BIOLOGY (BIO)

BIO 500 Selected Topics (1-6 Credits)
Arts & Sciences
Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester.
Repeatable

BIO 501 Biology of Cancer (3 Credits)
Arts & Sciences
Classifications and model systems in cancer. Oncogenes; viral and chemical oncogenesis. Growth control, genetic and epigenetic changes, progression, invasion, metastasis, and tumor immunobiology. Cancer biochemistry, host-tumor interactions, chemotherapy, immunotherapy, and host-response modification.
Prereq: (BIO 326 and 327) or BIO 322

BIO 503 Developmental Biology (3 Credits)
Arts & Sciences
Regulation of form and differentiation in eucaryotic organisms. Control of development at the molecular, cellular, and organismal levels. Experimental approaches to provide an understanding of developmental processes.
Prereq: BIO 326 and 327

BIO 565 Cellular Physiology (3 Credits)
Arts & Sciences
A lecture course on basic problems of cell function, including energetics, membrane transport, contractility, and properties of excitable membranes.
Prereq: BIO 326 and 327

BIO 580 International Course (1-12 Credits)
Arts & Sciences
Offered through SUAbroad by educational institution outside the United States. Student registers for the course at the foreign institution and is graded according to that institution's practice. SUAbroad works with the S.U. academic department to assign the appropriate course level, title, and grade for the student's transcript.
Repeatable

BIO 600 Selected Topics (1-6 Credits)
Arts & Sciences
Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester.
Repeatable

BIO 602 Ethical Issues in Biology and Biotechnology (3 Credits)
Arts & Sciences
A detailed introduction to the field of bioethics, including foundations of ethics and moral reasoning, as well as both matters associated with responsible conduct of research and societal issues that represent areas of intersection of ethics and advances in biotechnology and biomedicine.

BIO 607 Advanced Neuroscience (3 Credits)
Arts & Sciences
Cross-listed with NEU 607
Double-numbered with BIO 407, NEU 407
Detailed analysis of the anatomy, physiology, and chemistry of the nervous system and behaviors that it mediates. Topics include: neurons and electrochemical properties of neurons, sensory and motor systems, homeostasis, sleep, consciousness, learning, and memory. Additional work required of graduate students.
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

BIO 608 Quantitative Methods for Life Scientists (0-3 Credits)
Arts & Sciences
This is a graduate level course for those conducting research in field- or laboratory-based life sciences, wishing to use statistics and data analysis and produce effective data presentation.

BIO 610 Graduate Research Laboratory (1-3 Credits)
Arts & Sciences
Work in research laboratories to acquire skills and techniques.
Repeatable 6 times for 6 credits maximum

BIO 611 Evolutionary Mechanisms (3 Credits)
Arts & Sciences
Double-numbered with BIO 411
Core processes & mechanisms involved in evolution, extending to molecular evolution, evolutionary genetics, & genomics. Topics include: genetic variation, mutation & neutral evolution, selection, drift & inbreeding, quantitative genetics, molecular evolution, selection in the wild, adaptation, & speciation. Additional work required of graduate students.

BIO 614 Brain & Behavioral Plasticity (3 Credits)
Arts & Sciences
Double-numbered with BIO 414
Behavioral adaptations give animals the ability to use their pasts to solve new problems, an ability important to their survival. This course will examine behavioral plasticity and the brain mechanisms responsible for adaptive changes inn behavior. Additional work required of graduate students.

BIO 615 Conservation Biology (3 Credits)
Arts & Sciences
Double-numbered with BIO 415
Considered from the standpoint of modern molecular, genetic, and population biology. Biodiversity, minimum viable populations, reserve design, genetic variation, applications of recombinant DNA technology, ex situ, care and ecosystem reconstruction. Additional work required of graduate students.

