BIOLOGY (BIOL)

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BIOL 101 General Biology I (3 Credit Hours)
Fundamental principles of Biology including: introduction to the scientific method, basic biological chemistry; cell structure and function; energy transformations; mechanisms of cell communication; cellular reproduction; and principles of genetics.
Interdisciplinary Option: Bioethics, Bioinformatics, Forensic Science
Course equivalencies: ACBIO 101 / BIOL 101
Outcomes:
Students will be able to demonstrate understanding of the historical foundations, methodologies employed, general architecture and functioning of the cell - the basic unit of life

BIOL 102 General Biology II (3 Credit Hours)
Pre-requisites: BIOL 101 and 111
A continuation of BIOL 101. Fundamental principles of Biology including: evolutionary theory; general principles of ecology; study of plant structure and function; and comparative animal physiology.
Interdisciplinary Option: Bioethics, Forensic Science
Course equivalencies: ACBIO 102 / BIOL 102
Outcomes:
Students will be able to demonstrate an understanding of the fundamental principles of ecology and evolution, as well as the anatomy and physiology of representative plant and animal phyla

BIOL 110 Liberal Arts Biology (3 Credit Hours)
Pre-requisites: ENVS 101 or ENVS 137; No requirement for students with a declared major or minor in the Department of Anthropology, Department of Biology, Department of Chemistry, Department of Environmental Science, Department of Physics, Bioinformatics, Forensic Science or Neuroscience
Liberal Arts Biology is a second tier core course in the area of Scientific Literacy. It covers fundamental principles of biological sciences at a level for non-science majors. The focus of the course will vary depending on expertise of the instructor. All instructors will address the same fundamental principles.
Knowledge Area: Tier 2 Scientific Knowledge
Outcomes:
Students understand the scientific method, diversity of life, classification of organisms, cell structure and function, the chromosomal and molecular basis of inheritance, and organ systems of the human body

BIOL 111 General Biology I Lab (1 Credit Hour)
Complements General Biology I lecture material through observation, experimentation, and when appropriate, dissection of representative organisms. Physical and chemical phenomena of life as well as systematics and comparative anatomy and physiology of selected organisms will be examined.
Interdisciplinary Option: Bioethics, Forensic Science
Course equivalencies: BIOL 111/ACBIO 111
Outcomes:
Students will be able to demonstrate an understanding of the diversity of living organisms, including comparisons in cell structure and function, and comparative organismal evolution and ecology

BIOL 112 General Biology II Lab (1 Credit Hour)
Pre-requisites: BIOL 101 and BIOL 111
Complements General Biology II lecture material through observation, experimentation, and when appropriate, dissection of representative organisms. Physical and chemical phenomena of life as well as systematics and comparative anatomy and physiology of selected organisms will be examined.
Interdisciplinary Option: Bioethics, Forensic Science
Course equivalencies: ACBIO 112 / BIOL 112
Outcomes:
Students will be able to demonstrate an understanding of the diversity of living organisms, including comparisons in cell structure and function, and comparative organismal evolution and ecology

BIOL 195 Special Topics in Biology (1-4 Credit Hours)
Special Topics - Specific areas of study in the biological sciences.

BIOL 205 Plant Biology Lec/Lab (4 Credit Hours)
Pre-requisites: BIOL 102 and BIOL 112
Lecture and laboratory. Survey of the principles of botany including development and reproduction, structure, phylogeny and metabolism."
Outcomes:
Students will understand the basic morphology of plants; utilize morphology in the identification of local plants; understand the anatomy of plants; understand the relationship between anatomy and basic physiology; recognize that differences in physiological function allow different plants to be found in specific environments; appreciate the diversity of organisms called "plants

BIOL 210 Laboratory Techniques (2 Credit Hours)
Lab sessions designed to prove a firm foundation in basic techniques and procedures, use of equipment and apparatus; keeping a lab notebook and in data collection and treatment.
Outcomes:
Students will acquire basic skills needed to work in a research laboratory

BIOL 215 Ornithology (3 Credit Hours)
An introduction to the biology of birds including the topics of anatomy, physiology, behavior, ecology and evolution. Includes some field trips to learn how to identify species and to collect behavioral information.
Course equivalencies: BIOL 215/ENVS 215
Outcomes:
Students will demonstrate an understanding of the biology of birds and be able to identify some of the commoner species of birds in our area

