

Course Descriptions

Spring 2022

Undergraduate Courses

BIO 123 M001 and M002: General Biology II (3 Credits)

MW 12:45-2:05PM (M001)

MW 3:45-5:05PM (M002)

Instructor: Jason Wiles

The second of a two-course sequence comprising a survey of major biological concepts ranging from the molecular level to global ecology. Units within Biology 123 include biodiversity, plant structure and function, human and comparative animal anatomy and function, ecology, and evolution, which is the central and unifying concept of biology and the framework around which the understanding of other concepts in this course is constructed.

BIO 124 M003-M025: General Biology II Laboratory (1 Credit)

T, W, TH, F (1 Day/Week-Varied Times)

Instructor: Jason Wiles/Staff

This is the laboratory course associated with BIO 123. Includes inquiry-based exploration and practical application of concepts discussed in BIO 123. Students registered for BIO 124 must also register for BIO 123.

BIO 200 M001: Introduction to Biological Research (2 Credits)

TH 2:00-3:20PM

Instructor: Mariah Maxwell

An entry-level seminar course primarily for first-year students interested in biological research. Students will improve their science literacy and communication skills through reading different kinds of scholarly literature, writing for different audiences, and engaging with potential faculty research mentors from the SU Biology department.

NEU 211 M001: Introduction to Neuroscience (3 Credits)

MW 12:45-2:05PM

Prerequisite: High School Biology and Chemistry

Instructor: Robin Jones

This course is an introduction to the mammalian nervous system, with emphasis on the structure and function of the human brain. Students interested in the Neuroscience Integrated Learning Major should know that this course is one of two possible entry-level required courses for that major. Topics include the cell biology and function of nerve cells and associated cells such as glia, selected sensory systems, and control of movement. Lectures, demonstrations and other activities including discussion of brain diseases will be used to illustrate concepts.

BIO 200 M002-M009: Integrative Biology Lab (2 Credits)

M, T, W, TH, F (1 Day/Week-Varied Times)

Prerequisite: BIO 121 or equivalent

Instructors: Yasir Ahmed, Melanie Blanden, and Scott Pitnick

Students will design and perform their own experiments with the culmination of these experiments resulting in a presentation or short scientific paper. The course is set up as **two modules** lasting 8 and 6 weeks, respectively. **Module 1** will cover key research skills in experimental design, analysis, and basic laboratory skills. Other topics covered in Module 1 include responsible conduct of research, inclusion, equity, and diversity in science, reading and analyzing scientific papers, and an introduction to model organisms commonly used in biological research. In **Module 2**, students will apply what they have learned in Module 1 through design and performance of their own experiments using a live organism. They will need to use the analytical techniques learned in previous weeks to organize and present their data.

BIO 217 M001: Anatomy & Physiology II (4 Credits)

Lecture: MW 12:45-2:05PM

Laboratory: T, W (1 Day/Week – Varied Times)

Recitation: M, TH, F (1 Day/Week – Varied Times)

Prerequisite: BIO 121, 123, and 124 or equivalent

Instructor: Vera McIlvain

This is a continuation of the BIO 216 lecture and laboratory course studying the structure and function of human tissues, organs and systems. The endocrine, respiratory, cardiovascular, digestive and reproductive systems, metabolism, and energetics will be covered. Laboratories will include bench top and interactive computer experiments, anatomy, histology and non-invasive experiment on human subjects. This course cannot be used to fulfill the requirements of the Biology major. Credit cannot be given for BIO 217 after successfully completing BIO 317.

BIO 223 M001 and M002: Peer Led Team Learning (PLTL) Leadership Training II (1-2 Credits)

T 11:00-11:55AM (M001)

TH 9:30-10:25AM (M002)

Prerequisite: PLTL I (course grade of B or higher)

Instructor: Julia Snyder

This course relates educational research literature and learning to classroom applications in problem solving activities. Students are prepared to be peer leaders of a small, problem-solving group of students by attending weekly one-hour meetings and participating in Blackboard and in-class discussion groups. Peer leaders are then responsible for holding a 1-hour problem solving session each week and keeping a record of attendance for their group sessions.

