

# Course Descriptions

Spring 2021

## 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. Weekly asynchronous recorded lectures and live synchronous student-centered sessions.

### **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. Half of the labs will be in-person and half online. Full online labs are for international students only.

### **BIO 200 M002 and M003: Introduction to Biological Research (2 Credits)**

**T 3:30-4:50PM (M002)**

**TH 5:00-6:20PM (M003)**

Instructors: Mariah Maxwell (M002) and Takunda Maisva (M003)

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. This will be offered synchronously online.

**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. The lecture will be synchronously online. The labs and recitations will be in-person with options for those who cannot be face-to-face.

**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. Meetings may be synchronously online and/or in-person depending on the consensus of the class.

**BIO 300 M001: Autonomic Physiology (3 Credits)**

**MW 2:15-3:35PM**

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.** This lecture will be synchronously online.

**BIO 305 M001: Integrative Biology Laboratory (3 Credits)**

**Lecture: M 10:35AM-12:05PM**

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

Prerequisite: BIO 121 or equivalent and BIO 326 or 327 or 345

Instructors: Katharine Lewis, Eleanor Maine, and PTI

This class provides students with early laboratory experience, presenting a quantitative, integrated view of subcellular, cellular, developmental, organismal, and ecosystem/environmental perspectives on biology. The lecture will be synchronously online. In-person attendance required for select labs.

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

**Lecture: MW 12:45-2:05PM**

**Laboratory: F 8:25-11:25AM or 12:45-3:45PM**

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.** The lecture will be synchronously online. The labs are in-person with options for those who cannot be face-to-face.

**BIO 326 M001: Genetics (3 Credits)**

**Lecture: TTH 11:00AM-12:20PM**

**Recitations: W & F (1 Day/Week – Varied Times)**

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. The lecture will be synchronously online. Recitation sections vary for some will be setup as in-person and some will be strictly online.

**BIO 360 M001: Biology Lab Assistant (1 Credit)**

**M 3:45-5:05PM**

Prerequisite: One upper division 3 credit Biology lab such as BIO 435 and 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. This is in-person only.

**BIO 396 M001: Stem Cells and Society**

**TTH 12:30-1:50PM**

Crosslisted with: PHI 396 M001

Instructors: Scott Erdman and Nicole Fortier

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.** The lecture will be synchronously online.

### **BIO 400 M001: Microscopy Cell & Developmental Biology (3 Credits)**

**MW 2:15-3:35PM**

Meets with: BIO 600 M001

Prerequisite: BIO 326 and BIO 327

Instructor: Heidi Hehnly

Microscopy in Cell and Developmental Biology is a course in light microscopy for undergraduates and graduates in molecular, cellular, developmental, and neurobiology. This course provides advanced discussions on methodology in Cell and Developmental Biology, with a focus on the primary literature that lead to major discoveries in Cell Biology. The course also discusses systematic and in-depth examination of image formation and application of video and digital methods for exploring subtle interactions between light and cells. This course emphasizes the quantitative issues that are critical to the proper interpretation of images obtained from various light microscopes. This is a primary-literature based course where students will cover the foundational studies that contributed to our current knowledge on cell and development biology and that employed imaging approaches. This is a hybrid-class this year with an in class and online portion. **It satisfies the communication skills requirement and the Cell & Molecular Biology (CM) distribution requirement.**

### **BIO 400 M002: Applied Genomics (3 Credits)**

**MWF 9:30-10:25AM**

Meets with: BIO 600 M002

Prerequisite: BIO 326 and BIO 327

Instructor: Yasir Ahmed

This course is designed for upper-level undergraduate and graduate students. The course will be a comprehensive introduction to Next Generation Sequencing (NGS) technologies and their application to a variety of biological research problems, such as genome assembly and annotation, gene expression analysis, microbial genomics, and comparative evolutionary analyses. In addition to lectures, which will cover concepts and describe methods, students will receive hands-on computational training, read and discuss scientific papers, and engage in projects analyzing multi'omic datasets. The main goal of the course is to provide students with the necessary skills to be able to navigate genomic datasets and execute the appropriate bioinformatic approaches to analyze such data. **It satisfies the communication skills requirement and the Ecology and Evolutionary Biology (EE) distribution requirement.** This course is offered both synchronously online and in-person.