BIOL 240 Psychology & Biology of Perception (3 Credit Hours)
Pre-requisites: PSYC 101; For Biology majors: BIOL 102, BIOL 112, and PSYC 101 Introduction to the study of sensory systems, especially vision and audition, emphasizing historical development of the field, multi-disciplinary scientific approaches; recent research and theory on the mechanisms of seeing and hearing; and applications of research to real-world problems
BIOL 240 is cross-listed with PSYC 240.
Interdisciplinary Option: Neuroscience
Course equivalencies: X-PSYC240/BIOL240

BIOL 242 Anatomy and Physiology I (4 Credit Hours)
Pre-requisites: BIOL 102, BIOL 112, and [(CHEM 102 and 112) or CHEM 106 or CHEM 180]
Lecture, laboratory, and demonstrations. Organization of the human body from the cellular to the organismal level. Anatomy of body systems and their physiology related to 1) support and movement (integumentary, skeletal and muscular systems) and integration and control (nervous and endocrine systems). Dissection of representative organs is required.
Outcomes:
Students will be able to demonstrate knowledge of human anatomy at the microscopic and gross levels; Students will be able to correlate structure and function and will have a firm understanding of the organizing principle of human physiology, homeostasis and explain the role of the nervous and endocrine systems in its maintenance

BIOL 243 Anatomy and Physiology II (4 Credit Hours)
Pre-requisites: BIOL 242
Lecture, laboratory and demonstrations. A continuation of BIOL 242. Anatomy of body systems and their physiology related to 1) regulation and maintenance (cardiovascular, lymphatic respiratory, digestive and urinary systems) and reproduction and development (male and female reproductive systems.) Dissection of representative organs is required. Prerequisites are BIOL 101, 102, 111, 112, BIOL 242 and CHEM 101, 102, 111, 112.
Outcomes:
Students will be able to demonstrate a comprehensive integrated knowledge and understanding of human anatomy and physiology at all levels

BIOL 246 Ancient Human-Animal Interactions (3 Credit Hours)
Pre-requisites: For BIOL-BS, BIOL-MINR, and BIOE-BS students: BIOL 102; for all others: ANTH 101, ANTH 104, BIOL 102, ENVS 101, or ENVS 137
This course focuses on human-animal interactions in the past and covers how humans have shaped the geographic ranges and behaviors of animals today. Questions on whether humans caused prehistoric animal extinctions and how animal domestication occurred will be explored using evidence from archaeological and paleontological records around the world.
Course equivalencies: X - ANTH 246 / BIOL 246
Outcomes:
Students will demonstrate an understanding of how archaeologists use empirical data to answer questions about prehistoric human-animal interactions

BIOL 251 Cell Biology (3 Credit Hours)
Pre-requisites: Biophysics majors ONLY: (BIOL 101 and 111) and (CHEM 102 or CHEM 106 or CHEM 160); All other majors: BIOL 102 and 112) and [(CHEM 102 and 112) or CHEM 106 or CHEM 160]
This course covers basic molecular and cellular studies of living organisms, emphasizing the relationships between subcellular structures and biochemical and physiological functions of cells.
Outcomes:
Students will become familiar with a wide range of cell biological principles and experimental approaches that led to important discoveries, gain an appreciation of the scientific method, and learn about the goals of modern cell biology research

BIOL 252 Cell Biology Laboratory (1 Credit Hour)
Co-requisites: BIOL 251
Pre or Laboratory experiences designed to explore relationships between structure and function of subcellular components.
Outcomes:
Working knowledge of a variety of techniques utilized in the cell biology laboratory

BIOL 265 Ecology (3 Credit Hours)
Pre-requisites: BIOL 102, BIOL 112, and (CHEM 102 or CHEM 106 or CHEM 160)
Relationships of organisms to their environment and to each other at the organism, population, community, and ecosystem levels.
Outcomes:
Students will understand the fundamental principles governing the interactions of organisms and their environment at the population, community, and ecosystem levels

BIOL 266 Ecology Laboratory (1 Credit Hour)
Co-requisites: BIOL 265
Pre or Laboratory and field experience designed to illustrate the principles of ecology and to give students experience in collecting, processing, and analyzing data. Field trips required.
Course equivalencies: BIOL266/ESP 266
Outcomes:
Students will understand the methodology and use techniques in studying interactions of organisms to the environment and to each other at the organism, population, community, and ecosystem levels

