The view of vertebrate and invertebrate developmental biologists on a series of topics like segmentation, Hox and Polycomb-group genes, limb development, and cell death is presented in this course. In addition, the lecturers discuss and compare the function of proteins required for specific developmental pathways in invertebrates whose homologs are involved in tumorigenesis in vertebrates. Additional topics include: evolution, evolutionary trees, and the

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evolution of developmental pathways, as well as how during evolution numerous molecular players are conserved and how they are deployed in various developmental processes in diverse organisms.

Credits: 2

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Andrew Groves

Topics in Development (GS-DB- 425)

The purpose of this course is to introduce the students to some current topics in developmental biology, to improve the students' ability to read and interpret primary literature, and to improve the students' skills in presenting scientific data. A lecturer introduces a topic and then assigns two papers to two students to present in the next lecture. All students are expected to critically evaluate and interpret the assigned papers prior to attending class, and the selected students prepare a 45 min lecture on the assigned topic. Each student presents twice. Topics discussed include sex determination, epithelial morphogenesis and cancer, hematopoietic and cardiac development, stem cell therapy, skin cancer, nuclear hormone receptors, cell motility and invasive behavior (metastasis), and ectoderm-mesoderm interactions.

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Mirjana Maletic-Savatic and Dr. Joshua Wythe

Special Projects (GS-DB- 435)

Faculty mentored research for students who have selected their thesis advisor but have not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Andrew Groves

Special Topics (GS-DB- 463)

Scholarly study directed by a faculty member. Special topics allows a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr. didactic course requirement.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Andrew Groves

Seminar in Developmental Biology (GS-DB- 466)

The purpose of this course is to guide the students into learning how to approach scientific literature directly. Students are expected to read the primary literature and lead discussions in a group setting.

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Students in the Program in Developmental Biology participate in this seminar every term during their first four years at BCM.

Credits: 1

Term: 2, 3, 4

Counts for 30 hr. requirement: N

Director: Dr. Andrew Groves

Readings (GS-DB- 548)

Faculty directed literature projects that survey a specialized topic of interest to the student.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Andrew Groves

Research Rotation (GS-DB- 549)

Faculty mentored research for students who have not yet selected a faculty advisor .

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Andrew Groves

Dissertation (GS-DB- 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degrees.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Andrew Groves

Immunology

Logic and Presentation of Problem-Solving (GS-IM- 400)

Understanding and presenting research in a logical manner is a critical skill for scientists. This course dissects of the logic of problem-solving science through using the rubrics of "OPTEMA" (Observations; Problematization; Testable ideas; Experimental design: Methods; and Analysis) and teaches both logical analysis and presentation through the One Figure Journal Club in which class participants including the instructor work through a single journal club article. In addition, the elements of scientific discourse, scientific statements with their associated citations, are approached using the evidential typology of Bruno Latour and a typology of citation –functions.

Credits: 1

Term: 1

Revised: 07.10.2017

Counts for 30 hr. requirement: N

Director: Dr. John Rodgers

Logic and Rhetoric of Writing Science (GS-IM- 401)

Uses structure-functional analysis of scientific text to teach techniques of reading and writing science articles based on logic and rhetoric principles of *transdiscourse* (including summary, synopsis, paraphrase and, occasionally, quotation) and *metadiscourse* (including *hedges* and *boosts*).

Credits: 1

Term: 2

Counts for 30 hr. requirement: N

Director: Dr. John Rodgers

Logic and Rhetoric of Writing Proposals (GS-IM- 402)

This course covers the logic of experimental design for general experimentation and grant proposals and the art of persuasion as it pertains to grant proposals. It will also cover the needs to students preparing for qualifying exams.

Credits: 1

Term: 4

Counts for 30 hr. requirement: N

Director: Dr. John Rodgers

Clinical Aspects of Immunology (GS-IM- 405)

This course is designed for immunology students to learn more about the roles and importance of immunology in various human diseases and animal models, including cancer immunology, autoimmune diseases, infectious/tropical diseases, allergy and immunodeficiency. The goals of this course are to introduce students to these active research topics, to bridge basic immunology to clinical immunology, and motivate them for the selection of their own research topics related to important human diseases. This course will combine faculty lectures (50%), student presentations of scientific papers and student-designed future directions in the selected topics (50%).

Credits: 3

Term: 5

Counts for 30 hr. requirement: Y

Director: Dr. Richard Cook

Seminars in Immunology Research (GS-IM-407)

Graduate students will attend a weekly research seminar series. Presentations in this series are by Baylor Faculty, Postdoctoral Fellows and Graduate students as well as presentations by scientists from other institutions. Students having passed their Qualification Exam will present their laboratory research once per year. Faculty and student evaluators will provide student presenters with useful written and oral feedback on their presentations based on anchored rubrics.

Credits: 1

Revised: 07.10.2017

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Gretchen Diehl

Immunology (GS-IM- 423)

This is a series of lectures stressing basic concepts in immunology. These include immunoanatomy and cytology, innate immunity, development of the immune system, immunoglobulin structure and genetics, antigen-antibody reactions, the major histocompatibility complex and antigen presentation, T cell receptors (genetics, structure, selection), T cell activation and effector functions, cell trafficking, phagocytic cell functions, immune responses to infections organisms and tumors, autoimmunity, allergies and immunodeficiency. The course includes weekly reviews led by senior graduate students that help to explore and clarify concepts.

Credits: 3

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Jonathan Levitt

Regulation of Immune Responses (GS-IM- 425)

This course is composed of mini-lectures by faculty (30%) and student presentations and discussions of articles (70%) from the current literature. Students receive written constructive comments from the instructors to help improve their presentation content and style. The focus of the articles, selected by the participating faculty, is on the cells, proteins and mechanisms that regulate cellular and humoral immune responses. Topics that are covered include pathways for antigen presentation by MHC molecules, thymic selection, T cell receptor structure/function, T cell co-stimulation, regulatory and memory T cells, dendritic cells, NK, CD4 and CD8 cell function, autophagy, toll-like receptors, cell-cell interaction molecules, and B cell activation and differentiation.

Credits: 3

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Richard Cook

Molecular Immunology (GS-IM- 428)

This course consists of a series of faculty lectures (50%) and student-led discussions (50%) of major molecular mechanisms that control immune responses. Students receive written constructive comments from the instructors to help improve their presentation content and style. The course approaches the subject of immunology from the viewpoints of innate immunity, the immunological synapse, ion channels, central and peripheral tolerance, microRNA control of gene regulation in lymphocytes, lymphocyte activation and CTL killing. Each student develops a research proposal in an area covered in the course, guided by the companion course GS-IM 406.

Credits: 3

Term: 4

Revised: 07.10.2017

Counts for 30 hr. requirement: Y

Director: Dr. Richard Cook

Special Projects (GS-IM- 435)

Faculty mentored research for students that have not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. John Rodgers

Immunology Journal Club (GS-IM- 446)

This course consists of weekly meetings, attended by students and faculty, for student presentations and discussions of high impact literature in immunology. These weekly meetings are considered a part of a student's education. Students are required to attend all immunology seminars.

Credits: 1

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Min Chen

Special Topics (GS-IM- 463)

Scholarly study directed by a faculty member. Special topics allows a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr course requirement.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. John Rodgers

Readings (GS-IM- 548)

Faculty-directed literature projects that survey a specialized topic of interest.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. John Rodgers

Research Rotation (GS-IM- 549)

Faculty-mentored research for students who have not yet selected a faculty advisor.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Revised: 07.10.2017

Director: Dr. John Rodgers

Dissertation (GS-IM- 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. John Rodgers

Integrative Program in Molecular and Biomedical Sciences

IMBS Director's Course (GS-MB- 401)

This course will prepare students to become leaders in interdisciplinary and integrative cell and molecular biomedical research by developing practical and intellectual skills very early in their training. The objectives are to: i) identify and evaluate the primary scientific literature and interpret the results; ii) evaluate and identify critical problems, identify significance and innovative approaches; iii), develop and justify the scientific rationale, testable hypotheses, design rigorous experimental approaches to test leading hypotheses using multiple and independent predictions; iv) develop specific aims and grant proposals; v) develop scientific writing skills; vi) write and orally defend a mock grant proposal; and vii) develop and give lucid presentations.

