BIOLOGICAL SCIENCES

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HOOD, GLEN: Ph.D., University of Notre Dame; M.S., Texas State University; B.S., Texas State University; Assistant Professor

KASHIAN, DANIEL M.: Ph.D., University of Wisconsin, Madison; M.S., B.S., University of Michigan; Professor and Associate Chair

KASHIAN, DONNA R.: Ph.D., University of Wisconsin; M.S., Michigan State University; B.S., Eastern Michigan University; Professor

KENNEY, JUSTIN: Ph.D., Temple University; B.S., B.A., Case Western Reserve University; Assistant Professor

LEE, PEI-CHUNG: Ph.D., Case Western Reserve University; M.S., National Yang-Ming University, Taiwan; B.S., National Tsing-Hua University, Taiwan; Assistant Professor

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MIZUKAMI, HIROSHI: Ph.D., University of Illinois; B.A., International Christian University of Tokyo; Professor Emeritus

MOORE, WILLIAM S.: Ph.D., University of Connecticut; B.S., Michigan State University; Professor Emeritus

MYHR, KAREN L.: Ph.D., B.S., University of Michigan; Assistant Professor (Research)

NJUS, DAVID L.: Ph.D., Harvard University; B.S., Massachusetts Institute of Technology; Professor

PILE, LORI A.: Ph.D., University of Cincinnati; B.Sc., University of Toledo; Associate Professor

POPADIC, ALEKSANDAR: Ph.D., University of Georgia; B.S., University of Belgrade; Professor

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- Biological Sciences (M.A.) (https://bulletins.wayne.edu/graduate/college-liberal-arts-sciences/biological-sciences/biological-sciences-ma/)
- Biological Sciences (M.S.) (https://bulletins.wayne.edu/graduate/college-liberal-arts-sciences/biological-sciences/biological-sciences-ms/)
- Molecular Biotechnology (M.S.) (https://bulletins.wayne.edu/graduate/college-liberal-arts-sciences/biological-sciences/molecular-biotechnology-ms/)
- Biological Sciences (Ph.D.) (https://bulletins.wayne.edu/graduate/college-liberal-arts-sciences/biological-sciences/biological-sciences-phd/)

- Biological Sciences and Urban Sustainability (Ph.D. Dual-Title) (https://bulletins.wayne.edu/graduate/college-liberal-arts-sciences/biological-sciences/biological-sciences-urban-sustainability/)

BIO 5001 Molecular Biology Cr. 3
This course provides an in-depth introduction to genetic mechanisms and molecular biology. The course will cover DNA replication and repair as well as mechanisms of gene expression and protein production in prokaryotic and eukaryotic systems. Offered Winter.
Prerequisites: BIO 3070 with a minimum grade of C- and BIO 3100 with a minimum grade of C-

BIO 5020 Comprehensive Virology Cr. 3
Course provides students with a comprehensive knowledge of molecular virology, from viral classification, vital structures and life cycles, to host response and global health. Offered for undergraduate credit only. Offered Fall.
Prerequisites: BIO 2270 with a minimum grade of C-, BIO 3250 with a minimum grade of C-, or BIO 3270 with a minimum grade of C-
Restriction(s): Enrollment is limited to Undergraduate level students.

BIO 5040 Biometry Cr. 4
Quantitative methods in biology. Statistical approach to data analysis and the design of experiments. Laboratory section permits actual analysis of selected statistical problems. Offered Intermittently.
Prerequisites: BIO 2600 with a minimum grade of C- and (STA 1020 with a minimum grade of C-, STA 2210 with a minimum grade of C-, or MAT 2020 with a minimum grade of C-)

BIO 5060 Special Topics Cr. 1-6
Formalized treatment of the current state of knowledge in a significant area of biology. Topics to be announced in Schedule of Classes. Offered Intermittently.
Prerequisites: BIO 2600 with a minimum grade of C-
Repeatable for 6 Credits

BIO 5080 Cellular Basis of Animal Behavior Cr. 3
Relationship between behavior and neuroscience using a variety of animal models, each examined from the level of natural behavior progressively to the cellular level. Topics include: sensory systems, motor behavior, and learning. Offered Winter.
Prerequisite: BIO 2550 with a minimum grade of C- or BIO 2600 with a minimum grade of C- or PSY 3120 with a minimum grade of C- or PSY 3330 with a minimum grade of C-
Equivalent: PSY 5080

BIO 5100 Aquatic Ecology Cr. 4
Physical, chemical and biological processes occurring in lakes, streams and wetlands. Offered for undergraduate credit only. Offered Every Other Year.
Prerequisites: BIO 1500 with a minimum grade of C- and BIO 3500 with a minimum grade of C-
Restriction(s): Enrollment is limited to Undergraduate level students.
Fees: $95

BIO 5145 Principles of Genetic Analysis Cr. 3
This course emphasizes the theory and applications of modern methods of genetic analysis and gene manipulation. Practical and theoretical aspects of methods will be considered. Offered Fall.
Prerequisites: BIO 3070 with a minimum grade of C-, BIO 3100 with a minimum grade of C-, and BIO 4110 with a minimum grade of C-

BIO 5150 Genomics Cr. 3
Introduction to the theory and practice of genomics. Topics include sequencing and mapping, overview of genomes, comparative genomics, transcriptomes, population genetics and genomics, basic bioinformatics and statistics, population-level variation (SNPs, MNPs, indels), ethics, evolutionary genomics, and functional genomics. Offered for undergraduate credit only. Offered Fall.
Prerequisites: BIO 3070 with a minimum grade of C- and BIO 3100 with a minimum grade of C-
Restriction(s): Enrollment is limited to Undergraduate level students.