BIOL 280 Evolution of Human Disease (3 Credit Hours)
Pre-requisites: BIOL 102
The complex interaction between humans and pathogens is explored throughout time, with particular emphasis on the role and impact of human biology, human culture, and changing environments.
Interdisciplinary Option: Bioethics
Course equivalencies: X-ANTH280/BIOL280/BIET280
Outcomes:
Students will be able to demonstrate understanding of the human immunological system, competing paradigms of human health, the processes and mechanisms of biological evolution, the pathogeneses of specific diseases, and the archaeological, paleopathological, paleodemographic, and historical data used to explore the evolution of disease

BIOL 281 Evolution of the Human Diet (3 Credit Hours)
Pre-requisites: For BIOL-BS, BIOL-MINR, and BIOE-BS students: BIOL 102; for all others: ANTH 101 or BIOL 102
This interdisciplinary course explores the evolution of the human diet utilizing a biocultural perspective. The complex interplay between our diet, biology, and culture is examined through energy acquisition, primate and hominin nutrition, the Agricultural Revolution and Industrialization on human health, food sustainability, and nutritional inequality through socioeconomic and gender lenses.
Course equivalencies: X-BIOL 281/ANTH 281
Outcomes:
Students will identify the role food has played throughout the 6-7 million years of human evolution, and its significance in terms of climate change variability, evolutionary adaptations and contemporary inequality

BIOL 282 Genetics (3 Credit Hours)
Pre-requisites: For Bioinformatics and Biophysics Majors ONLY: BIOL 101; CHEM 102 or CHEM 106 or CHEM 160; For all other majors: BIOL 102, 112; CHEM 102 or CHEM 106 or CHEM 160
This course surveys principles and processes of genetic inheritance, gene expression, molecular biology, developmental, quantitative, population and evolutionary genetics.
Interdisciplinary Option: Bioinformatics, Forensic Science
Outcomes:
Students will develop knowledge and awareness of the genetic bases of modern biology; Students will understand Mendelian principles of inheritance, chromosome and DNA structure and replication, gene expression, molecular biology, genetic bases of development and other biological processes, and quantitative, population and evolutionary genetics

BIOL 283 Genetics Laboratory (1 Credit Hour)
Pre-requisites: BIOL 282; Or corequisite: BIOL 282
Experiments and demonstrations to illustrate chromosomal structures and transmission, molecular biology, gene linkage, gene frequencies and variation.
Interdisciplinary Option: Bioinformatics, Forensic Science
Outcomes:
Students will develop technical skills and ability to interpret data from a variety of types of genetics experiments

BIOL 284 Behavioral and Cognitive Neuroscience (3 Credit Hours)
Pre-requisites: For BIOL-BS, BIOL-MINR, and BIOE-BS students: BIOL 102 and NEUR 101; For all others: NEUR 101
Overview of topics and methodologies used in behavioral and cognitive neuroscience including: attention, learning and memory, language, reasoning, decision making, intelligence, emotions, social cognition, and consciousness. BIOL 284 is cross-listed with PSYC 382.
Interdisciplinary Option: Neuroscience
Course equivalencies: X-PSYC 382/BIOL 284
Outcomes:
Students will understand theories regarding brain mechanisms, underlying mental events and the technologies used for studying these mechanisms

BIOL 296 Introduction to Research (1 Credit Hour)
Pre-requisites: BIOL 102, 112; Permission of the instructor; Biology Core highly recommended
Students will begin reading the literature in the field of their mentor, conduct experiments designed by the mentor, and give a presentation on their work or studies, in preparation for upper level undergraduate research.
This course satisfies the Engaged Learning requirement.
Outcomes:
Students will develop critical reading skills and become familiar with basic lab techniques in the area of their mentor

BIOL 302 General Microbiology Lec/Lab (4 Credit Hours)
Pre-requisites: BIOL 251 and BIOL 282 Lecture and laboratory
Fundamental concepts of microbial life, physiology, and metabolism.
Outcomes:
Students will learn the differences between the 3 domains of life and will comprehend the biochemistry, morphology, growth characteristics, structure and ecology of microbes

BIOL 303 Seminar in Neuroscience (1 Credit Hour)
Pre-requisites: NEUR 101 with a grade of C- or better
The seminar introduces students to the interdisciplinary nature of modern neuroscience with an emphasis on the various neuroscience research activities that take place at Loyola University Chicago, and reviews current neuroscience research topics. BIOL 303 is cross-listed with NEUR 300.
Interdisciplinary Option: Neuroscience
Course equivalencies: X-BIOL303/NEUR300
Outcomes:
Students will demonstrate understanding of the interdisciplinary and multidisciplinary nature of modern neuroscience, and the research questions and experimental approaches used at the Lakeshore and Medical Center campuses