### **BIO 400 M005: Experimental Designs & Interpretations (3 Credits)**

**T 2:00-4:45PM**

Meets with: BIO 600 M005

Instructor: Paul Gold

This seminar will discuss issues in analyses of data in primary articles. Using multiple papers, the topics include: Do the authors compare the correct groups? Does the design, and do the results, adequately address the question posed in the introduction? Most class meetings will involve student presentations of papers and evaluation of the papers as above. The course will include multiple presentations and papers by each student. The class is directed mainly toward those undergraduates who are engaged in active research and 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 M006: Science Outreach in Biology (3 Credits)**

**TTH 12:30-1:50PM**

Meets with: BIO 600 M006

Prerequisite: Permission by Instructor Only

Instructor: Katie Becklin

Through their research, scientists have a unique opportunity to impact society. Scientists are increasingly called upon to share their expertise with the public to inform decision-making. Sharing that knowledge successfully requires scientists to be skilled communicators who can engage diverse people in the wonder of science. In this course, you will (1) learn about the principles of science communication and outreach, (2) gain practical experience working with outreach programs, and (3) design your own original, evidence-based outreach program addressing a scientific issue of public concern. **This course satisfies the communication skills requirement.** It will meet in-person only.

### **BIO 400 M008: Quantitative Methods for Life Scientists (3 Credits)**

**TTH 9:30-10:50AM**

Meets with: BIO 600 M008

Prerequisites: MAT 221 and 222

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.** The lecture is offered synchronously online with a voluntary recitation strictly in-person.

### **BIO 400 M009: Seminar in Ecosystem Science (3 Credits)**

**MW 3:45-5:05PM**

Meets with: BIO 600 M009

Prerequisite: BIO 345

Instructor: Doug Frank

Ecosystem science is the study of the metabolism of energy and nutrients in terrestrial and aquatic habitats. This course will include three modules addressing (1) the controls on flows of energy and nutrients in ecosystems, (2) how climate change are/will disrupt these dynamics, and (3) some societal consequences of climate change. The course will be a seminar type format with most classes involving student-led discussions of papers published in the primary literature. **This course satisfies the communication skills requirement and the Ecology and Evolutionary Biology (EE) distribution requirement.** The class is offered synchronously online and in-person.

**BIO 400 M010: Minorities in Ecology and Evolution (3 Credits)**

**TTH 11:00AM-12:20PM**

Meets with: BIO 600 M010

Prerequisite: BIO 345

Instructor: Kari Segraves

This discussion-based course will highlight the research advances of underrepresented scholars and will examine current and historical bias in the field of ecology and evolution. The course format will include student presentations, student-led discussions, participation, and written assignments. **This course satisfies the communication skills requirement and the Ecology and Evolutionary Biology (EE) distribution requirement.** It will meet synchronously online.

**BIO 400 M011: Advances in Biotechnology Research & Ideas (3 Credits)**

**TTH 11:00AM-12:20PM**

Meets with: BIO 600 M011

Prerequisite: BIO 326 and 327

Instructor: Ruth Phillips

What is going on in biotechnology, in the real world, right now? This topical course explores a variety of cutting-edge biotechnology research areas. The particular subject matter varies from semester to semester, based on the most recent advances in biotechnology. Topics include gene therapy/gene editing, personalized medicine, stem cells/regenerative medicine, bioremediation, environmental and sustainability biotechnology, optogenetics, nanotechnology, immunotherapy, and many others. Readings are drawn primarily from current scientific journal articles. The course is student-centered and project-based, in order to encourage students to develop a broad understanding of what biotechnology can be used for, while pursuing aspects of the field that interest them most. Emphasis is placed on creatively and critically applying basic principles of biotechnology to solve problems that matter. **This course satisfies the communication skills requirement and the Cell & Molecular Biology (CM) distribution requirement.** It will meet synchronously online.