BIO 5180 Field Investigations in Biological Sciences Cr. 12
Field studies of one to fifteen weeks, emphasizing biological principles and techniques demonstrated in the field. Offered Intermittently.
Prerequisites: (BIO 2200 with a minimum grade of C- or BIO 2600 with a minimum grade of C-), BIO 1500 with a minimum grade of C-, and BIO 1510 with a minimum grade of C-
Fees: $125
Repeatable for 20 Credits

BIO 5240 Molecular Systems Biology Cr. 3
Introduces the basic design principles of biological circuits and networks and their functional designs at the molecular, pathway, whole cell, and population levels. Students will perform a comprehensive group project to build a computational model of a simple biological network. Offered Every Other Year.
Prerequisites: BIO 3070 and PHY 2140

BIO 5260 Evolution of Pathogen Genomes of Modern Disease Cr. 3
Understanding the evolutionary processes that shape pathogen genomes is critical to our understanding of infectious disease biology. This course will introduce fundamental concepts in genome evolution, and use common pathogens as examples to discuss the uniqueness of different evolutionary processes and genomic changes in each pathogen, with special emphasis on microbes. Much of the answers lie in the genomes of these pathogens and how their genomes change over time. Offered Intermittently.
Prerequisites: BIO 2700 with a minimum grade of C- or BIO 4200 with a minimum grade of C-

BIO 5280 Bioinformatics Cr. 3
Basic Linux commands and PERL programming skills, sequence comparison, phylogenetic analysis, gene/genome patterns. Offered for undergraduate credit only. Offered Winter.
Prerequisites: BIO 3070 with a minimum grade of C- and BIO 3100 with a minimum grade of C-
Restriction(s): Enrollment is limited to Undergraduate level students.

BIO 5290 Evolutionary Medicine Cr. 3
Examines the recent trend in applying fundamental evolutionary concepts to medical field and how this trend can lead to better treatment and therapy development. Students will explore a range of topics, from what is a disease to body defenses and reproductive medicine, by reading and discussing assigned material from their textbooks and selected research articles. Offered Winter.
Prerequisites: BIO 2550 with a minimum grade of C-, BIO 2600 with a minimum grade of C-, or BIO 2700 with a minimum grade of C-

BIO 5310 Infections and Innate Immunity Cr. 3
There is a constant arms race between pathogens and their hosts. Tipping the balance decides outcomes and severity of infections. The hosts equip multiple lines of defense against the invading pathogens, meanwhile, the pathogens use a wide variety of arsenals to counteract host defense. This course is designed to introduce infection strategies used by pathogens and anti-microbial responses in the host cells at cellular and molecular levels. The course covers the interactions between hosts and microbes, including small molecules, post-translational modifications, protein interactions, signaling transduction and molecular machineries. Understanding these mechanisms during host-microbe interactions will provide important foundation for developing potential therapeutics. Offered Fall.
Prerequisite: BIO 2200 with a minimum grade of C- or BIO 2270 with a minimum grade of C- or BIO 3250 with a minimum grade of C- or BIO 2600 with a minimum grade of C- or BIO 2550 with a minimum grade of C-

BIO 5330 Principles and Applications of Biotechnology I Cr. 3
Review of origins of molecular biotechnology and its characteristic technologies; survey of applications of biotechnology to problems in industries. Offered Fall.
Prerequisites: BIO 2200 with a minimum grade of C-, BIO 3070 with a minimum grade of C-, and BIO 3100 with a minimum grade of C-

BIO 5350 Microbial Biofilms Cr. 3
The objective of the course is understand the features, and molecular mechanisms used by bacteria to build or disperse microbial biofilms. Students will learn the techniques and tools used to research microbial biofilms. Offered Intermittently.
Prerequisites: BIO 3250 with a minimum grade of C-

BIO 5440 Terrestrial Ecology Cr. 4
Ecology of forests and grasslands. Field study and interpretation of ecological processes. Importance of species-site relationships and disturbance history. Offered for undergraduate credit only. Offered Every Other Year.
Prerequisites: BIO 1500 with a minimum grade of C-
Restriction(s): Enrollment is limited to Undergraduate level students.
Fees: $250

BIO 5490 Population and Community Ecology Cr. 3
Population dynamics of animals and plants. Life history theory. Species interactions. Structure and dynamics of communities. Offered for undergraduate credit only. Offered Every Other Year.
Prerequisites: BIO 3500 with a minimum grade of C- and (STA 1020 with a minimum grade of C-, MAT 2020 with a minimum grade of C-, or STA 2210 with a minimum grade of C-)
Restriction(s): Enrollment is limited to Undergraduate level students.

BIO 5540 Landscape Ecology Cr. 3
Concepts, methods, and applications of landscape ecology; causes and implications of ecological patterns and heterogeneity on landscapes; interrelationships of patterns and ecological processes. Offered Every Other Year.
Prerequisites: BIO 1500 with a minimum grade of C- and BIO 3500 with a minimum grade of C-
Restriction(s): Enrollment is limited to Undergraduate level students.