Credits: 1

Term: 1, 2, 3, 4

Counts for 30 hr. requirement: N

Director: Dr. Frederick Pereira

Biology of Aging & Age Related Diseases (GS-MB- 430)

This course provides students and post-docs with the most up-to-date information on current understanding of the aging process and age-related human disorders. The course not only covers molecular aspects of aging research, including models and theories of aging, but also clinical perspectives of aging. This advanced (elective) graduate course is offered for students who wish to either specialize in or have a strong background in the interrelated areas of development, aging and age-related diseases. Students are strongly encouraged to actively participate by posing questions and contributing to discussions of each topic.

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Frederick Pereira

Translational Cancer Biology (GS-MB- 431)

This course integrates the basic science and translational aspects of research with clinical applications, thus enhancing student understanding of current research and clinical correlations in particular cancers. Each week will have a particular cancer focus and the meeting time will include a clinically focused lecture, a basic science focused lecture, and a journal club article presented by students. Students will attend a minimum of two tumor board sessions during the term, which include a patient case presentation followed by discussion detailing the background, treatment, outcomes, and research avenues of the patient's malignancy. These tumor boards can be attended at any time during the course.

Credits: 2

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Jason Yustein

Special Projects (GS-MB- 435)

Faculty mentored research for students that have not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. David Nelson

Special Topics (GS-MB- 463)

Scholarly study directed by a faculty member. Special topics allow a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr course requirement.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. David Nelson

Seminar in Cell & Molecular Biology (GS-MB- 466)

This is a Research in Progress Seminar Series for students enrolled in the Integrative Molecular and Biomedical Sciences Graduate Program (IMBS). The objective of the course is for students within the Graduate Program to have an opportunity to present their ongoing research to a diverse group of colleagues, and to receive feedback from these colleagues in regards to the quality of their presentation and work. The aggregate of the IMBS student body is divided into student six critique groups, two of which are assigned to each seminar on a rotating basis. Each member of the assigned critique group is required to complete one of two evaluation forms (Presentation Style or Scientific Rigor) and return it to the student presenting.

Credits: 1

Term: 1, 2, 3, 4, 5

Revised: 07.10.2017

Counts for 30 hr. requirement: N
Director: Dr. Joel Neilson

Readings (GS-MB- 548)

Faculty directed literature projects that survey a specialized topic of interest.
Credits: Variable
Term: 1, 2, 3, 4, 5
Counts for 30 hr. requirement: N
Director: Dr. David Nelson

Research Rotation (GS-MB 549)

Faculty mentored research for students who have not yet selected a faculty advisor
Credits: Variable
Term: 1, 2, 3, 4, 5
Counts for 30 hr. requirement: N
Director: Dr. David Nelson

Dissertation (GS-MB 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree
Credits: Variable
Term: 1, 2, 3, 4, 5
Counts for 30 hr. requirement: N
Director: Dr. David Nelson

Molecular and Cellular Biology

Explorative Data Analysis (GS-CB-400)

Explorative Data Analysis will teach concepts of statistical learning and of data integration in database systems that together will enable students to explore and learn from large and complex datasets to generate new and unique biological insights. The approach to teaching will emphasize methods of statistical learning and their conceptual underpinnings rather than their mathematical properties, and will use a hands-on approach to progressive 'omics'-data integration and mining by using community-based resources for data analysis rather than on writing codes

Credits: 2

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Rainer Lanz

Reproductive Biology (GS-CB- 406)

Reproductive Biology covers mammalian reproductive processes at all levels of biological organization (anatomical, physiological, cellular, biochemical and molecular). The course is taught with a comparative approach analyzing findings in different animal model systems and clinical studies to ensure that clinical issues affecting reproductive success are presented, and to also demonstrate how basic science is moving toward understanding the causes and treating reproductive failure and diseases.

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. JoAnne Richards and Dr. Stephanie Pangas

Cellular Signaling (GS-CB- 425)

Cellular signaling covers major cellular signaling pathways, actions of intracellular kinases and nuclear receptors, and strategies for regulating cell signaling. The pathways covered include those regulated by GPCR, receptor tyrosine kinases, TGF β , Notch, Hedgehog, WNT, Hippo and nuclear receptors. In addition, signaling pathways regulated by small molecules including calcium, phospholipids, cAMP, cGMP, and AMP are discussed.

Credits: 3

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Nancy Weigel

Integrated Microscopy (GS-CB- 426)

The course is composed of a set of lectures that cover basic and advanced forms of light and electron microscopy, and an accompanying set of practical labs where students receive hands-on training on all the available instruments. The main topics addressed in the class are: basic optics,

Revised: 07.10.2017

light- and fluorescence-based microscopy (i.e., brightfield, DIC, phase contrast, deconvolution, confocal, live cell imaging), fluorescence-based molecular tools (i.e., FRET, FRAP, fluorescent proteins), transmission electron microscopy, super-resolution microscopy (i.e., SIM, STORM), and specialized automated high throughput microscopy and image analysis.

Credits: 2

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Michael Mancini and Dr. Fabio Stossi

Special Projects (GS-CB- 435)

Faculty mentored research for students that have not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. JoAnne Richards

Introduction to Molecular Carcinogenesis (GS-CB- 457)

The course explores the fundamental concepts and experiments in tumor biology, cancer virology and oncogenes and growth control. This course provides a broad based introduction to students who have an interest in modern cancer research. Faculty from four departments (Cell Biology, Molecular Virology, Pharmacology and Biochemistry) serve as instructors.

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Yi Li

Cells, Tissues and Organs (GS-CB- 461)

The Cells, Tissues and Organs course focuses on analysis of structure/function relationships in tissues and organs. This will include correlating tissue histology with organ physiology. Interactive lectures and discussions occur simultaneously with direct observation of human and some animal model tissues by the students through multi-head microscopes with a pathologist. Students participate in weekly essays and presentations.

Credits: 2

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. David Rowley

Special Topics (GS-CB- 463)

Scholarly study directed by a faculty member. Special topics allows a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr course requirement.

Revised: 07.10.2017

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Joanne Richards

Introduction to Research and Research Proposals (GS-CB- 465)

Introduction to Research & Research Proposals addresses topics relevant to the successful conduct of research including plagiarism and misconduct, and preparation of effective oral and poster presentations and research papers, as well as optimizing use of web-based resources. The second section of the course instructs students in how to prepare a competitive grant proposal with emphasis on developing research plans, design and analysis of experiments and enhancing significance and innovation with the goal of preparing students to take their qualifying examination.

Credits: 1

Term: 5

Counts for 30 hr. requirement: N

Director: Dr. John Lydon

Seminar in Cell Biology (GS-CB- 466)

Student Seminar

Credits: 1

Term: 1, 4

Counts for 30 hr. requirement: N

Director: Dr. Charles Foulds

Regulation of Energy Homeostasis (GS-CB- 468)

Regulation of Energy Homeostasis addresses the control of metabolism in health and disease, and how energy balance is signaled among organs. Emphasis will be placed on defining regulatory mechanisms and pathways, with particular attention to abnormalities occurring with disease. The approach will be inter-disciplinary, including metabolomic, biochemical, genetic and cellular aspects.