BIOL 304 Intro to Developmental Biology (3 Credit Hours)
Pre-requisites: BIOL 251
The analysis of developmental processes such as; fertilization, embryonic cleavage, cell determination and cell differentiation in selected species. Emphasis will be on experiments that reveal how these processes are controlled at the molecular and cellular levels.
Outcomes:
Students will become familiar with a wide range of developmental biology principles and experimental approaches that led to important discoveries, gain an appreciation of the scientific method, and learn about the goals of modern developmental biology research

BIOL 307 Biology of Stem Cells (3 Credit Hours)
Pre-requisites: BIOL 251 and BIOL 282
Stem cell research represents an exciting area of biology. This course will cover the early discoveries that launched the field of stem cell biology, the different types of stem cells that exist, potential therapeutic uses of stem cells, and the ethical implications of these discoveries and therapies.
Outcomes:
Students will be able to read primary research articles, describe different stem cell types and therapeutic uses, and consider the ethical implications of stem cell research and therapies

BIOL 310 Categorical Data Analysis (3 Credit Hours)
Pre-requisites: STAT 203 or STAT 335
An introduction to modern-day extensions of simple linear regression and ANOVA to the chi-square test including logistic regression and log-linear modelling techniques based on generalized linear models. Methods for matched-pair, small datasets, ordinal and multi-category data also discussed. This course focuses on applications using real-life data sets, and uses popular software packages.

BIOL 313 Lab in Psychobiology (3 Credit Hours)
Pre-requisites: (BIOL/STAT 335 or PSYC 304) and (NEUR 101, PSYC/BIOL 240, or PSYC 382/BIOL 284); OR for PSYC-BS and Cognitive/Behavioral Neuroscience majors: PSYC 306 and (NEUR 101, PSYC/BIOL 240, or PSYC 382/BIOL 284) Minimum grades of C-
A 'hands on' experience with the instrumentation, measurement techniques and experimental designs used in electrophysiological studies of nervous system function. BIOL 313 is cross-listed with PSYC 311.
Interdisciplinary Option: Neuroscience
Course equivalencies: X-PSYC311/BIOL313

BIOL 315 Introductory Immunology Lec/Lab (4 Credit Hours)
Pre-requisites: BIOL 251 and BIOL 282
The study of the nature and molecular basis of immune responses. History and vocabulary of immunology; experiments involving immune recognition and destruction; theories regarding self-tolerance and immunological diseases.
Outcomes:
Students will learn the morphology and histology of the cells involved in an immune response, as well as how the cells develop and the molecular mechanisms used to recognize and eliminate non-self material; Students will become familiar with the evasion strategies of pathogens and the consequences associated with either hyper or hypo-responsiveness

BIOL 316 Limnology Lec/Lab (4 Credit Hours)
Pre-requisites: BIOL 265 and CHEM 102 or CHEM 106 or CHEM 180
An introduction to the structure and function of lake and stream ecosystems. The course includes the integration of physical, chemical, and biological parameters. Laboratories include weekend field trips to aquatic habitats.
Outcomes:
Students will learn methods of sampling and analyzing physical, chemical and biological factors in lake and stream ecosystems, and how to integrate these complex data sets to answer ecosystem process-level questions; Students will learn to evaluate the trophic status and health of a lake by the end of the course

BIOL 317 Models of Human Disease (3 Credit Hours)
This course explores approaches used to study human diseases from in vitro to in vivo levels and examines their strengths and weaknesses. Discussions will cover historical experiments and cutting-edge research to learn about the techniques used to generate data and how to interpret the results.
Outcomes:
Students will gain knowledge about human diseases and techniques used to model aspects of those diseases in the laboratory

BIOL 318 General Virology (3 Credit Hours)
Pre-requisites: BIOL 251 & BIOL 282
This course covers the molecular details of viral infection and the diverse strategies used by these pathogens to invade cells and avoid immune clearance. The focus will be on mammalian viruses of biomedical relevance.
Course equivalencies: BIOL 318 / BIOL 218
Outcomes:
Students will be able to demonstrate detailed understanding of basic viral structure, basic viral replication/infection cycles, and specific examples of viruses and their infection strategies