BIO 5610 Developmental Biology Lab Cr. 1
Slides, models, and 4-D computer programs used to enable the student to know and recognize the cascade of structural changes that take place during the embryological developmental pathways. Offered Winter.
Prerequisites: BIO 5620 with a minimum grade of C- (may be taken concurrently)
Fees: $55

BIO 5620 Developmental Biology Cr. 3
An analytical and comparative study of genetic and cellular mechanisms and their interaction with environmental factors to effect the developmental mechanisms which produce the adult organism. Origin and unfolding of structural patterns characteristic of different species; their evolutionary origins. Offered Winter.
Prerequisites: BIO 3070 with a minimum grade of C-

BIO 5640 Cancer Biology Cr. 3
Introduction to integrated analysis of cancer and cell biology, pathology, etiology and therapy. Offered Intermittently.
Prerequisites: BIO 2600 with a minimum grade of C-, BIO 3070 with a minimum grade of C-, and BIO 3100 with a minimum grade of C-

BIO 5660 Neural Signaling in Health and Disease Cr. 3
Addresses major principles of how various brain systems regulate physiological processes of the body function, both individually and as an integrated unit. Includes principles of physiological communication as it relates to homeostasis, metabolism, and both neural and endocrine communication; emphasis is given not only to major principles but also to how these principles were developed. Topics include (but are not limited to) dysfunction and disorders of the central nervous system (CNS) in the context of signaling pathways and hormonal systems, neurodegeneration, interaction between neurons and glia cells and neuroinflammation. Offered Fall.
Prerequisite: BIO 3200 with a minimum grade of C-

BIO 5680 Basic Endocrinology Cr. 3
Basic description of the human endocrine system, the endocrine control of several physiologic processes (growth, development, metabolism and reproduction), and a description of common endocrine disorders. Offered Fall.
Prerequisites: BIO 3200 with a minimum grade of C- or BIO 4120 with a minimum grade of C-
Equivalent: PSL 5680

BIO 5740 General Entomology Cr. 4
This course will focus on introducing students to the taxonomy (identification), natural history, ecology, and evolutionary biology of the Class Insecta and related taxa. Through in-class lectures and inside and outside the classroom lab-based activities, students will have the opportunity to apply the process of science to tap into the interdisciplinary nature of entomology. More specifically, after successfully completing this course, you should be able to sight-identify the major insect orders and species that exist in urban and suburban Detroit, and have a thorough understanding of the biology and evolution of insects, their diversity, their role in natural ecosystems, the basics of their physiology, development, and behavior, and the many important ways they affect human life. Offered Intermittently.
Prerequisite: BIO 2700 with a minimum grade of C-
Fees: $60

BIO 5750 Biology of Longevity and Aging Cr. 3
Longevity, aging and senescence viewed as fundamental biological processes common to most organisms. Data-based discussion of investigative methods and accepted facts regarding the mechanisms underlying longevity and aging, coupled with critical discussion of behavioral and biological interventions known to retard or reverse the aging processes. Systems biology overview of the process, including societal parameters necessary to the maintenance of longevity. Offered for undergraduate credit only. Offered Winter.
Prerequisites: BIO 3070 with a minimum grade of C-
Restriction(s): Enrollment is limited to Undergraduate level students.

BIO 5760 Proteins and Proteomics Cr. 3
The course gives students a solid understanding of the structure of proteins, functions of proteins including folding of proteins into native conformation and dynamic nature of protein structure; post-translational modification of proteins; protein degradation; approaches and techniques of protein purification and analyses; methods and analysis of proteome using proteomic approaches. Offered Intermittently.
Prerequisites: BIO 3100 with a minimum grade of C- and BIO 5600 with a minimum grade of C-

BIO 5890 Neuroplasticity Cr. 3
Neuroplasticity is the study of the ways the brain changes in response to genetic controls, and to the internal and external environments. Neuroplasticity includes neural development (neurogenesis and migration, neural differentiation, axon pathway formation, and synapse formation and maturation), mechanisms of learning and memory, homeostasis of excitability, aging, diseases, and responses to injury. To explore these topics, students will read and discuss readings from their textbook and seminal research articles from a variety of animal models, and run simulations. Offered Winter.
Prerequisites: BIO 3200 with a minimum grade of C-

BIO 6000 Molecular Cell Biology I Cr. 3
Analysis of cell structure at the molecular and cellular levels and the physiological consequences of these structures: isolation, physico-chemical properties, and biological attributes of cells, organelles, and biopolymers including nucleic acids, proteins, and lipids. Offered Fall.
Prerequisites: BIO 2600 with a minimum grade of C (may be taken concurrently) and BIO 3100 with a minimum grade of C (may be taken concurrently)

BIO 6010 Molecular Cell Biology II Cr. 4
Analysis of cell regulation at the molecular level. Cell development and differentiation. Genetic mechanisms including: DNA synthesis and repair, mechanism of gene expression and control. Offered Winter.
Prerequisite: BIO 6000 with a minimum grade of C-