Credits: 2

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Robb Moses and Dr. David Moore

Readings (GS-CB- 548)

Faculty directed literature projects that survey a specialized topic of interest.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. JoAnne Richards

Revised: 07.10.2017

Readings B (GS-CB- 548B)

Faculty directed literature projects that survey a specialized topic of interest.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. JoAnne Richards

Research Rotation (GS-CB- 549)

Faculty mentored research for students who have not yet selected a faculty advisor.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. JoAnne Richards

Dissertation (GS-CB- 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. JoAnne Richards

Molecular and Human Genetics

Introduction to Data Mining (GS-GE- 402)

Data mining provides practical approaches and tools that allow biomedical researchers to analyze and understand their data and to craft new hypotheses. The course will focus on data mining essentials and will cover standard approaches to clustering, classification, regression and model selection, along with several domain-oriented techniques such as gene enrichment analysis. We will focus on applications of these methods through a visual programming platform that requires no training in programming. We will provide a basic introduction to the inner workings and mathematics, helping students to intuitively understand the data analysis algorithms without having to understand deep mathematical concepts.

Credits: 2

Term: 1

Counts for 30 hr. requirement: Y

Director: Dr. Gad Shaulsky

Gene and Cell Therapy (GS-GE- 403)

This course covers various approaches to somatic and germ cell gene therapy, with emphasis on vector systems and other methods for gene delivery and targeting; model systems for specific applications of gene therapy; and the status of current therapeutic strategies for various inherited and acquired disorders.

Credits: 2

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Philip Ng

Human Genetics (GS-GE- 411)

The goal of this course is help graduate students learn the fundamental principles of human genetics they will need to be effective contributors to the field of human genetics. By the end of the course, students will have an increased ability to comprehend the human genetics literature, conduct human genetics research, accurately interpret genetic data obtained from human subjects and communicate these findings to other researchers and the general public.

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Daryl Scott

Clinical Genetics (GS-GE- 419)

The course is aimed at training graduate students in the applied aspects of clinical genetics. Students will learn how Human Geneticists address medical genetic problems in the clinic, interact with genetic fellows and learn how to design tests and experiments to address clinical problems.

Credits: 1

Term: 1

Counts for 30 hr. requirement: Y

Director: Dr. Daryl Scott

Mammalian Genetics (GS-GE- 421)

This course describes the contribution of mammalian cell culture and somatic cell genetics to the understanding of molecular mechanisms of gene expression. Topics covered include mammalian cell culture systems, properties of permanent and primary cell lines, isolation and selection of mutant cell lines, gene mapping, complementation analysis, cell hybrids, DNA mediated gene transfer, DNA and RNA viral vectors for gene transfer, gene transfer to the germline and somatic cells of animals.

Credits: 2

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Hamed Jafar-Nejad and Dr. Jason Heaney

Revised: 07.10.2017

Introduction to Medical Genetics (GS-GE- 425)

This course will: provide students insight into the specialty of medical genetics and its place within the practice of medicine in the United States; offer students an opportunity to understand what it is like to be a medical geneticist and work in a diagnostic laboratory; and, inform students about educational and training requirements that lead to eligibility for board certification by the ABMG. The focus of the course will be on laboratory specialties, however, the specialties of Clinical Genetics and Genetic Counseling will also be discussed.

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Marco Sardiello

Special Projects (GS-GE- 435)

Faculty mentored research for students that have not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Gad Shaulsky

Bioinformatics and Genomic Analysis (GS-GE- 459)

This course is intended to provide a background in the theory and application of standard computational methods for molecular biology research. The topics to be discussed include databases, sequence comparison, phylogeny, pattern inference and matching, RNA secondary structure, and protein structure. The course will also address computational issues for the Human Genome Program in the areas of large-scale DNA sequencing, chromosome mapping, and gene recognition. During the term, a seminar speaker, with expertise in an area relevant to the subject area of the course, is invited as a guest lecturer. Students are required to attend this seminar.

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Kim Worley

Special Topics (GS-GE- 463)

Scholarly study directed by a faculty member. Special topics allows a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr course requirement.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Gad Shaulsky

Revised: 07.10.2017

Seminar in Molecular & Human Genetics (GS-GE- 466)

This course is required of all first and second year students enrolled in the Molecular and Human Genetics Graduate Program. The course is conducted as a journal club to study current literature, to practice critical analysis of the literature and to refine presentation techniques. First year students present papers from the current literature, all students join in discussion of the paper presented.

Credits: 1

Term: 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Hamed Jafar-Nejad and Dr. Noah Shroyer

Student Research Seminar (GS-GE- 468)

A seminar series in which senior students (second year and up) will present their own research to an audience of students and faculty to develop their oral communication skills. The students will present their own work approximately once each year in a revolving schedule. Following each student's seminar, constructive advice from faculty and students will be provided about improving presentation skills and about producing effective presentation materials. The course is aimed to supply the students with the experience necessary to perform highly successful presentations outside of the college in national scientific meetings.

Credits: 1

Term: 1, 2, 3, 4

Counts for 30 hr. requirement: N

Director: Dr. Christophe Herman and Dr. Herman Dierick

Readings (GS-GE- 548)

Faculty directed literature projects that survey a specialized topic of interest.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Gad Shaulsky

Research Rotation (GS-GE- 549)

Faculty mentored research for students who have not yet selected a faculty advisor.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Gad Shaulsky

Dissertation (GS-GE- 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree

Revised: 07.10.2017

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Gad Shaulsky

Molecular Physiology & Biophysics and Cardiovascular Sciences

Molecular Physiology & Biophysics

Advanced Topics in Muscle Physiology (GS-PY- 400)

This course will focus on skeletal muscle and integrate current information on molecular structure of muscle, its function, signaling pathways controlling its development, growth and response to disease. The course consists of lectures by faculty, presentations by students of assigned papers with student participating and a final exam.

Credits: 2

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. George Rodney

Introduction to Animal MRI (GS-PY- 411)

This course provides an introduction to the theory and application of small animal MRI which is currently not readily available through other courses.

Credits: 2

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Robia Pautler

Grant Writing Skills (GS-PY- 413)

The goal of this course is to guide students to write a specific aims page on a specified theme while teaching them about grant structure, grant writing styles, and reinforcing scientific thinking in developing models, hypotheses, and experimental tests through question and answer sessions. The course interleaves lectures with group discussion. In the lectures, the students will be instructed in the overall layout of a grant, the purpose of the various grant sections, and the writing style for grants. Before each discussion, the students will be required to write a section of the specific aims page. In the discussion, the students will question each other's hypotheses, aims and approaches.

Credits: 1

Term: 2

Counts for 30 hr. requirement: N

Revised: 07.10.2017

Director: Dr. Irina Larina, Ph.D., Dr. William Lagor, Ph.D.

Cell Physiology (GS-PY- 415)

This course will introduce students to a variety of topics related to cellular physiology while also providing instruction as to how one critically evaluates primary research literature. The topics covered will include NeuroPhysiology, Metabolism and Physiology, Cancer Physiology, Cardiovascular Physiology, Muscle Physiology and Biophysics/Bioengineering. The lectures will be general overviews of the stated topics so that students of varying academic backgrounds may become familiar with systems they will encounter in subsequent physiology courses. The course will consist of a 1-hour class that meets twice weekly. The first class will consist of a faculty lecture from an expert in each respective field. The second class will be in the format of a journal club Powerpoint presentation and include an open discussion and critical evaluation of literature pertaining to the previous faculty lecture. The presenting faculty member will choose a single paper to accompany their lecture.

Credits: 2

Term: 1

Counts for 30 hr. requirement: Y

Director: Dr. Ross Poché

Human Physiology I (GS-PY- 430)

This course will provide students with the basic knowledge of organ systems and integrative physiology in humans upon which the pathophysiology of human diseases can later be expanded. Lectures are intended to educate students about the current research being performed in each field and to elicit ideas about future research and human applications. Topics covered in this course, which is the first of two Human Physiology courses, include: cellular physiology, the nervous system, skeletal muscle, the cardiovascular system, and the respiratory system.