BIO 317 M001: Anatomy & Physiology II for Biology Majors (4 Credits)

Lecture: MW 12:45-2:05PM

Laboratory: F 8:25-11:25AM M003) or 12:45-3:45PM (M002)

Prerequisite: BIO 121

Instructor: Vera McIlvain

This Anatomy & Physiology II course is a 300-level course for Biology, Biotechnology & Biochemistry majors. It is a 4-credit course, of which 3-credits of lab can be applied to the Biology major, unlike BIO 217. This class will have the same lecture room and time (Monday & Wednesdays 12:45-2:05 p.m.) as BIO 217. Students in the BIO 317 class will have weekly quizzes, a midterm and a final exam, as will those in BIO 217. However, the students registered for BIO 317 will have a joint laboratory and recitation section on Fridays from 8:25 am to 11:25 pm or 12:45 to 3:45 pm. These sections will not be the same as those laboratory and recitation sections in BIO 217. They will include a cat dissection, histology and other activities appropriate for a 300-level course. Understanding of laboratory material will be evaluated with 2-3 laboratory practicals. Credit cannot be given for BIO 317 after successful completion of BIO 217. **This course satisfies the Cell & Molecular Biology (CM) distribution requirement.**

BIO 326 M001: Genetics (3 Credits)

TTH 11:00AM-12:20PM

Prerequisite: BIO 121 or equivalent and CHE 106 or 109 or 150

Instructor: Sarah Hall

This course discusses the principles of inheritance, structure and synthesis of nucleic acids and proteins, microbial genetics, recombinant DNA technology and introduces you to the basic biology of modern genomics.

BIO 360 M001: Biology Lab Assistant (1 Credit)

M 3:45-5:05PM

Prerequisite: One upper division 3 credit Biology lab such as BIO 471

Instructor: Jason Wiles

Students who have completed an upper division 3 credit hour lab may receive one credit hour for assisting in the teaching of laboratories. It may be repeated once for credit.

BIO 361 M001: Autonomic Physiology (3 Credits)

TTH 12:30-1:50PM

Prerequisite: BIO 121 or BIO 123 or NEU 211

Instructor: Robin Jones

This course is an exploration of the autonomic nervous system, its regulation of various organ systems as well as diseases and disorders that manifest because of autonomic dysregulation. **This course satisfies the communication skills requirement and the Cell & Molecular Biology (CM) distribution requirement.**

BIO 396 M001: Stem Cells and Society**TTH 12:30-1:50PM**

Crosslisted with: PHI 396 M001 and REL 359 M001

Instructors: Mark Brockway, Scott Erdman, and Hille Paakkunainen

This course discusses the science of stem cells and the philosophical, religious and legal complexities surrounding the research and use of stem cell technologies. **It satisfies the Cell & Molecular Biology (CM) distribution requirement.**

BIO 400 M003: Experimental Designs & Interpretations (3 Credits)**MW 3:45-5:05PM**

Meets with: BIO 600 M003

Prerequisite: BIO 326 and BIO 327

Instructor: Ruth Phillips

Seminar class where students (1) evaluate published papers for rigorous design, statistics and interpretation to determine their validity and contributions and (2) compose a series of mini grants to design and propose future experiments and studies. Additional work required for graduate students. **This course satisfies the communication skills requirement and the Cell & Molecular Biology (CM) distribution requirement.** This course is offered synchronously online.

BIO 400 M015: Pharmacology of Drugs of Abuse (3 Credits)**MW 2:15-3:35PM**

Meets with: BIO 600 M015

Prerequisite: BIO 327, CHE 275 and NEU 211

Instructor: James Hewett

This course covers major drugs of abuse, include Alcohol, Cannabis, Cocaine, Methamphetamine, and Opiates, and will include relevant neuroanatomy and cellular and biochemical mechanisms of their mode of action. Extra work will be required for graduate students. **This course satisfies the communication skills requirement and the Cell & Molecular Biology (CM) distribution requirement.**

BIO 400 M016 and M017: Advanced Microscopy Techniques in Cell & Developmental Biology Lab (3 Credits)**Lecture: M 2:15-3:10PM****Laboratory: W 12:45-4:45PM**

Meets with: BIO 600 M016 and M017

Prerequisite: BIO 326 and BIO 327

Instructor: Heidi Hehnly

Both a literature-based course in light microscopy with hands on lab experience using high-end microscopic systems. Students cover studies contributing to their knowledge on cell and development biology while implementing those techniques in the lab. Additional work required for graduate students. **This course satisfies the communication skills requirement, the Cell and Molecular Biology (CM) distribution requirement, and 3-credits of upper division lab experience.**

BIO 400 M018: BioArt (3 Credits)**F 2:15-6:15PM**

Meets with: TRM 500 M002

Instructor: Heidi Hehnly and Boryana Rossa

This course is a studio and history class, which brings together transmedia and biology students, offering overlap of disciplines with hands on study of digital imaging technologies, microscopy, biological drawing, and lecturing on the relatively new field of bio-art. Additional work required for graduate students.