BIO 616 Biology of Aging (3 Credits)
Arts & Sciences
Double-numbered with BIO 416
Reviews and discusses current topics on biology of aging emphasizing distinctions between healthy and pathological aging. Primary focus will be on molecular, cellular, systems-level and whole organism changes accompanying aging. Additional work required of graduate students. Additional work required of graduate students.

BIO 621 Grad Capstone in Biotechnology (1 Credit)
Arts & Sciences
Students will synthesize Biotechnology principles and concepts while developing skills in workshop-style sessions that enhance their competitiveness as applicants for jobs in the field and/or professional schools.

BIO 624 Readings in Neuroscience (0-3 Credits)
Arts & Sciences
Cross-listed with NEU 613, CSD 753, PSY 778, BEN 613
A literature-based team-taught course focusing on in depth discussions of classical or recent papers of exceptional import to neuroscience. Students will complete weekly readings assigned by faculty and participate in a 3-hr/wk group facilitated discussion

BIO 625 Interdisciplinary Methods of Neuroscience (0-3 Credits)
Arts & Sciences
Cross-listed with NEU 614, CSD 754, PSY 779, BEN 614
A practical interdisciplinary survey course whereby neuroscience faculty introduce students to a wide array of methodologies, including molecular, cellular, developmental, systems, behavioral, and cognitive neuroscientific approaches to investigate basic, pre-clinical, translational, and clinical questions to unravel the relationship between brain and behavior.

BIO 630 Genetics Laboratory (3 Credits)
Arts & Sciences
Double-numbered with BIO 430
Experience in genetic methods and analyses using various model organisms, such as budding yeast, fruit flies, nematodes, and mustard plants. Experiments will include gene mapping, phenotypic analysis, transformation, complementation, and an introduction to molecular biology. Additional work required for graduate students.

BIO 631 Population Genetics (3 Credits)
Arts & Sciences
Double-numbered with BIO 431
Models of population growth, Hardy-Weinburg equilibrium, X-linkage and two loci, subdivision, inbreeding and finite populations, quantitative characters, selection, migration, mutation, the fundamental theorem, stochastic processes, and requisite mathematics. Computer programming is part of the laboratory requirement. Additional work required of graduate students.

BIO 632 Droplets and Gels in Healthy and Diseased Cells (3 Credits)
Arts & Sciences
Double-numbered with BIO 432
Examines how macromolecules spatially reorganize inside cells to form biomolecular condensates (sometimes called membraneless organelles). Dysregulation of condensates is linked to neurodegenerative disorders and cancer. We will read recent primary literature and interface with active researchers. Additional work required of graduate students.
Shared Competencies: Communication Skills (https://coursecatalog.syracuse.edu/shared-competencies/communication-skills/); Scientific Inquiry and Research Skills (https://coursecatalog.syracuse.edu/shared-competencies/scientific-inquiry-and-research-skills/)

BIO 634 Advanced Microscopy Techniques in Cell and Developmental Biology Lab (3 Credits)
Arts & Sciences
Double-numbered with BIO 434
Both a literature-based course in light microscopy and a hands-on lab experience using high-end microscopic systems. Students cover studies contributing to their knowledge on cell and development biology while implementing those techniques in the lab. Additional work required for grad students.

BIO 635 Physical Cell Biology (3 Credits)
Arts & Sciences
Cross-listed with PHY 635, CHE 635, CEN 635, BEN 635
This interdisciplinary class for science and engineering students provides an introduction to the quantitative description of biological systems and processes. The focus is on the biological and physical aspects of structure and function of cells and their subsystems.

BIO 636 Pharmacology of Substance Abuse (3 Credits)
Arts & Sciences
Double-numbered with BIO 436
This course covers major substances of abuse, including alcohol, marijuana, cocaine, hallucinogens, methamphetamine, and opiates, and will include relevant neuroanatomy and cellular and biochemical mechanisms of their mode of action. Additional work required of graduate students.