Credits: 3

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Frank T. Horrigan

Human Physiology II (GS-PY- 431)

This course will provide students with the basic knowledge of organ systems and integrative physiology in humans upon which the pathophysiology of human diseases can later be expanded. Lectures are intended to educate students about the current research being performed in each field and to elicit ideas about future research and human applications. Topics covered in this course, which is the second of two Human Physiology courses include: the immune system, renal physiology, bone, the endocrine system, the reproductive system, the gastrointestinal system and liver.

Credits: 3

Term: 3

Counts for 30 hr. requirement: Y

Revised: 07.10.2017

Director: Dr. Frank T. Horrigan

Special Projects (GS-PY- 435)

Faculty mentored research for students that have not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Christine Beeton

Special Topics (GS-PY- 463)

Scholarly study directed by a faculty member. Special topics allows a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hour course requirement.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Christine Beeton

Transmembrane Signaling (GS-PY- 465)

This highly interactive upper level course is designed for students interested in understanding in-depth the important principles of trans-membrane signaling. In addition to introducing the roles of lipids, ion channels, kinases, and second messengers, selected examples of signal transduction pathways underlying muscle physiology and cell survival will be discussed in detail. One half of the course will be lectured by experts from related fields. Each lecture is paired with a group discussion of a relevant article.

Credits: 2

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Christine Beeton

Seminar in Molecular Physiology & Biophysics (GS-PY- 466)

Student Seminar

Credits: 1

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Irina Larina

Reading (GS-PY- 548)

Faculty directed literature projects that survey a specialized topic of interest.

Credits: Variable

Revised: 07.10.2017

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Christine Beeton

Research Rotation (GS-PY- 549)

Faculty mentored research for students who have not yet selected a faculty advisor.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Christine Beeton

Dissertation (GS-PY- 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Christine Beeton

Cardiovascular Sciences

Cardiovascular Physiology (GS-CS- 411)

Topics covered include cardiac cycle, cardiac contractility, neural, and nonneural control of the circulation, biomedical instrumentation, and physical analytical methods. The various components of the cardiovascular system is integrated to define its basic control functions.

Credits: 4

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Xander Wehrens and Dr. Na Li

Cardiovascular Disease and Pathology (GS-CS- 412)

This course explores cause and mechanism of cardiovascular disease. Specific topics include mechanistic discussion of atherosclerosis (lipids and lipoproteins, inflammation, oxidatively modified LDL), hypertension (epidemiology, mechanisms, and consequences), hemostasis (thrombosis and bleeding disorders), cerebral stroke, heart failure (systolic and diastolic dysfunction), cardiac arrhythmias, myocardial ischemia (healing and remodeling, cardiac fibrosis, myocarditis), laterality in heart disease and aging in the cardiovascular system. This course is taught by a combination of clinicians, basic scientists, and clinician scientists from throughout the Texas Medical Center.

Credits: 3

Term: 5

Revised: 07.10.2017

Counts for 30 hr. requirement: Y
Director: Dr. James Martin

Special Projects (GS-CS- 435)

Faculty mentored research for students that have not been admitted to candidacy.
Credits: Variable
Term: 1, 2, 3, 4, 5 (not offered in AY17)
Counts for 30 hr. requirement: N
Director: Dr. Sean Marrelli

Special Topics (GS-CS-463)

Scholarly study directed by a faculty member. Special Topics allows a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr course requirement.
Credits: Variable
Term: 1, 2, 3, 4, 5 (not offered in AY17)
Counts for 30 hr. requirement: N
Director: Dr. Sean Marrelli

Seminar in Cardiovascular Sciences (GS-CS-466)

Student Seminar
Credits: Variable
Term: 3, 4, 5 (not offered in AY17)
Counts for 30 hr. requirement: N
Director: Dr. Sean Marrelli

Readings (GS-CS-548)

Faculty directed literature projects that survey a specialized topic of interest.
Credits: Variable
Term: 1, 2, 3, 4, 5 (not offered in AY17)
Counts for 30 hr. requirement: N
Director: Dr. Sean Marrelli

Research Rotation (GS-CS-549)

Faculty mentored research for students who have not yet selected a faculty advisor.
Credits: Variable
Term: 1, 2, 3, 4, 5 (not offered in AY17)
Counts for 30 hr. requirement: N
Director: Dr. Sean Marrelli

Revised: 07.10.2017

Dissertation (GS-CS- 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Christine Beeton

Molecular Virology and Microbiology

General Virology (GS-MV- 401)

This series of lectures and student paper presentations emphasize fundamental principles related to interactions of animal viruses with their host cells. General topics include chemical and physical properties of viruses, virus classification, cultivation and assay of viruses, viral replication and morphogenesis, vaccines and antivirals, viral pathogenesis, virus vectors, and viral oncogenesis. These topics are highlighted through detailed discussions of selected RNA and DNA virus families.

Credits: 4

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Ronald T. Javier

Literature Review in Molecular Virology & Microbiology (GS-MV- 410)

Literature Reports is a course in which all students in the Department of Molecular Virology and Microbiology must participate. At each meeting, two students each present a paper that they have picked alone, or with the help of their faculty mentor, to an audience of their fellow students and MVM faculty. (Every session has a different faculty mentor.) The goal of the class is to give the students a chance to gain experience presenting to critical audiences, to learn to critically assess data, respond to oral questions and prepare cogent presentations.

Credits: 1

Term: 1, 2, 3, 4

Counts for 30 hr. requirement: N

Director: Dr. Anthony Maresso

Genetics of Animal Viruses (GS-MV- 411)

This series of lectures places emphasis on modern molecular genetic approaches to study animal viruses. Classical approaches are also covered when they provide useful accessory techniques to molecular methods. Lectures place emphasis on phenomena and reduce the emphasis on genetic peculiarities of the various viral taxonomic groups.

Credits: 3

Revised: 07.10.2017

Term: 4 (not offered in AY17)
Counts for 30 hr. requirement: Y
Director: Dr. Robert Franklin Ramig

Concepts in Microbial Pathogenesis (GS-MV- 413)

Microbial Pathogenesis will provide interested graduate students or postdoctoral fellows with knowledge of the basic and clinical aspects of mechanisms and consequences of microbial (bacterial and viral) pathogenesis. This course will provide students with the knowledge to understand how bacteria and viruses cause disease, insights into research approaches used to answer questions on microbial pathogenesis, and a forum for in depth discussion of data from selected papers and enhance their ability to critically analyze, discuss, and present data. \

Credits: 4
Term: 4 (not offered in AY17)
Counts for 30 hr. requirement: Y
Director: Dr. Margaret Ellen Conner

Bacterial Structure and Function (GS-MV- 417)

The course covers the physiology of bacterial cells with an emphasis on current research topics. The first part of the course is devoted to discussion of the components of the bacterial cell wall and their roles in pathogenesis, cell motility, cell structure, nutrient transport, and protein secretion. The next section of the course includes lectures on the regulation of bacterial function, including transcription, translation, and specialized functions unique to bacteria. Finally, mechanisms by which bacteria adapt to their environment are discussed.

Credits: 3
Term: 2
Counts for 30 hr. requirement: Y
Director: TBA

Special Projects (GS-MV- 435)

Faculty mentored research for students that have not been admitted to candidacy.

Credits: Variable
Term: 1, 2, 3, 4, 5
Counts for 30 hr. requirement: N
Director: Dr. Robert Franklin Ramig

Special Topics (GS-MV- 463)

Scholarly study directed by a faculty member. Special topics allows a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr course requirement.