BIO 6055 Biology of the Eye Cr. 3
Introduction to biology of eye structure/function, and to causes and clinical treatments of eye-related disorders and diseases. Offered for undergraduate credit only. Offered Fall.
Prerequisites: BIO 3200 with a minimum grade of C- and (BIO 3100 with a minimum grade of C- or CHM 5600 with a minimum grade of C-)
Restriction(s): Enrollment is limited to Undergraduate level students.
Equivalent: ANA 6050, PYC 6050

BIO 6060 Molecular Evolution Cr. 3
This course introduces the theory and practice of molecular sequence evolution analysis. It examines the pattern and process of evolutionary change at the DNA and protein level. The course covers relevant models of population genetics, nucleotide substitutions, and gene evolution, methods of multiple sequence alignments and phylogenetic inference, and their significance in current applications of protein structure prediction and genetic ancestry analyses. Offered Every Other Year.
Prerequisites: BIO 2700 with a minimum grade of C- or BIO 3070 with a minimum grade of C-

BIO 6090 Population Genetics Cr. 3
Theoretical bases for microevolutionary change in natural populations of organisms; basic to study of evolutionary genetics and evolutionary ecology. Offered Intermittently.
Prerequisite: BIO 3070 with a minimum grade of C-

BIO 6150 Neuronal Circuits Cr. 3
In this course we will discuss neuronal circuits (NCs) as functional units of the nervous system. The course aims to highlight the importance of NCs as an intermediate level of organization, that bridges the role of individual neurons with the performance of the nervous system as a whole. We will explore the structure and function of neuronal circuits, how they are studied through the use of informative model organisms (emphasis on invertebrate and small vertebrate models) and state-of-the-art experimental and theoretical methods, the role of neuronal circuits in learning, decision making, and locomotion, the evolution of neuronal circuits, neuromodulation and neuronal control, the impact of aging, and the concept of internal state. Finally, we will discuss how circuits form bigger networks, see connectomes, and we will touch on key interdisciplinary methods for the study of NCs. Offered Intermittently.
Restriction(s): Enrollment limited to students in a Doctor of Philosophy, Master of Arts or Master of Science degrees.

BIO 6160 Proteins and Proteomics Cr. 3
Structure and dynamics of proteins at the molecular level. Strategies used to biochemically purify, analyze, and characterize proteins. Offered Winter.
Prerequisite: BIO 3100 with a minimum grade of C- or CHM 5600 with a minimum grade of C- or CHM 6620 with a minimum grade of C-

BIO 6165 Biodiversity Changes in the Anthropocene Cr. 4
This course is a study of the Anthropocene—what scientists argue is our current epoch in geologic time—emphasizing changes in Earth's biodiversity as a result of human activities. Following an introduction to the Anthropocene, how it can be defined, and key ecological principles of biodiversity, we will explore the history and context for various types of human-influenced change. We will then survey seven human drivers of biodiversity change—from climate and chemical changes to habitat alteration and resource use and finally species transport (including modern pandemics) and invasion. We will wrap up the course examining past, present, and future tipping points, shifting baselines, goals and targets for management, and attitudes. Through this course, you will be challenged to consider both domestic and global (indigenous and western) perspectives of biodiversity change and issues concerning environmental justice. Emphasis will be placed on biodiversity shifts as influenced by humans. Offered Yearly.
Restriction(s): Enrollment is limited to Graduate level students.
Equivalent: ESG 6165

BIO 6180 Membrane Biology Cr. 3
Comprehensive analysis of cellular and model membranes integrating molecular structure and physiological properties. Structural, dynamic, and physiological properties examined, including molecular and macromolecular assemblies, physical and chemical analysis of molecular motion, functional aspects including trans-membrane signaling. Offered Intermittently.
Prerequisite: BIO 6000 with a minimum grade of C
Restriction(s): Enrollment is limited to Undergraduate level students.

BIO 6185 Environmental DNA for Ecosystem Monitoring and Conservation Cr. 4
This course is a study of environmental DNA principles, approaches, and applications to study anthropogenic change in the environment. Following an introduction to the field of eDNA, challenges and limitations, early landmark studies, and applications in a variety of ecosystems and types of research questions, we will shift our focus to the technical background for designing an eDNA study—including how eDNA samples are collected, processed, and analyzed— and wrap up with considerations of the future of DNA metabarcoding. Emphasis will be placed on eDNA as a tool for studying environmental changes caused by humans. Offered Yearly.
Prerequisites: BIO 3070 with a minimum grade of C
Restriction(s): Enrollment is limited to Graduate level students.
Equivalent: ESG 6180

BIO 6190 Advanced Special Topics Cr. 6
Formalized treatment of current state of knowledge in a significant area of biology. Topics to be announced in Schedule of Classes. Offered Intermittently.
Repeatable for 6 Credits

BIO 6195 Environmental Microbiology Cr. 4
This course is a study of microbial diversity, approaches, and anthropogenic change in the environment. Following an introduction to the field of environmental microbiology, emerging global issues, and exploration of microorganisms in various habitats, we will focus on recent advances in characterization of microorganisms, pathogen transmission (including modern day pandemics), indicators of ecosystem health, and risk assessment. Through this course, you will also develop an understanding of how environmental microbiological samples are collected and processed, analyze how to track microbial sources and transport, and evaluate how microbiota interact with pollutants and ecosystems. Emphasis will be placed on microbiotic changes in the environment as influenced by humans. Offered Yearly.
Equivalent: ESG 6190