BIO 637 Seminar in Developmental Neuroscience (3 Credits)
Arts & Sciences
Double-numbered with BIO 437
Seminar course designed to enable students to develop & practice skills in critical analysis as applied to reading primary scientific literature, covering some of the general principles of how a functioning nervous system is made in developing animals. Additional work required of graduate students.

BIO 638 Open Problems in Soft Interfaces (3 Credits)
Arts & Sciences
Cross-listed with PHY 638, CHE 638, CEN 638, BEN 638
In this seminar course on soft and biological materials and interfaces, teams from science and engineering will identify, discuss and assess current articles from the literature. Writing skills related to publishing peer-reviewed research are introduced.

BIO 639 Seminar in Ecosystem Ecology (3 Credits)
Arts & Sciences
Double-numbered with BIO 439
Examines the main drivers of climate, biodiversity, trophic structure - of energy and nutrient flows through terrestrial and aquatic ecosystems by exploring reviews and the primary research literature. Additional work required of graduate students.

BIO 640 Applied Genomics (3 Credits)
Arts & Sciences
Double-numbered with BIO 440
Introduction to Next Generation Sequencing (NGS) technologies and their application to a variety of biological problems, such as genome assembly and annotation, gene expression analysis, microbial genomics, and comparative evolutionary analyses. Additional work required for graduate students.

BIO 641 Seminar in Infectious Diseases (3 Credits)
Arts & Sciences
Double-numbered with BIO 441
Seminar focusing on human diseases caused by infectious agents such as viruses and bacteria. Cause (agent), contagion, symptoms, treatment & potential outcomes will be discussed. Lectures & review of patient case studies. Additional work required of graduate students.

BIO 642 Seminar in Model Organism Genetics (3 Credits)
Arts & Sciences
Double-numbered with BIO 442
Literature review of research papers using model genetic systems to investigate topics including animal and plant development, cancer, neurological disease, behavior, and aging. Additional work is required of graduate students.

BIO 643 Seminar in Epigenetics (3 Credits)
Arts & Sciences
Double-numbered with BIO 443
Seminar covering how epigenetic (gene expression inherited without change in DNA sequence) mechanisms regulate gene expression for proper development of organisms, including how they regulate health & behavior of animals due to environmental stimuli. Additional work is required of graduate students.

BIO 644 Seminar in Neurotoxicology (3 Credits)
Arts & Sciences
Double-numbered with BIO 444
Examination of the mechanisms and consequences of toxicity of poisons in the central and peripheral nervous systems with a focus on the primary research literature. Additional work is required of graduate students.

BIO 645 Environmental Biology Laboratory (3 Credits)
Arts & Sciences
Double-numbered with BIO 445
Students learn spatial and Geographic Information System software, statistical analysis and evaluation of satellite data to explore, through discovery-based learning, major global environmental changes and their relevance to biodiversity and ecosystem function. Additional work required of graduate students.

BIO 646 Epigenetics of Health & Disease (3 Credits)
Arts & Sciences
Double-numbered with BIO 446
Exploration of how epigenetic modifications influence our health and modify our risk of disease, including neurodevelopmental and neurodegenerative disorders, heart disease, and obesity. Additional work required of graduate students.

BIO 649 Biotechnology Lab (3 Credits)
Arts & Sciences
Double-numbered with BIO 449
This course provides an essential foundation in laboratory techniques used in modern biotechnology. Emphasis is placed on understanding the principles and applications of methods and preparing students for professional laboratory work.
Advisory recommendation Prereq: BIO 326

BIO 650 Seminar in Evolutionary Genetics (3 Credits)
Arts & Sciences
Double-numbered with BIO 450
Topics relating to the fundamental principles underlying the evolution and genetics of complex traits. Current and/or classic examples from the primary research literature will be chosen for discussions. Additional work is required of graduate students.

BIO 652 Neurodegenerative Disease (3 Credits)
Arts & Sciences
Double-numbered with BIO 452
This seminar course is intended to review and to stimulate discussion about the current status of our knowledge about neurodegenerative disease, emphasizing distinctions between pathological and healthy brain aging. Jrs. & Srs. only; others by permission.