BIOL 319 Evolution (3 Credit Hours)
Pre-requisites: BIOL 282; BIOL 265 recommended
This course focuses on analysis of processes and patterns of evolution. Topics include population genetic principles, fossil patterns and geologic ages, phylogenetic analysis of relationships of species, experimental approaches to evolutionary questions, and evolutionary perspectives on human biology and relationships.
Outcomes:
Students will develop knowledge and awareness of evolutionary processes and patterns, the evidence for them, and how evolutionary hypotheses are tested experimentally; They will develop an appreciation of the primary literature through reading and discussing research articles

BIOL 320 Animal Behavior (3 Credit Hours)
Pre-requisites: ANTH 101 or ANTH 103; or BIOL 102 & BIOL 112
This course examines the biological basis of animal behavior including function and evolution of behavior patterns. Mechanisms and the adaptive significance of behaviors are examined and analyzed. BIOL 320 is cross-listed with ANTH 320.
Interdisciplinary Option: Neuroscience
Course equivalencies: X-ANTH320/BIOL320/ESP 320
Outcomes:
Students will have an understanding of both proximate and ultimate causes of a broad array of behaviors in animals and their implications for the life histories of those animals

BIOL 321 Great Transitions in Vertebrate History (3 Credit Hours)
Pre-requisites: BIOL 265
The major vertebrate groups-fish, amphibians, reptiles, birds, and mammals-arose through great transitions in size and form. These transitions opened up previously inaccessible habitats for those groups to radiate throughout, creating the remarkable diversity we observe today. In this class, students will learn about the major transitions that occurred in vertebrate history within the context of Earth's geological history. Students will also learn about the adaptive changes in anatomy and life history that have allowed those radiations to successfully radiate in those habitats. Students will also learn about species whose unique attributes allow them to occupy the most extreme habitats on earth, such as the deep sea, arctic, and high elevation habitats.
Outcomes:
Learn the major radiations of vertebrates and their evolutionary relationships, the general characteristics of the major organ systems in those radiations, the major evolutionary transitions that occurred during vertebrate history, and how changes in ecology, life history, and anatomy change during organismal evolution

BIOL 323 Comparative Anatomy Lec/Lab (4 Credit Hours)
Pre-requisites: BIOL 251, BIOL 282
A study of homologous systems and vertebrate phylogeny in both lecture and lab.
Outcomes:
Students will understand the evolutionary relationships and processes that are involved in the development of vertebrate anatomy

BIOL 325 Primatology-Behavior & Ecology (3 Credit Hours)
Pre-requisites: ANTH 101 or any 100-level Biology course
This course examines primate behavior and ecology from a comparative and evolutionary perspective. Students will be introduced to the diversity across taxonomic groups within the Order Primates. Through class discussion and observation, students will explore key issues in primate studies. Students will develop and apply skills in primate observation.
Course equivalencies: X-ANTH325/BIOL325/ESP 325
Outcomes:
Students will be able to describe the taxonomic diversity of non-human primates and explain the impact of biological, evolutionary, and ecological factors on primate behavior

BIOL 326 Human Osteology Lec/Lab (4 Credit Hours)
This course focuses on developing a deep understanding of the human skeleton and ways in which biological anthropologists and forensic anthropologists use this knowledge to explore human biological diversity. Through hands-on exercises and class discussion, students will build analytical skills that are foundational to many techniques used by professionals and will appreciate the complex ethical considerations inherent to the fields of biological and forensic anthropology. Pre-requisites: BIOL 102 and BIOL 112; ANTH 101 or ANTH 103.
Interdisciplinary Option: Forensic Science
Course equivalencies: X-ANTH326/BIOL326
Outcomes:
Students will be able to demonstrate superior knowledge of skeletal anatomy, analyses of skeletal remains from archaeological contexts, and apply current techniques designed to understand and explore human variation, stature, ancestry, age-at-death, sex, and pathological conditions

BIOL 327 Wetland Ecology (4 Credit Hours)
Pre-requisites: BIOL 265
An introduction to the study of wetlands habitats. This course includes discussion of physical and chemical factors, biota, production and community dynamics. Laboratories include several field trips to regional wetland habitats.
Course equivalencies: BIOL327/ESP 327
Outcomes:
Students will understand the functioning of wetlands, become aware of the variety of wetlands and become familiar with wetland biota, especially wetland plants