BIO 6330 Principles and Applications of Biotechnology II Cr. 3
Application of molecular biology and recombinant DNA technology of contemporary eukaryotic systems. Topics include: specialized application of PCR for cloning, generation of antibodies, the expression of recombinant proteins in cultured cells and transgenic animal models. Offered Winter.
Prerequisite: BIO 5330 with a minimum grade of C-

BIO 6420 Ecotoxicology and Risk Assessment Cr. 3
Provides students with an overview of ecological and environmental aspects of toxicology and pollution biology. The course will emphasize population, community, and ecosystem responses to contaminants. General understanding of ecology, chemistry, and basic statistics is essential. Offered Every Other Winter.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 6490 Molecular and Cellular Neurobiology Cr. 3
The brain is the most complex object known to man and is the storehouse of our lives. In the past century, humanity has made great strides in our understanding of the brain. In this class, we take a reductionist approach to understanding how the brain works. We start with exploring the basic mechanisms by which neurons process information by studying electrical signaling (Unit I) and chemical signaling (Unit II). These then serve as a foundation for building up an integrated appreciation for how the nervous system interacts with the outside world (Unit III). Taken together, this class provides the foundation for understanding how neurons work individually, an in concert, to from the nervous system. This class will also prepare students for approaching more advanced topics in neuroscience. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 6510 Molecular Interactions Cr. 1
Introduces to methods to study biomolecular interactions. Topics covered will include yeast two-hybrid, protein tagging, protein chips, DNA/RNA footprinting, DNase,MNase, hypersensitivity, ATAC-seq, ChIP-PCR, ChIP-chip, ChIP-seq, HITS-CLIP, PAR-CLIP, three hybrid, Co-immunoprecipitation, EMSA, flourescence polarization and FRET, SPR, isothermal calorimtery and microscale thermophoresis, proximity labeling and lipid: protein interactions. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 6520 Gene Expression Manipulation Systems Cr. 1
Introduces methods to manipulate gene expression. Topics include: Bacterial transformation methods - natural vs artificial competency, conjugation, phage transduction. Eukaryotic cell culture transfection methods - transient and stable. Transgenic organism manipulation: methods for gene knock-out and inducible expression including - homologous recombination, site specific recombination, Lambda red recombination, markerless in-frame deletion, Cre-Lox, transposons, RNAi, CRISPR, TALENS, P-element mutagenesis, inducible/repressible promoters, expression reporters. Offered Winter.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 6530 Protein Structure and Dynamics Cr. 1
Provides a solid understanding of the structure of proteins, their physiological functions, and an understanding that the molecular basis of a number of diseases is associated with protein abnormalities. Offered Winter.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 6540 Principles of Genetic Analysis Cr. 1
Emphasizes the theory and applications of modern genetic methods of analysis. Practical and theoretical aspects of methods will be considered. Exams and quizzes will focus on concepts, experimental design and strategy. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 6690 Special Topics in Neurobiology Cr. 3
This course will enable students to apply their knowledge of neurobiology to explore a current research area in depth. The course will involve reading and discussing articles from the scientific literature. Offered Winter.
Prerequisites: BIO 3200 with a minimum grade of C-

BIO 6700 Responsible Conduct of Research Cr. 1
Fulfills federal requirements for in person faculty-led training in scientific ethics and responsible conduct of research. Offered Fall.

BIO 6890 Introduction to Research Practice - Honors Cr. 1
Provides instruction in basic laboratory safety and accepted standards for research conduct. It will provide professional development and networking opportunities for students interested in careers in research and the biomedical sciences. Instruction may be provided in the form of reading assignments, discussions, lectures and case studies. It is a co-requisite for students enrolling in BIO 6891-6894 for the first time. Offered Every Term.
Prerequisites: BIO 6891-6894 with a minimum grade of C- (may be taken concurrently)

BIO 6891 Honors Undergraduate Research in Biological Sciences Cr. 1
Original research performed under the guidance of a faculty member. Registration is by permission only. Offered Every Term.
Prerequisites: BIO 6890 with a minimum grade of C- (may be taken concurrently)
Repeatable for 5 Credits

BIO 6892 Honors Undergraduate Research in Biological Sciences Cr. 2
Original research performed under the guidance of a faculty member. Registration is by permission only. Offered Every Term.
Prerequisites: BIO 6890 with a minimum grade of C- (may be taken concurrently)
Repeatable for 6 Credits

BIO 6893 Honors Undergraduate Research in Biological Sciences Cr. 3
Original research performed under the guidance of a faculty member. Registration is by permission only. Offered Every Term.
Prerequisites: BIO 6890 with a minimum grade of C- (may be taken concurrently)
Repeatable for 6 Credits

BIO 6894 Honors Undergraduate Research in Biological Sciences Cr. 4
Original research performed under the guidance of a faculty member. Registration is by permission only. Offered Every Term.
Prerequisites: BIO 6890 with a minimum grade of C- (may be taken concurrently)
Repeatable for 8 Credits

BIO 6990 Honors Directed Study in Biology Cr. 1-4
To be taken under direction of Biological Sciences faculty. Offered for undergraduate credit only Offered Every Term.
Restriction(s): Enrollment is limited to students with a major in Biological Sciences Honors or Biological Sciences; enrollment is limited to Undergraduate level students; enrollment limited to students in a BS in Biological Science or Bachelor of Arts degrees.
Repeatable for 99 Credits

BIO 6994 Technical Communication in Molecular Biotechnology Cr. 3
Methods of written and oral communication in the biotechnology field. Offered Winter.