BIO 656 Seminar in Human Disease Genomics (3 Credits)
Arts & Sciences
Double-numbered with BIO 456
Introduces students to influential genomic studies of the etiology & epidemiology of human disease. Recent insights into the genetic basis of human adaptation & its potential relevance to disease predisposition will be discussed. Additional work required of graduate students.
Shared Competencies: Communication Skills (https://coursecatalog.syracuse.edu/shared-competencies/communication-skills/)

BIO 657 Principles of Human Toxicology (3 Credits)
Arts & Sciences
Cross-listed with FSC 657
Double-numbered with BIO 457, FSC 457
This course examines key aspects of human toxicology, including dose-response relationships, absorption, distribution, biotransformation, elimination, toxicokinetics, molecular mechanisms of toxicity, pesticides, metals, and toxic responses in specific organ systems. Additional work required of graduate students.
Shared Competencies: Scientific Inquiry and Research Skills (https://coursecatalog.syracuse.edu/shared-competencies/scientific-inquiry-and-research-skills/)

BIO 658 Seminar in Animal Communication (3 Credits)
Arts & Sciences
Double-numbered with BIO 458
Fundamental principles underlying how and why animals communicate with each other. Examination of the behavioral role of signaling, the conflicts that arise when senders and receivers have differing interests, and the behavioral strategies that result from these conflicts. Additional work required of graduate students.
Shared Competencies: Communication Skills (https://coursecatalog.syracuse.edu/shared-competencies/communication-skills/); Scientific Inquiry and Research Skills (https://coursecatalog.syracuse.edu/shared-competencies/scientific-inquiry-and-research-skills/)

BIO 659 Plants & People (3 Credits)
Arts & Sciences
Double-numbered with BIO 459
Focus on plant biology, the role of plants in the environment and society, and current topics surrounding plants and people. Additional work is required of graduate students.
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/); Communication Skills (https://coursecatalog.syracuse.edu/shared-competencies/communication-skills/)

BIO 662 Molecular Genetics (3 Credits)
Arts & Sciences
Double-numbered with BIO 462
An introduction to gene and genome functions, mechanisms of gene regulation, epigenetics and the molecular basis of human disease. An emphasis will be placed on genomic, transcriptomic and epigenomic systems level approaches to these topics. Additional work required of graduate students.
Advisory recommendation Prereq: BIO 326, 327
Shared Competencies: Communication Skills (https://coursecatalog.syracuse.edu/shared-competencies/communication-skills/); Scientific Inquiry and Research Skills (https://coursecatalog.syracuse.edu/shared-competencies/scientific-inquiry-and-research-skills/)

BIO 663 Molecular Biotechnology (3 Credits)
Arts & Sciences
Double-numbered with BIO 463
Molecular Biotechnology is the 1st course of a two-course Biotechnology series. The other course, Applied Biotechnology, is offered in spring. These courses complement each other but one is not required for the other. Additional work required of graduate students.

BIO 664 Applied Biotechnology (3 Credits)
Arts & Sciences
Double-numbered with BIO 464
The second of a two-course Biotechnology series intended to introduce students to the scientific background necessary for applying tools of biotechnology for improvement of animal and human health, agriculture and environment. Additional work required of graduate students.

BIO 665 Molecular Biology Laboratory (3 Credits)
Arts & Sciences
Double-numbered with BIO 465
Basic experimental techniques: isolation of DNA, restriction endonuclease cleavage of DNA, cloning of DNA, isolation of clones from DNA libraries, in vitro mutagenesis and other techniques to manipulate nucleic acids. Additional work required of graduate students.
Advisory recommendation Prereq: BIO 326 and BIO 327

BIO 667 Advances in Biotechnology Research & Ideas (3 Credits)
Arts & Sciences
Double-numbered with BIO 467
This course surveys a variety of cutting-edge biotechnology research areas and explores current applications of biotechnology research. Additional work required for graduate students.