**BIO 400 M013: Evolutionary Ecology Lab (3 Credits)**

**T 2:00-4:45PM**

Prerequisite: BIO 345

Instructor: Kari Segraves

This lab course will build on Bio 345 by revisiting general concepts in evolutionary ecology. Students will design and implement novel research projects in evolutionary ecology and will write up the results as a research article for publication in a scientific journal. The course format will include hands-on exercises, student-led discussions, and oral/written synthesis of the primary literature. **This course satisfies the communication skills requirement, the Ecology and Evolutionary Biology (EE) distribution requirement and 3-credits of upper-division lab experience.** The lab will be offered in-person only.

**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 undergraduates 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.** It will be offered in-person only.

**BIO 409 M001: General Microbiology (4 Credits)****Lecture: MWF 11:40AM-12:35PM****Laboratory: MW 12:45-2:05PM or 2:15-3:35PM or 3:45-5:05PM**

Prerequisite: BIO 326 and BIO 327

Instructor: PTI

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.** The lecture will be synchronously online, but the labs will be in-person only.

**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. It will be offered synchronously online.

**BIO 421 M002: Capstone Seminar in Biotechnology (3 Credits)****MW 12:45-2:05PM**

Prerequisites: BIO 463

Instructor: Surabhi Raina

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 course satisfies the communication skills requirement.** This class will be offered synchronously online and in-person.

### **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.** It will be offered synchronously online.

### **BIO 452 M001: Neurodegenerative Disease (3 Credits)**

**W 2:15-5:05PM**

Meets with: BIO 652 M001

Prerequisite: BIO 326 and 327

Instructor: Donna Korol

This seminar course is intended to review and to stimulate discussion about the current status of our knowledge regarding neurodegenerative disease. While the main focus is on the etiology, neurobiology, and emergent symptoms of the diseases, broader biological, sociological, and historical perspectives are woven into the material. This course will include student presentations and a variety of written assignments. Juniors and seniors only. Although not required, prior neuroscience coursework-related or research is encouraged. **It satisfies the communication skills requirement and the Cell & Molecular Biology (CM) distribution requirement.** It will be offered synchronously online.

### **BIO 456 M001: 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 and the Ecology and Evolutionary Biology (EE) distribution requirement.** It will be offered in-person.

### **BIO 457 M001: Principles of Human Toxicology (3 Credits)**

**MW 2:15-3:35PM**

Meets with: BIO 657 M001

Crosslisted with: FSC 457/657 M001

Prerequisite: BIO 327, CHE 275, and MAT 285

Instructor: James Hewett

This course will examine the interactions between chemical, physical or biological substances and mammalian systems that result in adverse changes in physiological function. Concepts in chemistry, biochemistry, cell biology, and anatomy and physiology will be applied to the study of absorption, distribution, biometabolism and elimination of toxic agents, or poisons. In addition, general molecular mechanisms by which poisons act will be examined, including the processes of genotoxicity and carcinogenesis. Several general classes of poisonous agents, including pesticides, herbicides, and heavy

metals, will be discussed in some detail. Finally, students will learn about important concepts in exposure risk assessment and the government agencies that regulate use of and exposure to chemicals in our food and environment. **This course satisfies the Cell & Molecular Biology (CM) distribution requirement.** It will be offered in-person only.

### **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 TH 12:30-3:35PM (M003)**

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.** The lecture will be offered synchronously online and in-person, but the lab is strictly in-person only.