BIO 6999 Honors Undergraduate Research Thesis Cr. 2
Preparation of a thesis, satisfactory completion of which assures Honors graduation, providing performance in preceding Honors courses has been at Honors level; to be taken under direction of Biological Sciences faculty. Offered for undergraduate credit only. Offered Every Term.
Prerequisite: BIO 6891 with a minimum grade of C- or BIO 6892 with a minimum grade of C- or BIO 6893 with a minimum grade of C- or BIO 6894 with a minimum grade of C- or BIO 6990 with a minimum grade of C-
Restriction(s): Enrollment is limited to students with a major in Biological Sciences Honors; enrollment is limited to Undergraduate level students.

BIO 7001 Molecular Biology Cr. 3
This course provides an in-depth introduction to genetic mechanisms and molecular biology. The course will cover DNA replication and repair as well as mechanisms of gene expression and protein production in prokaryotic and eukaryotic systems. Offered Winter.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7011 Principles of Toxicology Cr. 3
Basic concepts and principles of toxicology, including toxicity of major classes of chemicals (pesticides, solvents, metals) and organ systems (renal, immune, digestive, neuro and respiratory) affected. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.
Equivalent: PHC 7410

BIO 7020 Comprehensive Virology Cr. 3
Course provides students with a comprehensive knowledge of molecular virology, from viral classification, vital structures and life cycles, to host response and global health. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7040 Signaling Transduction Mechanisms Cr. 3
Overview of signaling strategies and mechanisms used by prokaryotes and eukaryotes (including plants) to sense and respond to extracellular or intracellular stimuli. Additional study of bioinformatic, biochemical, and genetics approaches to characterization of signaling proteins, systems and networks. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7045 Biometry Cr. 4
Provides practical tools for the design of experiments, data exploration and statistical analysis of data. Prepares students to begin to design scientific studies and experiments, critically evaluate data and test hypotheses via data analysis. While the course will delve into some underlying statistical theory, a major emphasis will be providing exposure to and hands-on experience with basic approaches to the analysis of univariate and multivariate data. Offered Yearly.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7055 Biology of the Eye Cr. 3
An introduction to the structure and function of the human eye, the mechanisms underlying common ocular diseases, and emerging research and therapeutic strategies. The course draws on faculty across the Ophthalmology, Visual and Anatomical Sciences (OVAS) department and covers foundational topics in anatomy, physiology, and pathology of the visual system. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.
Equivalent: OVA 7055, PYC 7050

BIO 7060 Evolutionary and Developmental Biology Cr. 3
Introduction to animal diversity. Genetic pathways and networks in development; focus on limb and organ formation. Evolving developmental pathways: case studies. Genetic source materials for developmental evolution. Speciation and developmental evolution. Offered Every Other Year.
Prerequisite: BIO 5620 with a minimum grade of C-
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7090 Molecular Genetics of Development Cr. 3
An examination of the current and classical research literature dealing with the role of gene action in development. Offered Intermittently.
Prerequisite: BIO 5620 with a minimum grade of C-
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7110 Aquatic Ecology Cr. 4
Physical, chemical and biological processes occurring in lakes, streams, and wetlands. Offered Every Other Fall.
Restriction(s): Enrollment is limited to Graduate level students.
Fees: $95

BIO 7145 Principles of Genetic Analysis Cr. 3
This course emphasizes the theory and applications of modern methods of genetic analysis and gene manipulation. Practical and theoretical aspects of methods will be considered. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7150 Genomics Cr. 3
Introduction to the theory and practice of genomics. Topics include sequencing and mapping, overview of genomes, comparative genomics, transcriptomes, population genetics and genomics, basic bioinformatics and statistics, population-level variation (SNPs, MNPs, indels), ethics, evolutionary genomics, and functional genomics. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7180 Membrane Biology Cr. 3
Comprehensive analysis of cellular and model membranes integrating molecular structure and physiological properties. Structural, dynamic, and physiological properties examined, including molecular and macromolecular assemblies, physical and chemical analysis of molecular motion, functional aspects including trans-membrane signaling. Offered Winter.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7240 Molecular Systems Biology Cr. 3
Introduces the basic design principles of biological circuits and networks and their functional designs at the molecular, pathway, whole cell, and population levels. Students will perform a comprehensive group project to build a computational model of a simple biological network. Offered Every Other Year.
Prerequisites: BIO 3070 and PHY 2140
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7280 Bioinformatics Cr. 3
Basic Linux commands and PERL programming skills, sequence comparison, phylogenetic analysis, gene/genome patterns. Offered Winter.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7300 Communication of Research Cr. 2
During this course, students will learn to present scientific results and make compelling scientific arguments orally, visually and in written form. In addition, students will learn to professionally and constructively critique the work of others. Students will also prepare a professional resume/CV and cover letter for job applications. Offered Winter.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7310 Sustainability of Urban Environmental Systems Cr. 2
Students will be introduced to topics in urban sustainability from multiple disciplinary perspectives such as: ecology, anthropology, communication, engineering, economics and urban planning. Questions in fostering a more sustainable urbanism will be introduced and evaluated. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.
Equivalent: CE 7311