BIO 668 Microbiomes in Biotechnology and Medicine (3 Credits)
Arts & Sciences
Double-numbered with BIO 468
In this course, we will survey the microbial communities that live on and in humans from a genetic, biochemical, and molecular perspective. Additional work is required for graduate students.

BIO 669 Science of Countering Weapons of Mass Destruction (3 Credits)
Arts & Sciences
Cross-listed with FSC 669
Double-numbered with FSC 469, BIO 469
Scientific basis and means for countering WMDs, including biological systems. Protective measures, proven doctrines, practical questions, and problem solving. Additional work required of graduate students.

BIO 670 Experience Credit (1-6 Credits)
Arts & Sciences
Participation in a discipline or subject related experience. Student must be evaluated by written or oral reports or an examination. Permission in advance with the consent of the department chairperson, instructor, and dean. Limited to those in good academic standing.
Repeatable

BIO 671 Cell and Developmental Biology Laboratory (3 Credits)
Arts & Sciences
Double-numbered with BIO 471
Survey of current methods employed in cell and developmental biology, including microscopy and imaging techniques, spatial analysis of gene expression, protein expression and localization, cell fractionation, and immunocytochemistry. Review general laboratory methods, data analysis, reporting.
Shared Competencies: Communication Skills (https://coursecatalog.syracuse.edu/shared-competencies/communication-skills/); Scientific Inquiry and Research Skills (https://coursecatalog.syracuse.edu/shared-competencies/scientific-inquiry-and-research-skills/)

BIO 672 Advanced Light Microscopy (3 Credits)
Arts & Sciences
Cross-listed with FSC 672
Double-numbered with BIO 472, FSC 472
Theory and practice of modern light microscopy, including the fundamentals of image formation and applications in the biological and biomedical sciences, including reviews of microscopy methods and analog and digital image capture. Additional work required of graduate students.

BIO 673 Pharmaceuticals and Cells (3 Credits)
Arts & Sciences
Double-numbered with BIO 473
This course begins with an introduction to basic principles of pharmacology and drug discovery/development, followed by a thorough exploration of current research in signal transduction-related pharmaceuticals. Additional work for graduate students.

BIO 674 Experimental Design & Interpretation (3 Credits)
Arts & Sciences
Double-numbered with BIO 474
Seminar class where students (1) evaluate published papers for rigorous design, statistics and interpretation to determine their validity and contributions and (2) compose a series of mini grants to design and propose future experiments and studies. Additional work required for graduate students.

BIO 675 Biochemistry Laboratory (4 Credits)
Arts & Sciences
Double-numbered with BIO 475
Experiments on amino acids, proteins, enzymes, fatty acids and nucleic acids, illustrating modern biochemical techniques applied to the chemistry of living cells. Titrations; electrophoresis; gel filtration; kinetics; spectrophotometric assays; cellular fractionation and analysis. Additional work required of graduate students.
Advisory recommendation Prereq: BIO 326, 327; Coreq: BIO 575

BIO 676 Cold Cases (3 Credits)
Arts & Sciences
Cross-listed with FSC 676
Double-numbered with FSC 476, BIO 476
Methods and practice in solving unsolved cases using fundamental science, court documents, and other sources of information. Will include work on real cases. Additional work required of graduate students.

BIO 677 Personalized Medicine (3 Credits)
Arts & Sciences
Double-numbered with BIO 477
This course will address topics related to providing effective, personalized therapeutic treatment of diseases based on the genomic and proteomic profile of an individual. Additional work required for graduate students.