BIO 400 M019 and M020: Environmental Biology Lab (3 Credits)**Lecture: T 2:00-2:55PM****Laboratory: TH 12:30-4:30PM**

Meets with: BIO 600 M019 and M020

Prerequisite: BIO 345

Instructor: Mark Ritchie

This course explores global environmental problems such as habitat fragmentation, biodiversity loss, warming, and pollution from excess nitrogen and carbon through laboratory exercises. Skills learned include using simple Geographical Information Systems, basic Python programming, and spreadsheets as well as analysis of online biodiversity databases. Involves some outside winter activity and tree identification. Additional work required for graduate students. **This course satisfies the communication skills requirement, the Ecology and Evolution (EE) distribution requirement, and 3-credits of upper division lab experience.**

BIO 400 M021: Perspectives in Alzheimer's (1 Credit)**F 10:40-11:35AM**

Meets with: BIO 600 M021

Instructor: Donna Korol

Additional work required for graduate students. For InROADS scholars only.

BIO 400 M022: Modulation of Brain Function (3 Credits)**T 2:00-4:45PM**

Meets with: BIO 600 M022

Instructor: Paul Gold

Traditional models of synaptic transmission are based on release of neurotransmitters to act on postsynaptic ionotropic receptors, resulting in excitation and inhibition of the postsynaptic neuron. However, many chemicals released by neurons act on metabotropic (G-protein coupled) receptors, sometimes located at a distance considerably further from release sites than a traditional synaptic cleft. These are neuromodulators and can regulate the excitation/inhibition state of neural networks, i.e., beyond acting across a synapse. This course will examine neuromodulators, which include norepinephrine, serotonin, acetylcholine, peptides, and others. After initial classes to define the topic, the organization of the course will be comprised of student presentations and papers that select a modulator and examine its functional properties, defined during development, regulation of neurophysiology, neural plasticity and memory and other behaviors. Additional work required for graduate students. **This course satisfies the communication skills requirement and the Cell & Molecular Biology (CM) distribution requirement.**

BIO 400 M023: Quantitative Methods for Life Scientists (3 Credits)

TTH 9:30-10:50AM

Meets with: BIO 608 M001

Instructor: Jason Fridley

This is a graduate-level course in statistics and data analysis for those conducting research in field- or laboratory-based life sciences. Through a series of case studies involving the primary biological literature, students will discuss key statistical concepts (e.g., random sampling, modeling uncertainty, statistical independence, model inference, multilevel data) and their relation to common methods, including generalized regression, analysis of variance, contingency tables, mixed models, post hoc tests, and more advanced methods (e.g., maximum likelihood, Bayesian approaches, multivariate models), depending on student interests. Students will be encouraged to work in groups on weekly assignments and case studies will reflect student research areas. There are no prerequisites but students should be experienced with spreadsheet manipulation and have familiarity with or a desire to learn R. **This course satisfies the communication skills requirement and the Ecology and Evolutionary Biology (EE) distribution requirement.**

BIO 407 M001: Advanced Neuroscience (3 Credits)

TTH 9:30-10:50AM

Meets with: BIO 607 M001

Crosslisted with: NEU 407

Prerequisite: BIO 211 and NEU 211; suggested BIO 327

Instructor: Sandra Hewett

This course builds on the student's expected background in neuroscience, cell biology, chemistry and physics. It is taught at the upper undergraduate and beginning graduate student level. The course spans the physiology and chemistry of the nervous system, from the molecular to the cellular and systems level. Topics covered include the electrochemical and biophysical properties of neurons, neuron-glia interactions, sensory and motor systems. **It is a required course for undergraduate students enrolled in the Neuroscience ILM and graduate students in the Interdisciplinary Neuroscience Graduate Concentration. It also satisfies the Cell and Molecular Biology (CM) distribution requirement for biology majors.**

BIO 409 M001: General Microbiology (4 Credits)

Lecture: MWF 9:30-10:25AM

Laboratory: MW 12:45-2:05PM or 2:15-3:35PM or 3:45-5:05PM

Prerequisite: BIO 326 and BIO 327

Instructor: Roy Welch

This lecture and laboratory course introduces students to the biology of microorganisms and to microbial diseases. Pathogenic microorganisms, microbial diseases, public health issues, and immunology are all reviewed in General Microbiology. The major emphasis of the remainder of the course is bacteriology, but there are a number of lectures devoted to viruses, protozoa, algae and fungi. Topics in bacteriology include the structure of bacteria, bacterial genetics and gene regulation, and the ecology of bacteria. The laboratory emphasizes the basic skills necessary to isolate, cultivate and identify microorganisms. This is a 4-credit course, which only satisfies 1-credit of lab experience. **It fulfills the Cell and Molecular Biology (CM) distribution requirement.**