Credits: Variable
Term: 1, 2, 3, 4, 5
Counts for 30 hr. requirement: N

Revised: 07.10.2017

Director: Dr. Robert Franklin Ramig

Seminar in Molecular Virology (GS-MV- 466)

Student Seminar

Credits: 1

Term: 2, 3, 4

Counts for 30 hr. requirement: N

Director: Dr. Robert Franklin Ramig

Readings (GS-MV- 548)

Faculty directed literature projects that survey a specialized topic of interest.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Robert Franklin Ramig

Research Rotation (GS-MV- 549)

Faculty mentored research for students who have not yet selected a faculty advisor

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Robert Franklin Ramig

Dissertation (GS-MV- 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Robert Franklin Ramig

Neuroscience

Fundamentals of Human Neuroimaging (GS-NE- 400)

Neuroimaging has rapidly become one of the most popular and powerful tools for neuroscience. This course surveys a variety of brain imaging modalities, describing what each measures and how the results are used for research. Neuroscience has classically relied on invasive electrode measurements, mostly in animals, to directly map electrical activity in the brain, and modern microelectrode arrays have expanded this method. Two other brain activity measurement schemes,

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electroencephalography (EEG) and magnetoencephalography (MEG), provide non-invasive measurements with excellent temporal resolution but limited spatial accuracy. Recently, magnetic resonance imaging (MRI) has become tremendously popular because it is non-invasive, involves no ionizing radiation, and offers substantial flexibility. In particular, MRI is used to measure brain structure in a variety of fashions, to measure white-matter connectivity using diffusion-weighted imaging (e.g., DTI), and to measure brain function (e.g., fMRI). Extensive techniques have been developed to localize and probe cortical activity in a variety of specialized areas. Optical imaging techniques have also contributed substantially to our understanding of brain function, mostly as an invasive technique in animal models. Positron-emission tomography (PET) provides additional specialized information about brain function. Students should have introductory physics and calculus capability at the freshman level.

Credits: 4

Terms: 1-2

Counts for 30 hr. requirement: Y

Director: Dr. David Ress

Neurobiology of Disease (GS-NE- 422)

This course will cover important and scientifically tractable disorders of nervous system function. The course will expose the students to the incidence, clinical manifestations, pathophysiology and current scientific models of the causes and mechanisms of some of the most common disorders of brain and nervous system function and development throughout the lifespan.

Credits: 2

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Jeffrey Noebels

Physiology of the Visual System (GS-NE- 424)

This is an advanced level course on the physiology of the visual system. It covers the biochemistry, physiology and biophysics of phototransduction, synaptic transmission in the retina and functional architecture of the retina and central visual pathways. Additionally, principles of visual information processing in the eye and in the brain, mechanisms controlling eye movement and gaze stabilization are discussed.

Credits: 3

Terms: 4

Counts for 30 hr. requirement: Y

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Director: Dr. Samuel Wu

Analyses of Neuronal Function (GS-NE- 431)

This course will cover the basic concepts of synaptic biology. The topics include the organization of the synapses, neurotransmitter release, neurotransmitter receptors, synaptic plasticity in learning and memory, synaptic organization of microcircuits, and synaptic dysfunction in diseases. Students will learn synaptic biochemistry, cell biology, and physiology and how to study synapses.

Credits: 2

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Mingshan Xue

Special Projects (GS-NE-435)

Faculty mentored research for students that have not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Matthew Rasband

Genetics for Neuroscience (GS-NE- 441)

This course is intended to teach neuroscience students how to tackle neurobiological problems using genetic strategies and tools. Students will be exposed to the basic concepts in genetics and will be taught the advantages and approaches used in invertebrate model organisms, *C. elegans* and *D. melanogaster*, focusing on different genetic, cell biological and neurobiological tools available in those organisms. The course will also focus on mouse genetics, highlighting the different techniques and approaches commonly used in the mouse, followed by genetic approaches in humans.

Credits: 2

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Ben Deneen

Preparing for Your Neuroscience Qualifying Exam (GS-NE- 447)

This course will explain the requirements and expectations of the qualifying exam in Neuroscience. The course is geared specifically towards second year students who have successfully completed their first year coursework and several months' work in their chosen thesis lab. The course will cover the format of the written and oral exams, tips for structuring the aims and scope of the written proposal, and provide students with opportunity to develop and deliver their oral presentation for feedback from the group. The goal of the course is to help students begin thinking about their work independently and to present their research problem and experimental goals clearly. Ultimately, this course is intended to encourage independent NRSA applications from those

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students who qualify.

Credits: 1

Term: 2

Counts for 30 hr. requirement: N

Directors: Dr. Joanna Jankowsky and Dr. Kim Tolias

Electrical Signaling in the Brain (GS-NE- 448)

This course covers the basic concepts of electrical signaling from the chemical and physical principles involved, to the biological components involved in generating, modulating and transmitting electrical signals in the brain. Students will learn about the foundations of electrical signaling, how ion channel function and regulation actively regulate membrane potential, how to analyze membrane potential using circuitry methods, and how to understand how electrical signals propagate across long distances. Finally we will explore some of the new methods to measure and manipulate electrical signaling in awake behaving animals.

Credits: 3

Term: 1

Counts for 30 hr. requirement: Y

Director: Dr. Paul Pfaffinger

Neuroscience Lab I (GS-NE- 449)

Students will be introduced to basic approaches of molecular and cellular neuroscience including learning how to model biological systems and how to perform basic laboratory techniques. Primary focus will be on understanding how to break complex neuronal systems down to enable useful computational analyses as well as the importance of design and controls in different experimental approaches. Students will be exposed to a combination of problem solving, practical demonstrations, and discussions of pluses and minuses for different approaches.

Credit: 1

Term 1

Counts for 30 hr. requirement: N

Director: Dr. Paul Pfaffinger

Neuroscience Lab II (GS-NE- 450)

This course extends the practical laboratory demonstrations begun in GS-NE-449 with hands-on demonstrations in systems and computational neuroscience. Methods to be covered include classical and modern neuro-anatomical techniques, in vivo pharmaco- and opto-genetics, model

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systems behavioral assays, fMRI, and computational modeling among others. One hour lecture and 3 hour laboratory demonstration per week.

Credits: 1

Term: 2

Counts for 30 hr. requirement: N

Director: Dr. Russell Ray

Neural Systems I (GS-NE- 455)

Neural Systems I course covers the mechanisms involved in processing sensory information by the brain. The course will cover the major sensory systems from organizational principles to the transformation of information. This course will cover the key topics in the processing of sensory information by the brain. The course will also introduce students to in depth analysis of important papers in systems neuroscience to better assist their development of critical reading skills. This course will prepare students for Neural Systems II which will cover how sensory inputs are transformed into motor actions by the brain. Following completion of this course student will understand the locations, functional organization, and functional significance of the main sensory processing streams in the central nervous system.

Credits: 3

Term: 3

Counts for 30 hr, requirement: Y

Director: Dr. Jeffrey Yau

Neural Systems II (GS-NE- 456)

Neural Systems II course covers the mechanisms involved in transforming sensory inputs into motor action and higher brain functions. The course will cover the spinal, cortical, limbic and cerebellar systems involved in motor planning and execution, behavioral control, and learning and memory. This course will cover the key topics in translation of sensory inputs into patterns of motor behavior as well as brain circuits involved in higher cognitive functions. The course will also introduce students to in depth analysis of important papers in systems neuroscience to better assist their development of critical reading skills. Following completion of this course student will understand the locations, functional organization, and functional significance of the main motor pathways as well as key findings linking brain function to complex cognitive behaviors.

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Roy Sillitoe

Prerequisites: Neural Systems I (GS-NE-455).