BIO 679 Mind the Gap: Inclusion, Diversity, Equity and Accessibility in STEM (3 Credits)
Arts & Sciences
Double-numbered with BIO 479
History of exclusion and bias that led to underrepresentation of women, people of color, people with disabilities and those with lower socioeconomic status in STEM fields and actionable steps that promote inclusion, diversity, equity, and accessibility. Additional work required of graduate students.
University Requirement Course: IDEA Requirement Eligible
Shared Competencies: Communication Skills (https://coursecatalog.syracuse.edu/shared-competencies/communication-skills/); Ethics and Integrity (https://coursecatalog.syracuse.edu/shared-competencies/ethics-and-integrity/)

BIO 688 Biological Literature (1-3 Credits)
Arts & Sciences
Lectures and library problems designed to acquaint student with reference sources. Technique of searching scientific literature and preparation of reports using such reference material. Also open to seniors.
Repeatable

BIO 690 Independent Study (1-6 Credits)
Arts & Sciences
In-depth exploration of a problem or problems. Individual independent study upon a plan submitted by the student. Admission by consent of supervising instructor or instructors and the department.
Repeatable

BIO 700 Selected Topics (1-6 Credits)
Arts & Sciences
Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester.
Repeatable

BIO 704 Scientific Writing for Graduate Students in the Life Sciences (3 Credits)
Arts & Sciences
Develop student's writing skills in preparation for writing research proposals, scientific papers, and meeting abstracts, and for communicating with the public. Major emphasis will be placed on preparing a proposal in a format suitable for the Biology PhD qualifying exam.

BIO 705 Graduate Research Seminars (0-1 Credits)
Arts & Sciences
Students present their thesis or dissertation research and critically evaluate the research presentations of other students.
Repeatable

BIO 787 Graduate Seminar in Functional Genomics (0-2 Credits)
Arts & Sciences
Students review, critically evaluate, and present various topics related to genomic methods used for analysis of biological processes in a variety of model organisms.
Repeatable 2 times for 2 credits maximum

BIO 791 Graduate Seminar in Species Interactions (0-2 Credits)
Arts & Sciences
Selected topics dealing with ecological and evolutionary perspectives of species interactions. Students review, critically evaluate, and summarize recent literature on given topics. The summaries are presented and discussed in class.
Repeatable

BIO 792 Animal Ecology & Behavior (0-3 Credits)
Arts & Sciences
Students review, critically evaluate, and summarize recent literature on given topics. The summaries are presented and discussed in class.
Repeatable

BIO 793 Plant Ecology (0-2 Credits)
Arts & Sciences
Students review, critically evaluate, and summarize recent literature on given topics. The summaries are presented and discussed in class.
Repeatable

BIO 795 Speciation (0-2 Credits)
Arts & Sciences
Students review, critically evaluate, and summarize recent literature on given topics. The summaries are presented and discussed in class.
Repeatable

BIO 797 Seminar: Topics in Evolution (0-2 Credits)
Arts & Sciences
Sexual selection and conflict, parental care, social evolution, speciation, morphological evolution. Critically evaluate and discuss recent historical and classical literature on the given topics.
Repeatable

BIO 799 Seminar in General Biology (1 Credit)
Arts & Sciences
A one credit course composed of research seminars. These seminars aim to raise student awareness of cutting-edge topics in the biological sciences, expose students to active researchers, and provide an opportunity for student discussion and analysis of the biological literature.
Repeatable 4 times for 4 credits maximum

BIO 800 Selected Topics (1-6 Credits)
Arts & Sciences
Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester. *
Repeatable

BIO 970 Experience Credit (1-6 Credits)
Arts & Sciences
Participation in a discipline or subject related experience. Student must be evaluated by written or oral reports or an examination. Permission in advance with the consent of the department chairperson, instructor, and dean. Limited to those in good academic standing.
Repeatable

BIO 990 Independent Study (1-6 Credits)
Arts & Sciences
Exploration of a problem, or problems, in depth. Individual independent study upon a plan submitted by the student. Admission by consent of supervising instructor(s) and the department.
Repeatable

BIO 997 Masters Thesis (1-6 Credits)
Arts & Sciences
Repeatable

BIO 999 Dissertation (1-15 Credits)
Arts & Sciences
Repeatable