BIO 413 M001: Neurobiology of Pain & Analgesia**TTH 12:30-1:50PM**

Prerequisite: BIO 121 or 123 or NEU 211

Instructor: Jen Cook

In this course, the etiology of chronic pain, and the mechanisms of its treatment will be explored. You will learn about how we have pain, beginning with how the somatosensory system functions under normal conditions. From there you will learn about the maladaptive changes that can occur following injury that contribute to the transition from acute to chronic pain. Finally, you will learn how we treat pain, including the mechanisms of action and the intersection of treatment and addiction. Throughout the semester you will also learn how to critically read and analyze primary articles related to the topics we are covering in class. We will explore cutting edge research in addition to foundational papers and reviews. Additionally, you will apply what we cover in lectures and discussions to the development of a detailed case study, integrating information from throughout the course. This course is intended for neuroscience majors and any other students who have an interest in the biological foundations of chronic pain and its treatment. This elective course is meant for juniors and seniors. It is taught assuming that students have taken lower-level biology and/or neuroscience coursework, having a strong foundation prior to taking the course. **This course satisfies the communication skills requirement and the Cell & Molecular Biology (CM) distribution requirement.**

BIO 416 M001: Biology of Aging (3 Credits)**MW 2:15-3:35PM**

Meets with: BIO 616 M001

Prerequisite: BIO 327 or BIO 355

Instructor: Donna Korol

Aging is an intrinsic property of all living organisms. However, the way in which aging manifests itself varies quite broadly within and between species. To understand the complex nature of aging and its place in the life cycle, this course will review topics related to the biology of aging across many levels of analysis from molecule to cell to system to organism. Classic and contemporary aging research will be evaluated from a variety of experimental models. In the process, we will dispel some of the myths of aging even as they relate to basic scientific findings and evaluate how the conventional wisdom on aging issues obtained through the media and other public sources reflects and influences basic research findings. Organization of the course includes lectures, discussions, quizzes, and a variety of written assignments. Additional work is required of graduate students. **This class fulfills the Cell and Molecular Biology (CM) distribution requirement.**

BIO 419 M001: Junior and Senior Thesis Seminar (1 Credit)**T 5:00-6:00PM**

Prerequisite: Acceptance into a Biology thesis program (Honors or Distinction)

Instructors: Scott Erdman and Scott Pitnick

A discussion-student presentation format course designed to introduce highly qualified students to biological research. Students present progress reports on their thesis research. The course is designed for open communication among people with interests in biological research. It must be taken for four semesters.

BIO 421 M002: Capstone Seminar in Biotechnology (3 Credits)

MWF 10:35-11:30AM

Prerequisites: BIO 463

Instructor: Melanie Blanden

This is a seminar course for senior Biotechnology majors. Students will evaluate scientific papers, current news stories, and biotechnology related issues. Evaluation will occur through readings, oral presentations, written assignments, and class discussion. This is for Biotechnology students only.

BIO 448 M004: Evolutionary Medicine (3 Credits)

TTH 3:30-4:50PM

Prerequisite: BIO 121 and BIO 345 (Spring)

Corequisites: BIO 345 (Fall)

Instructor: David Althoff

This course applies evolutionary principles to strengthen the prevention and treatment of human diseases. Can we cure the common cold? How and why do some emerging diseases become pandemic whereas others remain localized? Topics include management of diseases to decrease transmission rates and virulence, the germ theory of disease, antibiotic resistance, epidemiology, human evolution, and the history of medicine. Diseases such as malaria, influenza, HIV/AIDS, and cholera will be used as examples. In-class discussions and simulations will supplement the lecture. **This class satisfies the Ecology and Evolutionary Biology (EE) distribution requirement.**

BIO 456 M001: Seminar in Human Disease Genomics (3 Credits)

TTH 9:30-10:50AM

Meets with: BIO 656 M001

Prerequisite: BIO 326 and BIO 327

Instructor: Steve Dorus

This seminar class introduces students to influential genomic studies relating to human evolution and the etiology & epidemiology of human disease. Recent insights into the genetic basis of human adaptation & its potential relevance to disease predisposition will be discussed. **This course satisfies the communication skills requirement, the Cell & Molecular Biology (CM) distribution requirement and the Ecology and Evolutionary Biology (EE) distribution requirement.**

BIO 460/BCM 460: Research in Biology/Biochemistry (1-4 Credits)

Varied Times

Instructor: Varied

BIO 460 is intended for Biology majors and BCM 460 is intended for Biochemistry majors who wish to participate in either an experimental laboratory or field research project. BIO 460/BCM 460 replaces the use of independent study or experience credit courses for research purposes. Student research projects will incorporate use of the scientific method, experimentation, data analysis, data presentation and interpretation, and the responsibilities of scientific integrity. To enroll in BIO 460/BCM 460, the student must seek a sponsor who is willing to direct an appropriate project. Typically, the sponsor will assign the student to some aspect of an existing, larger research project. In consultation with the sponsor, the student will submit a form with the Academic Coordinator of the Biology Department which states the nature of

the project, the expectations regarding time commitment (3 hrs. per week per credit hr.), and the means for evaluation. The student will then receive a permission number to enroll in the course. The grading procedure is based on 1) the faculty member's evaluation of overall student performance, and 2) examination of required laboratory records or notebooks. Evaluation may also include a written report documenting the experience and results in a scientific format. Students can enroll in BIO 460/BCM 460 more than once, but only a total of 4-credits can be applied to the BS Biology/Biochemistry major requirements. For the BA in Biology, the 4-credits can be used as an upper-division elective.