Theoretical Neuroscience: Networks and Learning (GS-NE- 457)

This course provides an introduction to the mathematical theories of computation and learning by neural systems. These theories use concepts from dynamical systems (nonlinearities, attractors, chaos) and concepts from statistics (information, uncertainty, inference) to understand the properties

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and functions of brain computations (perception, cognition, and action).

Credits: 4

Term: 3-4

Counts for 30 hr. requirement: Y

Director: Dr. Zachary Pitkow

Brain Cell Biology and Development (GS-NE- 459)

Brain Cell Biology covers the basic molecular and cellular organization of the Nervous system. The first 2/3 of the course provides an overview and focal lectures on topics of particular importance to understanding molecular and cellular organization of neurons. The last third of the course covers aspects of neural development that integrates principles learned in the first 2/3 of the course.

Credits: 3

Term: 1

Counts for 30 hr. requirement: Y

Director: Dr. Matthew Rasband

Concepts of Learning and Memory (GS-NE- 462)

This course is designed to introduce graduate students to the field of learning and memory. The course will introduce the student to classical and modern concepts of learning and memory across all levels at which learning and memory is studied, including behavioral, anatomical, cellular, molecular and genetic levels of analysis. The basic concepts of learning and memory will also be related to known disease of learning and memory.

Credits: 3

Term: 4

Counts for 30 hr requirement: Y

Directors: Dr. Mauro Costa-Mattioli and Dr. Daoyun Ji

Special Topics (GS-NE- 463)

Scholarly study directed by a faculty member. Special Topics allows a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr course requirement.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Matthew Rasband

Cellular Neurophysiology I (GS-NE- 464)

This course provides a general background in cellular neurophysiology with an emphasis on an understanding of the properties of excitable nerve membranes and chemical synapses. The first part of the course covers the theory of ions in solutions, ion conduction through membranes, ion transport and distribution, nonlinear properties of neurons, nerve excitation and conduction, and

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stochastic properties of single ion channels. The second part of the course covers linear cable theory, multiple types of voltage-gated conductances, synaptic transmission including, quantal analysis; the role of calcium and transmitter release, various forms of synaptic plasticity.

Credits: 3

Term: 4 (not taught in AY17)

Counts for 30 hr. requirement: Y

Director: Dr. Samuel Miao-Sin Wu

Anatomy of the Nervous System (GS-NE- 471)

The course will cover the basic concepts in neuroanatomy in a combined lecture, demonstration, and hands-on lab format. The emphasis will be on the structural organization of the nervous system. A large part of the course will consist of lectures that cover a structure or region of the brain augmented by simultaneous hands-on dissection of fixed sheep brain tissue, histological photographs, and representative MRIs. The students will be divided into small teams and will dissect a sheep brain along with the instructor. It is expected that the teams will interact with the instructors as the lecture/demonstration progresses. Additional lectures and demonstrations will be used to compare and contrast mammalian brains with other species' brains commonly used in neuroscience research.

Credits: 2

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. David Shine

Prerequisites: Brain Cell Biology and Development (GS-NE-459)

Advanced Functional Magnetic Resonance Imaging Laboratory (GS-NE- 472)

This laboratory course will teach students to use blood-oxygen level dependent functional magnetic resonance imaging (BOLD fMRI) to explore human brain function. BOLD fMRI is the most popular method for examining the human brain, but poses unique technical, methodological, and data analysis obstacles. Students will learn how to overcome these obstacles by designing experiments and collecting fMRI data using the 3-tesla MRI scanners in BCM's Core for Advanced Magnetic Resonance Imaging (CAMRI).

Credits: 2

Term: 4

Counts for 30 hr. requirement: N

Director: Dr. Michael Beauchamp

Prerequisites: Fundamentals of Human Neuroimaging (GS-NE-400) and permission from Course Director

Theoretical Neuroscience: From Cells to Learning Systems (GS-NE- 473)

We present the theoretical foundations of cellular and systems neuroscience from a distinctly quantitative point of view. We develop the mathematical and computational tools as they are needed to model, analyze, visualize and interpret a broad range of experimental data. The material covered

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includes the biophysical properties of single neurons, their visual sensory responses and how they relate to behavior. Additionally, we cover synaptic transmission and plasticity, as well as its relation to the mechanisms underlying learning and memory, and development of visual sensory neuron properties

Credits: 4

Terms: 1-2

Counts for 30 hr. requirement: Y

Director: Dr. Fabrizio Gabbiani

Seminar Journal Club in Neuroscience (GS-NE-474)

This course is required of all first and second year students enrolled in the Neuroscience Graduate Program. The course is conducted as a journal club to study the scientific literature, practice critical analysis of the literature, and develop and refine presentation skills. This course is coordinated with the Department of Neuroscience seminar series such that second-year students present papers from the laboratory of the upcoming seminar speaker. All students join in discussion of the paper and evaluation of the journal club presentation.

Credits: 1

Terms: 2, 3, 4

Counts for 30 hr. requirement: N

Director: Dr. Javier Medina and Dr. Jeannie Chin

Core Concepts in Computational Neuroscience (GS-NE-475)

How do brains compute? This course covers the basic concepts underlying neuronal computation, from individual neurons up to networks of neurons in circuits. The focus will be on achieving a computational level understanding: how populations of neurons compute tasks critical for the organism's survival from sensory input. Students will also be exposed to key ideas from the field of Deep Machine Learning wherein artificial neural networks are employed to solve difficult real-world tasks.

Credits: 1

Term: 4

Counts for 30 hr requirement: Y

Director: Dr. Ankit Patel

Prerequisites: GS-NE-455 Neural Systems and GS-NE-456 Neural Systems II

Readings (GS-NE- 548)

Faculty directed literature projects that survey a specialized topic of interest.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Matthew Rasband

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Research Rotation (GS-NE- 549)

Faculty mentored research for students who have not yet selected a faculty advisor.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Matthew Rasband

Dissertation (GS-NE- 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Matthew Rasband

Pharmacology

Drug Discovery: From Bench to Bedside (GS-PG-414)

The objective of this course is to provide an overview of the making of a small-molecule drug. The topics include the identification of a drug target, bioassay development, structural biology, rational drug design and development, intellectual property protection as well as FDA regulations on new drug clinical trials.

Credits: 2

Term: 5

Counts for 30 hr. requirement: Y

Director: Dr. Yongcheng Song

General Pharmacology (GS-PG- 426)

Basic pharmacological principles as they apply to basic research and to everyday life. The objectives of this course are to present the basic principles of pharmacology. Principles of pharmacodynamics, pharmacokinetics and major classes of therapeutic agents will be discussed.

Credits: 4

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Pui-Kwong Chan

Chemical Biology (GS-PG-427)

Chemical Biology is a scientific discipline spanning the fields of chemistry, biology, and physics. It involves the application of chemical techniques, tools, and analyses, and often compounds produced

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through synthetic chemistry, to the study and manipulation of biological systems. The course teaches topics including an introduction to chemical biology, bio-orthogonal ligand reactions, small molecule inhibitors for protein-protein interactions and epigenetics, chemoproteomics, sensors for living cells, and state-of-the-art imaging techniques. The course content emphasizes applications of chemical tools in solving biological and biomedical problems.

Credits: 2

Term: 5

Counts for 30 hr. requirement: Y

Director: Dr. Jin Wang

Special Projects (GS-PG- 435)

Faculty mentored research for students that have not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Choel Kim

Special Topics (GS-PG- 463)

Scholarly study directed by a faculty member. Special topics allows a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr course requirement.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Choel Kim

Seminar in Pharmacology (GS-PG-466)

Student Seminar

Credits: 1

Term: 1, 2, 3, 4 ~~5~~

Counts for 30 hr. requirement: N

Director: Dr. Choel Kim

Readings (GS-PG- 548)

Faculty directed literature projects that survey a specialized topic of interest

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Choel Kim

Research Rotation (GS-PG- 549)

Faculty mentored research for students who have not yet selected a faculty advisor.