### **BIO 471 M001: Cell & Developmental Biology Laboratory (3 Credits)**

**Lecture: TU 12:30-1:25PM**

**Laboratory: TH 12:30-4:30PM**

Meets with: BIO 671 M001

Prerequisite: BIO 326 and BIO 327

Instructor: Melissa Pepling

This course reviews current methods employed in cell and developmental biology studies, including microscopy and imaging techniques, spatial analyses of gene expression, protein expression and localization, cell fractionation, and immunocytochemistry. In addition, it reviews general laboratory methods, data analysis and reporting. **This course satisfies the communication skills requirement, the Cell and Molecular Biology (CM) distribution requirement, and 3 credits of upper division lab experience.** It will be offered in-person only.

### **BIO 473 M001: Pharmaceuticals and Cells (3 Credits)**

**MW 3:45-5:05PM**

Meets with: BIO 673 M001

Prerequisite: BIO 326 and 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. **This course satisfies the communication skills requirement and the Cell & Molecular Biology (CM) distribution requirement.** It will be offered synchronously online.

### **BIO 476 M001: Cold Cases (3 Credits)**

**MW 3:45-5:05PM**

Meets with: BIO 676 M001

Crosslisted with: FSC 476/676 M001

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

Instructor: Robert Silver

This class involves methods and practice in solving unsolved cases using fundamental science, court documents, and other sources of information. Students will work on real cases. **This course satisfies the Cell and Molecular Biology (CM) distribution requirement.** It will be offered synchronously online.

### **BCM 476 M001: Biochemistry II (3 Credits)**

**MWF 9:30-10:25AM**

Prerequisite: BCM 475

Instructor: Ivan Korendovych

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**

Meets with: BCM 677 M001

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 3 credits of upper division lab experience.** It will be offered in-person only.

### **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)**

**TTH 2:00-3:20PM**

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.** It will be offered in-person only.

**BIO 503 M001: Developmental Biology (3 Credits)**

**TTH 11:00AM-12:20**

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.** It will be offered in-person with options for those who cannot be face-to-face.

## Graduate Courses

### **BIO 501 M001: Biology of Cancer (3 Credits)**

**TTH 2:00-3:20PM**

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.** It will be offered in-person only.

### **BIO 503 M001: Developmental Biology (3 Credits)**

**TTH 11:00AM-12:20**

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.** It will be offered in-person with options for those who cannot be face-to-face.

### **BIO 600 M001: Microscopy Cell & Developmental Biology (3 Credits)**

**MW 2:15-3:35PM**

Meets with: BIO 400 M001

Instructor: Heidi Hehnly

Microscopy in Cell and Developmental Biology is a course in light microscopy for undergraduates and graduates in molecular, cellular, developmental, and neurobiology. This course provides advanced discussions on methodology in Cell and Developmental Biology, with a focus on the primary literature that lead to major discoveries in Cell Biology. The course also discusses systematic and in-depth examination of image formation and application of video and digital methods for exploring subtle interactions between light and cells. This course emphasizes the quantitative issues that are critical to the proper interpretation of images obtained from various light microscopes. This is a primary-literature based course where students will cover the foundational studies that contributed to our current knowledge on cell and development biology and that employed imaging approaches. This is a hybrid-class this year with an in class and online portion.

**BIO 600 M002: Applied Genomics (3 Credits)****MWF 9:30-10:25AM**

Meets with: BIO 400 M002

Instructor: Yasir Ahmed

The course will be a comprehensive introduction to Next Generation Sequencing (NGS) technologies and their application to a variety of biological research problems, such as genome assembly and annotation, gene expression analysis, microbial genomics, and comparative evolutionary analyses. In addition to lectures, which will cover concepts and describe methods, students will receive hands-on computational training, read and discuss scientific papers, and engage in projects analyzing multi'omic datasets. The main goal of the course is to provide students with the necessary skills to be able to navigate genomic datasets and execute the appropriate bioinformatic approaches to analyze such data. This course is offered both synchronously online and in-person.

**BIO 600 M005: Experimental Designs & Interpretations (3 Credits)****T 2:00-4:45PM**

Meets with: BIO 400 M005

Instructor: Paul Gold

This seminar will discuss issues in analyses of data in primary articles. Using multiple papers, the topics include: Do the authors compare the correct groups? Does the design, and do the results, adequately address the question posed in the introduction? Most class meetings will involve student presentations of papers and evaluation of the papers as above. The course will include multiple presentations and papers by each student. This course is offered synchronously online.