BIO 461: Experience in Biology (0 Credits)

Varied Times

Instructor: Varied

This is an internship or work experience supervised by a faculty mentor. Projects may include experimentation, data analysis, presentation, and responsibilities of scientific integrity. Development and analysis of business plans or intellectual property in **biotechnology-focused** companies, agencies or law firms is also possible.

BIO 464: Applied Biotechnology (4 Credits)

Lecture: TTH 9:30-10:50AM (M001)

Laboratory: TU 12:30-3:35PM (M002) or W 12:30-3:35PM (M004)

Meets with: BIO 664 M001

Prerequisite: BIO 326 and BIO 327

Instructor: Surabhi Raina

This is the second course of a two-course Biotechnology series. The first course, BIO 463 Molecular Biotechnology, is offered in the fall. These courses complement each other, but one is not required for the other. They introduce students to the molecular and genetic principles and processes involved in biotechnology. Lectures will include topics such as the genetic modification of microbial, plant, & animal cells, forensic biotechnology, and important medical, industrial, agricultural and environmental applications of biotechnology. Labs will cover many of the methods routinely used in biotechnology labs. This course will address such questions as: What is biotechnology, how is it done, and how is it being used today? How can biotechnology impact lives of humans and other animals, plants, and the environment? What are the issues that biotechnology raises about the role of science and technology in society and ethical issues related to Biotechnology? Enrollment in the lab section will automatically enroll you in the lecture section. **This course satisfies the communication skills requirement, the Cell and Molecular Biology (CM) distribution requirement, and 3-credits of upper division lab experience.**

BIO 469 M001: Science of Countering Weapons of Mass Destruction (3 Credits)

MW 3:45-5:05PM

Meets with: BIO 669 M001

Crosslisted with: FSC 469 M001 and FSC 669 M001

Prerequisite: B- or better in BIO 327 and CHE 275

Instructor: Robert Silver

Scientific basis and means for countering WMDs, including biological systems. It will cover protective measures, proven doctrines, practical questions, and problem solving. Additional work required of graduate students. **This course satisfies the Cell and Molecular Biology (CM) distribution requirement.**

BIO 473 M002: Pharmaceuticals & Cells (3 Credits)**MW 12:45-2:05PM**

Meets with: BIO 673 M002

Prerequisite: BIO 326 and BIO 327

Instructor: Ruth Phillips

How do drugs affect cells, and why should we care? Students will be introduced to a variety of signal transduction pathways and their function in the regulation of cellular processes. To demonstrate applications of signal transduction in biotechnology, this course focuses on signaling cascades targeted in the treatment (or potential treatment) of medical conditions including cancer, asthma, depression, drug addiction, neurodegeneration, cardiovascular disease and developmental abnormalities. Additional work is required of graduate students. **This course satisfies the communication skills requirement and the Cell & Molecular Biology (CM) distribution requirement.** This course is offered synchronously online,

BCM 476 M001: Biochemistry II (3 Credits)**MWF 9:30-10:25AM**

Prerequisite: BCM 475

Instructor: Olga Makhlynets

Biochemistry II is a continuation of Biochemistry I. It covers: (a) mechanisms, integration and regulation of intermediary, autotrophic, nitrogen, and energy metabolism; (b) structure, function and metabolism of carbohydrates, lipids and proteins; and (c) the nature and function of subcellular organelles. **This course satisfies the Cell and Molecular Biology (CM) distribution requirement.**

BCM 477 M001: Protein & Nucleic Acids Laboratory (3 Credits)**Lecture: M 2:15-3:15PM****Laboratory: W 12:45-4:45PM**

Crosslisted with: CHE 477

Prerequisites: BIO 305 and BIO 326 or BCM 475 or CHE 474

Instructor: Davoud Mozhdehi

This class will involve experimental methods for production and purification of biomacromolecules with an emphasis on recent breakthroughs in biomolecular engineering. The course will include topics such as genetically encoded materials; polymerase chain reaction; site-directed mutagenesis; protein expression and purification; post-translational modification of proteins, nucleic acid, and protein electrophoresis. **It satisfies 3credits of upper division lab experience.**

BIO 490: Independent Study (1-6 Credits)**Varied Times**

Instructor: Varied

This is an exploration of a problem, or problems, in depth based on a plan submitted by the student. Admission to the course is by consent of the supervising instructor(s) and the department. A proposal is required.