BIO 7350 Microbial Biofilms Cr. 3
The objective of the course is understand the features, and molecular mechanisms used by bacteria to build or disperse microbial biofilms. Students will learn the techniques and tools used to research microbial biofilms. Offered Intermittently.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7440 Terrestrial Ecology Cr. 4
Ecology of forests and grasslands. Field study and interpretation of ecological processes. Importance of species-site relationships and disturbance history. Offered Every Other Year.
Prerequisite: BIO 1500 with a minimum grade of C- and BIO 4130 with a minimum grade of C-
Restriction(s): Enrollment is limited to Graduate level students.
Fees: $250

BIO 7490 Population and Community Ecology Cr. 3
Population dynamics of animals and plants. Life history theory. Species interactions. Structure and dynamics of communities. Offered Every Other Year.
Prerequisite: BIO 1500 with a minimum grade of C- and BIO 4130 with a minimum grade of C-
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7510 Eukaryotic Gene Structure and Function Cr. 2
Knowledge of current molecular technology is absolute prerequisite for this course; prerequisite course must have been satisfied. Analysis of structure, replication, expression and regulation of eukaryotic genome. Experimental approaches to study eukaryotic gene expression, critical comprehension of current research, design of experiments in gene expression. Offered Every Other Year.
Prerequisite: BIO 6010 with a minimum grade of C
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7540 Landscape Ecology Cr. 3
Concepts, methods, and applications of landscape ecology. Causes and implications of ecological patterns and heterogeneity on landscapes. Interrelationships of patterns and ecological processes. Offered Every Other Year.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7560 Light Microscopy and Imaging Cr. 2
The objective of the course is to provide students an in-depth understanding of current microscopy and imaging technology. Offered Winter.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7610 Infections and Innate Immunity Cr. 3
There is a constant arms race between pathogens and their hosts. Tipping the balance decides outcomes and severity of infections. The hosts equip multiple lines of defense against the invading pathogens, meanwhile, the pathogens use a wide variety of arsenals to counteract host defense. This course is designed to introduce infection strategies used by pathogens and anti-microbial responses in the host cells at cellular and molecular levels. The course covers the interactions between hosts and microbes, including small molecules, post-translational modifications, protein interactions, signaling transduction and molecular machineries. Understanding these mechanisms during host-microbe interactions will provide important foundation for developing potential therapeutics. Offered Intermittently.
Restriction(s): Enrollment is limited to Graduate level students; enrollment limited to students in a Doctor of Philosophy, Master of Arts or Master of Science degrees.

BIO 7660 Neural Signaling in Health and Disease Cr. 3
Addresses major principles of how various brain systems regulate physiological processes of the body function, both individually and as an integrated unit. Includes principles of physiological communication as it relates to homeostasis, metabolism, and both neural and endocrine communication; emphasis is given not only to major principles but also to how these principles were developed. Topics include (but are not limited to) dysfunction and disorders of the central nervous system (CNS) in the context of signaling pathways and hormonal systems, neurodegeneration, interaction between neurons and glia cells and neuroinflammation. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7740 General Entomology Cr. 4
This course will focus on introducing students to the taxonomy (identification), natural history, ecology, and evolutionary biology of the Class Insecta and related taxa. Through in class lectures and inside and outside the classroom lab-based activities, students will have the opportunity to apply the process of science to tap into the interdisciplinary nature of entomology. More specifically, after successfully completing this course, you should be able to sight-identify the major insect orders and species that exist in urban and suburban Detroit, and have a thorough understanding of the biology and evolution of insects, their diversity, their role in natural ecosystems, the basics of their physiology, development, and behavior, and the many important ways they affect human life. Students cannot earn credit for both BIO 5740 and BIO 7740. Offered Intermittently.
Restriction(s): Enrollment is limited to Graduate level students.
Fees: $60

BIO 7750 Biology of Longevity Aging Cr. 3
Longevity, aging and senescence viewed as fundamental biological processes common to most organisms. Data-based discussion of investigative methods and accepted facts regarding the mechanisms underlying longevity and aging, coupled with critical discussion of behavioral and biological interventions known to retard or reverse the aging processes. Systems biology overview of the process, including societal parameters necessary to the maintenance of longevity. Offered for graduate credit only. Offered Winter.
Prerequisite: BIO 3070 with a minimum grade of C-
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7760 Proteins and Proteomics Cr. 3
The course gives students a solid understanding of the structure of proteins, functions of proteins including folding of proteins into native conformation and dynamic nature of protein structure; post-translational modification of proteins; protein degradation; approaches and techniques of protein purification and analyses; methods and analysis of proteome using proteomic approaches. Offered Intermittently.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7777 Chemistry Biology Interface Seminar Series Cr. 1
The Chemistry Biology Interface (CBI) seminar series will expose students to CBI-related research, CBI-related professional development activities, review of current literature, topics in rigor and reproducibility, and networking social activities. These activities will be in the format of presentations, panel discussions, workshops, small group discussions, or social activities. The goal is for graduate students from discipline-specific fields to move across a multi-disciplinary landscape, or for students already working in inter-disciplinary fields, such as chemical biology, to gain new expertise in specific disciplines. Beyond scholarly goals, the seminar series will enrich the graduate experience by providing career guidance, non-laboratory skill development, training in rigor and reproducibility, and professional networking. Offered Fall, Winter.
Restriction(s): Enrollment is limited to Graduate level students.
Equivalent: CHM 7777, PSC 7777