**BIO 600 M006: Science Outreach in Biology (3 Credits)****TTH 12:30-1:50PM**

Meets with: BIO 600 M006

Instructor: Katie Becklin

Through their research, scientists have a unique opportunity to impact society. Scientists are increasingly called upon to share their expertise with the public to inform decision-making. Sharing that knowledge successfully requires scientists to be skilled communicators who can engage diverse people in the wonder of science. In this course, you will (1) learn about the principles of science communication and outreach, (2) gain practical experience working with outreach programs, and (3) design your own original, evidence-based outreach program addressing a scientific issue of public concern. It will meet in-person only.

**BIO 600 M008: Quantitative Methods for Life Scientists (3 Credits)****TTH 9:30-10:50AM**

Meets with: BIO 400 M008

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. The lecture is offered synchronously online with a voluntary recitation strictly in-person.

**BIO 600 M009: Seminar in Ecosystem Science (3 Credits)**

**MW 3:45-5:05PM**

Meets with: BIO 400 M009

Instructor: Doug Frank

Ecosystem science is the study of the metabolism of energy and nutrients in terrestrial and aquatic habitats. This course will include three modules addressing (1) the controls on flows of energy and nutrients in ecosystems, (2) how climate change are/will disrupt these dynamics, and (3) some societal consequences of climate change. The course will be a seminar type format with most classes involving student-led discussions of papers published in the primary literature. The class is offered synchronously online and in-person.

**BIO 600 M010: Minorities in Ecology and Evolution (3 Credits)**

**TTH 11:00AM-12:20PM**

Meets with: BIO 400 M010

Prerequisite: Permission by Instructor Only

Instructor: Kari Segraves

This discussion-based course will highlight the research advances of underrepresented scholars and will examine current and historical bias in the field of ecology and evolution. The course format will include student presentations, student-led discussions, participation, and written assignments. It will meet synchronously online.

**BIO 600 M011: Advances in Biotechnology Research & Ideas (3 Credits)**

**TTH 11:00AM-12:20PM**

Meets with: BIO 400 M011

Instructor: Ruth Phillips

What is going on in biotechnology, in the real world, right now? This topical course explores a variety of cutting-edge biotechnology research areas. The particular subject matter varies from semester to semester, based on the most recent advances in biotechnology. Topics include gene therapy/gene editing, personalized medicine, stem cells/regenerative medicine, bioremediation, environmental and sustainability biotechnology, optogenetics, nanotechnology, immunotherapy, and many others. Readings are drawn primarily from current scientific journal articles. The course is student-centered and project-based, in order to encourage students to develop a broad understanding of what biotechnology can be used for, while pursuing aspects of the field that interest them most. Emphasis is placed on creatively and critically applying basic principles of biotechnology to solve problems that matter. It will meet synchronously online.

**BIO 600 M013: Evolutionary Ecology Lab (3 Credits)**

**T 2:00-4:45PM**

Instructor: Kari Segraves

Students will design and implement novel research projects in evolutionary ecology and will write up the results as a research article for publication in a scientific journal. The course format will include hands-on exercises, student-led discussions, and oral/written synthesis of the primary literature. The lab will be offered in-person only.

**BIO 600 M014: Graduate Capstone in Biotechnology (1 Credit)**

**T 5:00-5:55PM**

Instructor: Ramesh Raina

The course will discuss current challenges in the areas of health care, agriculture, environment, and industry and consider contemporary strategies using tools of biotechnology to address these challenges. This class is for MS Biotechnology students only. It will meet in-person.