BIO 495: Distinction Thesis in Biology (1-3 Credits)

Varied Times

Instructor: Varied

This course is for students preparing a thesis in partial fulfillment of the requirements for the Distinction in Biology Program. Distinction students will enroll in the semester prior to graduation. **Departmental consent required.**

BIO 499/BCM 499: Biology/Biochemistry Honors Capstone Project (1-3 Credits)

Varied Times

Instructor: Varied

This is the completion of an Honors Capstone Project under the supervision of a faculty member.

BIO 501 M001: Biology of Cancer (3 Credits)

MWF 10:35-11:30AM

Prerequisites: BIO 326 and BIO 327

Instructor: Tom Fondy

This course covers four areas: (1) Clinical features: extent, effects, epidemiology, pathology, definitions, classifications, and model systems; (2) Basic biology of cancer cells: growth, biochemical characteristics, progression, invasion, metastasis; (3) Causation: viral oncogenesis, oncogenes, suppressor genes, apoptosis; and (4) Management: host response, immunology, and immunotherapy. **Acquisition and use of the Turning Point QT or QT2 transmitter (Not the RF 'clicker') is required. This course fulfills the Cell and Molecular Biology (CM) distribution requirement.**

BIO 503 M002: Developmental Biology (3 Credits)

TTH 11:00AM-12:20PM

Prerequisites: BIO 326 and 327

Instructor: Jessica MacDonald

This course will examine the mechanisms that control animal development at the cellular and molecular levels. Topics to be covered include patterns of early embryonic cleavage and morphogenesis, mechanisms of cellular differentiation, mechanisms of morphogenesis, pattern formation, and the genetic control of development. The class will emphasize the wide variety of experimental approaches used to study different aspects of development. Please note that this is **not** a descriptive embryology course. Rather, the goal is to provide students with an understanding of developmental mechanisms. Classes will involve lectures, small group discussions, and general discussions. **This course will satisfy the Cell and Molecular Biology (CM) distribution requirement.**

Graduate Courses

BIO 501 M001: Biology of Cancer (3 Credits)

MWF 10:35-11:30AM

Instructor: Tom Fondy

This course covers four areas: (1) Clinical features: extent, effects, epidemiology, pathology, definitions, classifications, and model systems; (2) Basic biology of cancer cells: growth, biochemical characteristics, progression, invasion, metastasis; (3) Causation: viral oncogenesis, oncogenes, suppressor genes, apoptosis; and (4) Management: host response, immunology, and immunotherapy. **Acquisition and use of the Turning Point QT or QT2 transmitter (Not the RF ‘clicker’) is required.**

BIO 503 M002: Developmental Biology (3 Credits)

TTH 11:00AM-12:20PM

Instructor: Jessica MacDonald

This course will examine the mechanisms that control animal development at the cellular and molecular levels. Topics to be covered include patterns of early embryonic cleavage and morphogenesis, mechanisms of cellular differentiation, mechanisms of morphogenesis, pattern formation, and the genetic control of development. The class will emphasize the wide variety of experimental approaches used to study different aspects of development. Please note that this is **not** a descriptive embryology course. Rather, the goal is to provide students with an understanding of developmental mechanisms. Classes will involve lectures, small group discussions, and general discussions.

BIO 600 M003: Experimental Designs & Interpretations (3 Credits)

MW 3:45-5:05PM

Meets with: BIO 400 M003

Instructor: Ruth Phillips

Seminar class where students (1) evaluate published papers for rigorous design, statistics and interpretation to determine their validity and contributions and (2) compose a series of mini grants to design and propose future experiments and studies. This course is offered synchronously online.

BIO 600 M004: Climate Change: Science, Perception and Policy (3 Credits)

M 2:15-5:00PM

Meets with: LAW 891 M001, PAI 770 M001, and PSC 700 M001

Instructors: Doug Frank, Mark Nevitt, Sarah Pralle, and Peter Wilcoxon

This course examines climate change from a multidisciplinary perspective that blends natural science, politics, economics, and law. It will cover: the drivers behind anthropogenic changes in the composition of the atmosphere that are causing climate change; the response of the global climate system; the global carbon, water, and nutrient cycles; local vulnerabilities of natural and social systems to climate change, and the likely impacts on those systems; actions that could reduce the impacts of climate change through adaptation; and actions that could mitigate the problem by reducing changes in the composition of the atmosphere. The course is intended to bring together students from a diverse range of backgrounds and does not have specific prerequisites.