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Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Choel Kim

Dissertation (GS-PG- 550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Choel Kim

Structural and Computational Biology and Molecular Biophysics

Computational Mathematics for Quantitative Biomedicine (GS-SB- 401)

This course introduces essential computational, statistical and mathematical concepts to students who are interested in computational biology. It is intended that each of the concepts will be taught in the context of the real biological problems ranging from genomics bioinformatics, structural biophysics, computational neuroscience, systems biology, protein design, drug discovery, and medical bioinformatics

Credits: 8

Term: 1-2

Counts for 30 hr. requirement: Y

Director: Dr. Zhandong Liu

Computational Molecular Biophysics and Structural Biology (GS-SB-402)

This course is designed for students in computationally-oriented theoretical, biophysical, biomedical and bioengineering majors to introduce the principles and methods used for computer simulations and modeling of macromolecules of biological interest. Fundamental concepts in statistical mechanics, thermodynamics, and dynamics will be emphasized. Protein conformation/dynamics, empirical energy functions and molecular dynamics calculations, as well as other approaches will be described. Specific biological problems are discussed to illustrate the methodology. Classic examples such as the cooperative mechanisms of hemoglobin and more frontier topics such as the motional properties of molecular motors and ion channels as well as results derived from the current literature are covered. Other potential topics are protein folding/predictions, the nature of reaction rate enhancement in enzyme catalysis, physical chemistry properties of biologically relevant nano-materials, simulations of free energy changes in mutations, electrostatic properties of protein,

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molecular recognition, and the properties of binding sites. Particular emphasis is also given to the applications of molecular graphics. During the final reading period, each student carries out an original research project that makes use of the techniques and grading is based on the written and oral presentations of the results from the final projects.

Credits: 6

Term: 1

Counts for 30 hr. requirement: Y

Director: Dr. Jianpeng Ma

Advanced X-ray Crystallography (GS-SB- 403)

X-ray crystallography is a powerful technique to determine atomic resolution structures from small, inorganic molecules to large, multi-subunit macromolecular assemblies. This course covers both theory and practical applications starting with crystallization, crystal systems, and data processing to finding a structure solution, model building, and structure refinement/validation. The course will prepare students with diverse scientific backgrounds to expand their research to protein crystallography as an analytical tool to probe the structure-function relationship of proteins and enzymes at the atomic level.

Credits: 3

Term: 4 (not taught in AY17)

Counts for 30 hr. requirement: Y

Director: Dr. Francis T.F. Tsai

Computer-Aided Discovery Methods (GS-SB- 405)

The objective of this course is to introduce students to the concepts, methods and tools relevant for computer-aided discovery using data collected using high-throughput technologies. The course will focus on the methods of integration of data, tools, and discovery processes and the methods of computational pattern discovery, hypothesis generation and testing. The students will master advanced applications of computing that enable new methods of discovery in a field of focus, which will initially be cancer biology. The course will not focus exclusively on technical, algorithmic or mathematical aspects nor will it focus on biology alone. Instead, the focus will be on genuine integration of the two fields.

Credits: 3

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Aleksandar Milosavljevic

Practical Introduction to Programming for Scientists (GS-SB- 406)

In this course students will learn Python, one of the most widely used scripting languages in scientific computing. The course is primarily aimed at students with little or no programming background, but those with some programming experience in other languages wishing to learn Python are also welcome. The course covers basic programming concepts and data structures, and students will learn to write simple programs to improve their data processing productivity. We will

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also cover a number of open source scientific libraries available in Python (Biopython, SciPy, Matplotlib, etc.). Some basic familiarity with using a computer will be expected, and each student must have a laptop computer for use in class by the beginning of the term.

Credits: 3

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Steven J. Ludtke

Current Topics in Computational Biomedicine (GS-SB- 407)

This course introduces graduate students to the diversity of biological and clinical research problems that benefit from computational approaches. On alternating weeks the students will be exposed to speakers, or they will present a journal club. The speakers are drawn from across BCM, the TMC, Rice University and the greater Houston area and occasionally will include outside seminar speakers. During this one hour, a format of two short talks from two different speakers will discuss some of the most salient current problems studied in their laboratories, often with a significant emphasis on computational aspects. Style and content vary but, generally, the level is introductory and accessible to all members of the audience. Topics range from genomics to clinical text-mining and from bioengineering to public health, representing the rich diversity of computational biology research in the Gulf Coast area. The following week, the students will present two papers at journal club. One paper will be drawn from the immediate literature of the past 3 months, and the second paper will be drawn from any past time period, focusing on highly cited past influential papers across the field of computational biology. The papers will be selected by the participating Faculty, drawn from the SCBMB program, with input from the students if they so desire.

Credits: 1

Term: 1, 2, 3, 4

Counts for 30 hr. requirement: N

Director: Dr. Oliver Lichtarge and Dr. Richard Sucgang

Molecular Biophysics: Methods and Principles (GS-SB-408)

This is a course lasting one semester (two BCM terms). It presents in lecture format a survey of the major techniques of molecular biophysics, and the underlying physical principles and mathematics on which they are based.

Credits: 6

Term: 1-2

Counts for 30 hr. requirement: Y

Director: Dr. Theodore Wensel

Electron Cryomicroscopy for Molecules & Cells (GS-SB- 410)

This course discusses in-depth theoretical and practical techniques in structural biophysics with a particular emphasis on electron imaging and crystallography. The topics include cryo-specimen preparative techniques, electron microscope optics, image contrast theory, specimen radiation damage, single particle image reconstruction, tomographic reconstruction, density based modeling,

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3-D visualization, biological knowledge discovery from cryo-electron imaging.

Credits: 2

Term: 4 (not taught in AY17)

Counts for 30 hr. requirement: N

Director: TBA

Structural Basis of Human Disease (GS-SB- 423)

This course is designed for medical and graduate students to understand the potential use of structural information for solving disease problems and to be aware of the different structural and computational tools. Each one hour lecture will be jointly led by two instructors who will present the medical problems and the structural approaches towards solving them. Attendance is required for passing this course.

Credits: 1

Term: 4

Counts for 30 hr. requirement: N

Director: Dr. B.V. Venkatar Prasad

Advanced Topics in Structural & Computational Biology (GS-SB- 430)

This course is designed for the SCBMB students to read current literature in structural and computation biology, to critically review the papers and to present the topic in front of an audience. This is run similar to a journal club. Under the supervision of the two faculty members, each student will pick a topic area, research the necessary papers and make a 50 minute lecture presentation.

Credits: 1

Term: 1, 2, 4

Counts for 30 hr. requirement: N

Director: Dr. Aleksandar Milosavljevic

Special Projects (GS-SB- 435)

Faculty mentored research for students that have not been admitted to candidacy. Students are expected to consult with the faculty on the research topic to investigate; take part in laboratory research, read relevant literature, interact with laboratory personnel, attend regular research laboratory meetings, and report the research results to the faculty mentor regularly and at the end of the term.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Aleksandar Milosavljevic

Special Topics (GS-SB- 463)

Scholarly study directed by a faculty member. Special topics allow a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr course

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requirement.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Aleksandar Milosavljevic

Readings (GS-SB-548)

Faculty directed literature projects that survey a specialized topic of interest in computational biology and biophysics. The student will pick a topic of interest and do a literature research after consulting with the faculty; hold regular meetings to discuss with the faculty on the chosen topics, and write up a summary report at the end of the term to provide a critical review on the state of the art knowledge of the chosen topics of study.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Aleksandar Milosavljevic

Research Rotation (GS-SB- 549)

Faculty mentored research for students who have not yet selected a faculty advisor.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Aleksandar Milosavljevic

Dissertation (GS-SB-550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Aleksandar Milosavljevic

Translational Biology and Molecular Medicine

Animal Models of Human Disease (GS-TB-401)

This course is designed to expose students to methodologies employed in generating animal models for human diseases and in analyzing these models. The major emphasis is on mouse models, but

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other model organisms will be discussed as well.