BIO 7890 Neuroplasticity Cr. 3
Neuroplasticity is the study of the ways the brain changes in response to genetic controls, and to the internal and external environments. Neuroplasticity includes neural development (neurogenesis and migration, neural differentiation, axon pathway formation, and synapse formation and maturation), mechanisms of learning and memory, homeostasis of excitability, aging, diseases, and responses to injury. To explore these topics, students will read and discuss readings from their textbook and seminal research articles from a variety of animal models, and run simulations. No credit after BIO 5890. Offered Winter.
Restriction(s): Enrollment is limited to Graduate level students.

BIO 7996 Research Problems Cr. 1-8
Original investigation. Offered Every Term.
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 998.99 Credits

BIO 7999 Master's Biotechnology Research Report Cr. 3
The purpose of the course is to help students document research findings during the study and scientifically present these findings in both written and oral formats. Through the course, students will improve their critical thinking and reasoning skills, analyses and presentation of scientific data, effective scientific communication skills and further develop skills to document scientific discoveries. Offered Spring/Summer.
Restriction(s): Enrollment is limited to students with a major in Molecular Biotechnology; enrollment is limited to Graduate level students.

BIO 8050 Scientific Proposal Writing Cr. 2
Scientific investigation begins with questions that address conceptual or applied problems but requires testable hypotheses and funding support leveraged from successful research proposals to initiate and sustain a research program that generates the answers. This course trains the elementary skills of identifying significant scientific questions, building hypotheses, developing experimental designs, and communicating these elements in the form of standard research proposal formats to the major stakeholders and funding agencies that support the Biological Sciences. Participation success is measured based on participation in lecture discussions, on-time completion and quality of writing assignments, and response to instructor and participant peer feedback. The class will cover the grant proposal formats of the major federal funding organizations (NIH, NSF, DOD, DOR, USDA or equivalent) and a selection of additional funding sources tailored to participant interests. Offered Intermittently.
Prerequisites: BIO 6000-9999 with a minimum grade of B
Restriction(s): Enrollment is limited to Graduate level students.

BIO 8888 Survey of Research at the Chemistry Biology Interface Cr. 3
The Chemistry Biology Interface course will teach students how to apply chemical approaches to study complete biological processes. It will commence with a basic overview of the biochemistry of biomolecules. Next, complex biological processes related to various diseases will be highlighted by introducing cell biology, model cells and organisms, and disease mechanisms. Finally, the course will highlight contemporary examples of how chemical methods are used to answer complex biological questions to show the value and innovation available by taking a multidisciplinary approach. The focus will be on development of skill sets that are applicable for research at the chemistry biology interface, rigor and transparency in data collection and analysis, and identification of cross-disciplinary research at Wayne State. Offered Winter.
Restriction(s): Enrollment is limited to Graduate level students.
Equivalent: CHM 8888, PHC 8888, PSC 8888, PSL 8888

BIO 8995 Graduate Seminar in Biology Cr. 2
Presentations by graduate staff, advanced students, visiting lecturers. Offered Yearly.
Restriction(s): Enrollment is limited to students with a major in Biological Sciences; enrollment is limited to Graduate level students; enrollment limited to students in a Doctor of Philosophy or Master of Science degrees.
Repeatable for 4 Credits

BIO 8996 Research in Molecular Biotechnology Cr. 1-4
Students spend two semesters doing research under the guidance of faculty associated with the Molecular Biotechnology Program and in other laboratories. Offered Winter, Spring/Summer.
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 8 Credits

BIO 8999 Master's Thesis Research and Direction Cr. 1-8
Offered Every Term.
Restriction(s): Enrollment limited to students with a class of Candidate Masters; enrollment is limited to Graduate level students.
Repeatable for 8 Credits

BIO 9990 Pre-Doctoral Candidacy Research Cr. 1-8
Research in preparation for doctoral dissertation. Offered Every Term.
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 12 Credits

BIO 9991 Doctoral Candidate Status I: Dissertation Research and Direction Cr. 3-9
Offered Every Term.
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 9 Credits

BIO 9992 Doctoral Candidate Status II: Dissertation Research and Direction Cr. 1-18
Offered Every Term.
Prerequisite: BIO 9991 with a minimum grade of S
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 18 Credits

BIO 9993 Doctoral Candidate Status III: Dissertation Research and Direction Cr. 7.5
Offered Every Term.
Prerequisite: BIO 9992 with a minimum grade of S
Restriction(s): Enrollment is limited to Graduate level students.

BIO 9994 Doctoral Candidate Status IV: Dissertation Research and Direction Cr. 7.5
Offered Every Term.
Prerequisite: BIO 9993 with a minimum grade of S
Restriction(s): Enrollment is limited to Graduate level students.

BIO 9995 Candidate Maintenance Status: Doctoral Dissertation Research and Direction Cr. 0
Offered Every Term.
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 0 Credits

BIO 9996 Lab Rotation Cr. 2
Research training in faculty laboratories on a rotating basis, up to two labs per semester. Offered Every Term.
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 4 Credits