BIO 600 M007: Graduate Capstone in Biotechnology (1 Credit)

M 12:45-1:40PM

Instructor: Surabhi Raina

Students will synthesize Biotechnology principles and concepts while developing skills in workshop-style sessions that enhance their competitiveness as applicants for jobs in the field and/or professional schools. This is for MS Biotechnology students only.

BIO 600 M015: Pharmacology of Drugs of Abuse (3 Credits)

MW 2:15-3:35PM

Meets with: BIO 400 M015

Instructor: James Hewett

This course covers major drugs of abuse, include Alcohol, Cannabis, Cocaine, Methamphetamine, and Opiates, and will include relevant neuroanatomy and cellular and biochemical mechanisms of their mode of action.

BIO 600 M016 and M017: Advanced Microscopy Techniques in Cell & Developmental Biology Lab (3 Credits)

Lecture: M 2:15-3:10PM

Laboratory: W 12:45-4:45PM

Meets with: BIO 400 M016 and M017

Instructor: Heidi Hehnly

Both a literature-based course in light microscopy with hands on lab experience using high-end microscopic systems. Students cover studies contributing to their knowledge on cell and development biology while implementing those techniques in the lab.

BIO 600 M018: BioArt (3 Credits)

F 2:15-6:15PM

Meets with: TRM 500 M002

Instructor: Heidi Hehnly and Boryana Rossa

This course is a studio and history class, which brings together transmedia and biology students, offering overlap of disciplines with hands on study of digital imaging technologies, microscopy, biological drawing, and lecturing on the relatively new field of bio-art.

BIO 600 M019 and M020: Environmental Biology Lab (3 Credits)

Lecture: T 2:00-2:55PM

Laboratory: TH 12:30-4:30PM

Meets with: BIO 400 M019 and M020

Instructor: Mark Ritchie

This course explores global environmental problems such as habitat fragmentation, biodiversity loss, warming, and pollution from excess nitrogen and carbon through laboratory exercises. Skills learned include using simple Geographical Information Systems, basic Python programming, and spreadsheets as

well as analysis of online biodiversity databases. Involves some outside winter activity and tree identification.

BIO 600 M021: Perspectives in Alzheimer's (1 Credit)

F 10:40-11:35AM

Meets with: BIO 400 M021

Instructor: Donna Korol

For InROADS scholars only.

BIO 600 M022: Modulation of Brain Function (3 Credits)

T 2:00-4:45PM

Meets with BIO 400 M022

Instructor: Paul Gold

Traditional models of synaptic transmission are based on release of neurotransmitters to act on postsynaptic ionotropic receptors, resulting in excitation and inhibition of the postsynaptic neuron. However, many chemicals released by neurons act on metabotropic (G-protein coupled) receptors, sometimes located at a distance considerably further from release sites than a traditional synaptic cleft. These are neuromodulators and can regulate the excitation/inhibition state of neural networks, i.e., beyond acting across a synapse. This course will examine neuromodulators, which include norepinephrine, serotonin, acetylcholine, peptides, and others. After initial classes to define the topic, the organization of the course will be comprised of student presentations and papers that select a modulator and examine its functional properties, defined during development, regulation of neurophysiology, neural plasticity and memory and other behaviors.

BIO 607 M001: Advanced Neuroscience (3 Credits)

TTH 9:30-10:50AM

Meets with: BIO 407 M001 and NEU 407 M001

Instructor: Sandra Hewett

An advanced introduction to neuroscience taught at the upper undergraduate or beginning graduate student level. The course spans the anatomy, physiology and chemistry of the nervous system, from the molecular to the cellular and systems level. Topics include neurons and electrochemical and biophysical properties of neurons, neurochemistry, sensory and motor systems, neural plasticity and development.

BIO 608 M001: Quantitative Methods for Life Scientists (3 Credits)

TTH 9:30-10:50AM

Meets with: BIO 400 M023

Instructor: Jason Fridley

This is a graduate-level course in statistics and data analysis for those conducting research in field- or laboratory-based life sciences. Through a series of case studies involving the primary biological literature, students will discuss key statistical concepts (e.g., random sampling, modeling uncertainty, statistical independence, model inference, multilevel data) and their relation to common methods, including generalized regression, analysis of variance, contingency tables, mixed models, post hoc tests, and more advanced methods (e.g., maximum likelihood, Bayesian approaches, multivariate models), depending on student interests. Students will be encouraged to work in groups on weekly assignments and case studies

will reflect student research areas. There are no prerequisites, but students should be experienced with spreadsheet manipulation and have familiarity with or a desire to learn R.

BIO 610: Graduate Research Laboratory (1-3 Credits)

Varied Times

Instructor: Varied

This is work in research laboratories to acquire skills and techniques. It may be repeated for a maximum of 6-credits.