Credits: 2

Term: 5

Counts for 30 hr. requirement: Y

Director: Dr. Cindy Buckmaster

Pathophysiology & Mechanisms of Human Disease (GS-TB-402)

This course will provide students with an understanding of the basic mechanisms of human disease with a systems biology perspective. Molecular defects at different levels including the gene, RNA, protein, cell, tissue, and organ will be covered. The focus is on helping students develop critical thinking skills that will help them approach complex scientific problems.

Credits: 2

Term: 4

Counts for 30 hr. requirement: Y

Director: Dr. Daniel Lacorazza

Translational Breast Cancer Research (GS-TB-405)

This course provides an introduction into current issues in translational breast cancer research. The course encompasses a series of lectures on problems in clinical breast cancer diagnosis and treatment, breast development, and evolution of breast cancer, and approaches to translational breast cancer research. The purpose of the course is to provide a broad understanding of clinical issues and problems in breast cancer, familiarize students with breast cancer from the clinician's standpoint, and with research areas of active development in the field.

Credits: 2

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Suzanne A. W. Fuqua

Introduction to Leadership Skills (GS-TB-407)

The objective of the course is to provide students with knowledge regarding the importance of leadership skills in their training and future career development. While leadership skills are essential components in career development, it is appreciated that leadership skills can't be taught and imparted upon students in a short didactic lecture-based setting. Therefore, the objective of this course is to introduce students to the basic concepts of leadership skills.

Credits: 1

Term: 3

Counts for 30 hr. requirement: N

Director: Dr. Suzanne A. W. Fuqua

Ethics, Conduct and Practical Aspects of Clinical Research (GS-TB-408)

This course is designed to provide students practical insight into the bioethical conduct, practical

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aspects, including types and categories of clinical trials and the different phases of translational research, as well as regulatory considerations of clinical and translational research. The course encompasses a series of interactive didactic lectures, homework assignments, and observation of an IRB meeting. The purpose of the course is to provide a broad understanding of bioethical issues within the context of clinical research, as well as an understanding of the complex relationship between investigators, their designees, and research subjects.

Credits: 2

Term: 5

Counts for 30 hr. requirement: Y

Director: Dr. Melissa Suter

Method and Logic in Translational Biology (GS-TB-409)

This course is intended to illustrate to first year graduate and medical students skills important for the translational biology researcher, through evaluation of two medical cases and translational research related to the cases. Reading material will provide information students need to progress with their evaluation of translational research pertaining to the medical case, as well as provide a context for training in how to read and interpret primary literature. Emphasis will be placed on discerning elegant experimental approaches, what constitutes a well-designed experiment with proper controls and considerations for moving discoveries from pre-clinical to clinical testing.

Credits: 2

Term: 3

Counts for 30 hr. requirement: Y

Director: Dr. Marta Fiorotto

Fundamentals of Epidemiology (GS-TB-410)

This course introduces the basic principles and methods of epidemiology, with an emphasis on critical thinking, analytic skills, and application to clinical practice and research. Topics include outcome measures, methods of adjustment, surveillance, quantitative study designs, and sources of data. The course is designed for professionals intending to engage in, collaborate in, or interpret the results of epidemiological research as a substantial component of their career.

Credits: 2

Term: 2

Counts for 30 hr. requirement: Y

Director: Dr. Michael Scheurer

Introduction to Pharmacoepidemiology and Pharmacogenetics (GS-TB- 411)

The purpose of this course is to outline strategies to avoid serious systemic toxicities from chemotherapy and radiotherapy. This course will review the principles of pharmacogenetics and pharmacogenomics, pharmacodynamics and pharmacokinetics, and will outline the impact of genetic polymorphisms in drug metabolism and other pathways on the toxicity of anticancer agents and other therapies. The emphasis is on research concepts and applications and the interdisciplinary nature of the field.

Revised: 07.10.2017

Credits: 1

Term: 3 (not offered in AY17)

Counts for 30 hr. requirement: N

Director: Dr. Michael Scheurer and Dr. Melanie Bernhardt

Special Projects (GS-TB- 435)

Faculty mentored research for students that have not been admitted to candidacy.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Cliona Rooney

Special Projects Clinical (GS-TB- 436)

Clinical faculty mentored research for students that have not been admitted to candidacy.

Credits: 3

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Ignatia B. Van den Veyver

Special Topics (GS-TB- 463)

Scholarly study directed by a faculty member. Special topics allow a faculty member to develop individualized courses for students. Special topics cannot be used to satisfy the 30 hr. course requirement.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Ignatia B. Van den Veyver

TBMM: Bench to Bedside (GS-TB-466)

This course is designed to provide a forum for an in-depth discussion of translational research. Each term will cover one subject or a specific aspect of a larger topic to allow for a more detailed review of the biomedical literature. The emphasis is on student participation and the role of the faculty member(s) at any given session is to facilitate the discussion. Students are expected to have reviewed assigned article(s) prior to each session and come prepared with comments, criticisms, questions or points of discussion. The faculty member will typically provide a brief overview of the topic at hand to provide some perspective on the subject, but will not direct the discussion. An outside speaker of national prominence engaged in translational research relevant to the topic will give a school-wide talk and meet with the TBMM students.

Credits: 1

Term: 1, 2, 3, 4, 5

Revised: 07.10.2017

Counts for 30 hr. requirement: N
Director: Dr. William J. Craigen

Seminar (GS-TB-467)

Students who have been admitted to candidacy (years 3 and above) will be required to present a seminar yearly on the topic of their ongoing thesis research project with emphasis on the translational aspects of their research project. The purpose of this course is to provide a forum for students to improve their knowledge and skills in planning, preparing and effectively presenting their scientific research to an inter-disciplinary audience.

Credits: 1

Term: 2, 3, 4

Counts for 30 hr. requirement: N

Director: Dr. Sundararajah Thevananther

Reading (GS-TB-548)

Faculty directed literature projects that survey a specialized topic of interest.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Ignatia B. Van den Veyver

Research Rotation (GS-TB-549)

Faculty mentored research for students who have not yet selected a faculty advisor.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Ignatia B. Van den Veyver

Dissertation (GS-TB-550)

Thesis research directed by a faculty mentor and advisory committee. Open only to candidates for the Ph.D. or M.S. degree.

Credits: Variable

Term: 1, 2, 3, 4, 5

Counts for 30 hr. requirement: N

Director: Dr. Cliona Rooney

Tropical Medicine

Diploma in Tropical Medicine Module 1 (GS-TM- 400)

This module is a component of the four-module Diplomat in Tropical Medicine program. This module will provide the learners with knowledge and basic understanding of epidemiology, biostatistics, ethics, health economics and public health policies. By the end of the module, learners will be able to explain epidemiological surveillance of emerging infectious diseases, perform basic biostatistics computation skills, and describe ethics, health economic, policy and other public health topics as they relate to global health.

Credits: 4

Term: 3

Counts for 30 hr requirement: N

Director: Dr. Kristy Murray and Dr. Laila Woc-Colburn

Seminar in Tropical Medicine - Global Health Policy (GS-TM 466)

This course consist of a series of weekly lectures on a topic in tropical medicine. Lectures will convey different themes in tropical medicine from one year to the next. The learning themes are global health policy, one health, globalization and the impact on Houston health, tropical medicine abroad, and tropical medicine research.

Credits: 1

Term: 3

Counts for 30 hr requirement: N

Director: Dr. Peter Jay Hotez