**BIO 607 M001: Advanced Neuroscience (3 Credits)**

**TUTH 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. It will meet in-person.

**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 625 M001: Methods in Neuroscience (0-3 Credits)**

**TTH 5:00-6:20PM**

Crosslisted with: NEU 614, BEN 614 and CSD 754

Instructor: Jen Cook

This practical interdisciplinary survey course allows neuroscience faculty to introduce students to a wide array of methodologies, including molecular, cellular, and developmental systems, as well as behavioral and cognitive neuroscientific approaches to investigate basic, pre-clinical, translational, and clinical questions to unravel the relationship between brain and behavior. Throughout the semester, students will complete readings assigned by each faculty member and participate in a facilitated discussion. Students will then be introduced to the methodology through a combination of literature, presentations, and practical virtual exercises determined by each professor based on feasibility, practicality, and ethical considerations. This class will meet synchronously online.

**BIO 652 M001: Neurodegenerative Disease (3 Credits)**

**W 2:15-5:05PM**

Meets with: BIO 452 M001

Instructor: Donna Korol

This seminar course is intended to review and to stimulate discussion about the current status of our knowledge regarding neurodegenerative diseases. While the main focus is on the etiology, neurobiology, and emergent symptoms of the diseases, broader biological, sociological, and historical perspectives are woven into the material. This course will include student

presentations and a variety of written assignments. Although not required, prior neuroscience related coursework or research is encouraged. It will meet synchronously online.

**BIO 656 M001: Human Disease Genomics (3 Credits)**

**TUTH 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. It will meet in-person.

**BIO 657 M001: Principles of Human Toxicology (3 Credits)**

**MW 2:15-3:35PM**

Meets with: BIO 457 M001

Crosslisted with: FSC 457/657 M001

Instructor: James Hewett

This course will examine the interactions between chemical, physical or biological substances and mammalian systems that result in adverse changes in physiological function. Concepts in chemistry, biochemistry, cell biology, and anatomy and physiology will be applied to the study of absorption, distribution, biometabolism and elimination of toxic agents, or poisons. In addition, general molecular mechanisms by which poisons act will be examined, including the processes of genotoxicity and carcinogenesis. Several general classes of poisonous agents, including pesticides, herbicides, and heavy metals, will be discussed in some detail. Finally, students will learn about important concepts in exposure risk assessment and the government agencies that regulate use of and exposure to chemicals in our food and environment. It will meet in-person only.

**BIO 664: Applied Biotechnology (4 Credits)**

**Lecture: TTh 9:30-10:50AM (M001)**

**Laboratory: T 12:30-3:35PM (M002) or 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. The lecture will be offered synchronously online and in-person. However, the lab is in-person only.

**BIO 671 M001: Cell & Developmental Biology Laboratory (3 Credits)**

**Lecture: TU 12:30-1:25PM**

**Laboratory: TH 12:30-4:30PM**

Meets with: BIO 471 M001

Instructor: Melissa Pepling

This course reviews current methods employed in cell and developmental biology studies, including microscopy and imaging techniques, spatial analyses of gene expression, protein expression and localization, cell fractionation, and immunocytochemistry. In addition, it reviews general laboratory methods, data analysis and reporting. Both the lecture and the lab will meet in-person.

**BIO 673 M001: Pharmaceuticals and Cells (3 Credits)**

**MW 3:45-5:05PM**

Meets with: BIO 473 M001

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. It will meet synchronously online.

**BIO 676 M001: Cold Cases (3 Credits)**

**MW 3:45-5:05PM**

Meets with: BIO 476 M001

Crosslisted with: FSC 476 M001 and FSC 676 M001

Instructor: Robert Silver

This class involves methods and practice in solving unsolved cases using fundamental science, court documents, and other sources of information. Students will work on real cases. It will meet synchronously online.

**BCM 677 M001: Proteins & Nucleic Acids Laboratory (3 Credits)**

**Lecture: M 2:15-3:15PM**

**Laboratory: W 12:45-4:45PM**

Meets with: BCM 477 M001

Crosslisted with: CHE 477

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. Lecture and lab will be in-person only.

**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. It will meet synchronously online.

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

**BIO 999 M001: Dissertation (0-15 Credits)**

**Varied Times**

Instructor: Varied