BIO 616 M001: Biology of Aging (3 Credits)

MW 2:15-3:35PM

Meets with: BIO 416 M001

Instructor: Donna Korol

Aging is an intrinsic property of all living organisms. However, the way in which aging manifests itself varies quite broadly within and between species. To understand the complex nature of aging and its place in the life cycle, this course will review topics related to the biology of aging across many levels of analysis from molecule to cell to system to organism. Classic and contemporary aging research will be evaluated from a variety of experimental models. In the process, we will dispel some of the myths of aging even as they relate to basic scientific findings and evaluate how the conventional wisdom on aging issues obtained through the media and other public sources reflects and influences basic research findings. Organization of the course includes lectures, discussions, quizzes, and a variety of written assignments.

BIO 624 M001: Readings in Neuroscience (0-3 Credits)

TTH 11:00AM-12:20PM

Crosslisted with: BEN 613 M001, CSD 753 M001, and NEU 613 M001

Instructor: Jen Cook

A literature-based team-taught course focusing on in depth discussions of classical or recent papers of exceptional importance to neuroscience. Students will complete weekly readings and participate in group facilitated discussion.

BIO 656 M001: Human Disease Genomics (3 Credits)

TTH 9:30-10:50AM

Meets with: BIO 456 M001

Instructor: Steve Dorus

This seminar class introduces students to influential genomic studies relating to human evolution and the etiology & epidemiology of human disease. Recent insights into the genetic basis of human adaptation & its potential relevance to disease predisposition will be discussed.

BIO 664: Applied Biotechnology (4 Credits)**Lecture: TTH 9:30-10:50AM (M001)****Laboratory: TH 12:30-3:35PM (M003)**

Meets with: BIO 464

Instructor: Surabhi Raina

This is the second course of a two-course Biotechnology series. The first course, BIO 663 Molecular Biotechnology, is offered in the fall. These courses complement each other, but one is not required for the other. They introduce students to the molecular and genetic principles and processes involved in biotechnology. Lectures will include topics such as the genetic modification of microbial, plant, & animal cells, forensic biotechnology, and important medical, industrial, agricultural and environmental applications of biotechnology. Labs will cover many of the methods routinely used in biotechnology labs. This course will address such questions as: What is biotechnology, how is it done, and how is it being used today? How can biotechnology impact lives of humans and other animals, plants, and the environment? What are the issues that biotechnology raises about the role of science and technology in society and ethical issues related to Biotechnology? Enrollment in a lab section will automatically enroll you in the lecture section.

BIO 669 M001 Science of Countering Weapons of Mass Destruction (3 Credits)**MW 3:45-5:05PM**

Meets with: BIO 469 M001

Crosslisted with: FSC 469 M001 and FSC 669 M001

Instructor: Robert Silver

Scientific basis and means for countering WMDs, including biological systems. It will cover protective measures, proven doctrines, practical questions, and problem solving.

BIO 673 M002: Pharmaceuticals & Cells (3 Credits)**MW 12:45-2:05PM**

Meets with: BIO 473 M002

Instructor: Ruth Phillips

How do drugs affect cells, and why should we care? Students will be introduced to a variety of signal transduction pathways and their function in the regulation of cellular processes. To demonstrate applications of signal transduction in biotechnology, this course focuses on signaling cascades targeted in the treatment (or potential treatment) of medical conditions including cancer, asthma, depression, drug addiction, neurodegeneration, cardiovascular disease and developmental abnormalities. This course is offered synchronously online.

BIO 688: Biological Literature (1-3 Credits)**Varied Times**

Instructor: Varied

A student reviews a specific area in conjunction with a faculty member in this tutorial. Prior to the beginning of the semester, a proposal for Independent Study must be completed (in which the area and procedures for

evaluation are described), signed by the supervising professor and given to the Academic Coordinator in the Biology Department for processing.

BIO 690: Independent Study (1-6 Credits)

Varied Times

Instructor: Varied

This course is a special project in which a graduate student conducts laboratory or field research unrelated to his/her thesis or dissertation research and supervised by a faculty member other than his/her supervisor. Prior to the beginning of the semester, a proposal for Independent Study must be completed (in which the project and procedures for evaluation are described), signed by the supervising professor and given to the Academic Coordinator in the Biology Department for processing.

BIO 705 M001: Graduate Research Seminars (0-1 Credit)

T 3:30-4:25PM

Instructor: Scott Erdman

Students present their thesis or dissertation research and critically evaluate the research presentations of other students.

BIO 997 M001: Master's Thesis (0-6 Credits)

BIO 999 M001: Dissertation (0-15 Credits)

Varied Times

Instructor: Varied