BIOL 328 Conservation Biology (3 Credit Hours)
Pre-requisites: BIOL 265
This course explores species diversity, natural and human induced extinctions, environmental ethics, and conservation practices being developed at the population, community, and ecosystem levels.
Course equivalencies: X-BIOL328/ESP 330
Outcomes:
Students will be able to describe conservation strategies being used by institutions around the world and understand the ecological theory that supports those strategies

BIOL 329 Winter Ecology (3 Credit Hours)
Pre-requisites: BIOL 265 or permission of instructor
The goal for Winter Ecology is to teach you about ecosystems in winter by immersing you in the winter environment at LUREC during J-term. Topics include the habitats on, in, and under snow, the morphological, physiological, life cycle modifications of temperate plants, and the winter adaptations of birds.
Course equivalencies: X-ENVS 319/BIOL 329
Outcomes:
Students will gain understanding of habitats and organisms present during winter in temperate ecosystems and gain experience with field techniques employed when studying these ecosystems

BIOL 330 Global Change Biology (3 Credit Hours)
Pre-requisites: BIOL 265 or ENVS 280
Human activities are changing our planet to such an extent that scientists have proposed we are in a new geological epoch, the 'Anthropocene'. Through lectures, discussions, and group projects we will examine key elements of global change including biodiversity loss, land-use alterations, climate change, and pollution.
Outcomes:
Learn global element cycles that drive biological processes; Read, critique, and discuss primary scientific literature

BIOL 335 Intro to Biostatistics (3 Credit Hours)
Pre-requisites: BIOL 102, MATH 132 or MATH 162 (as pre-requisite or co-requisite) or MATH 162A; Students may take MATH 162 as a prerequisite for STAT/BIOL 335 or take it concurrently as a corequisite with STAT/BIOL 335; For Bioinformatics Majors: only BIOL 101, MATH 132 or MATH 162 (as pre-requisite or co-requisite) or MATH 162A
An introduction to statistical methods used in designing biological experiments and in data analyses. Topics include probability and sampling distribution, designed biological experiments and analysis of variance, regression and correlation, stochastic processes, and frequency distributions. Computer laboratory assignments with biological data.
Interdisciplinary Option: Forensic Science
Course equivalencies: X-BIOL335/STAT335

BIOL 336 Advanced Biostatistics (3 Credit Hours)
Pre-requisites: STAT 203 or STAT 335
This course provides an overview of advanced topics in applied statistics with particular application in biology and medicine, including the interpretation of Minitab, SAS and S-Plus computer output.
Course equivalencies: X-STAT336/BIOL336
Outcomes:
Students interested in applied statistical methods will obtain skill in experimental design, linear regression, categorical data analysis and logistic analysis, nonlinear regression, bioassay and drug synergy methods, as well as multivariate and survival statistical methods

BIOL 337 Quantitative Methods in Bioinformatics (3 Credit Hours)
Pre-requisites: STAT 203 or STAT 335
This course develops the mathematical and statistical methods necessary to analyze and interpret genomic and proteomic data, including signal analysis, sequence alignment methods, data-base search methods useful in bioinformatics and data mining.
Interdisciplinary Option: Bioinformatics
Course equivalencies: XSTAT337/BIOL337/BIOI337
Outcomes:
Students will obtain the quantitative skills used in BLAST, including inference, stochastic processes and hidden Markov models, random walks, microarray analysis and biological sequence analysis

BIOL 340 Natural History of Belize (3 Credit Hours)
This Study Abroad field course is designed to build on the foundations learned in Ecology, Environmental Science, and Anthropology classes by examining the biodiversity and tropical ecosystems of Belize, by exploring the cultural traditions of some of its peoples, particularly the Mayans; and learn how local communities are involved in protecting and sustaining ecological and natural sites through community based conservation and sustainability practices Enrollment Conditions: For Environmental Science or Environmental Studies Majors/Minors: ENVS 137 For Biology Majors/Minors: BIOL 102 & 112 For Anthropology or International Studies Majors/Minors: Junior or Senior Standing
Course equivalencies: X - ENVS 340 /BIOL 340
Outcomes:
Provide a working understanding of the structure, function, and ecology of tropical ecosystems; their importance to local communities; and the social dimensions of environmental issues, especially those related to justice

BIOL 341 Histology Lec/Lab (4 Credit Hours)
Pre-requisites: BIOL 251 and BIOL 282
This course examines the microscopic anatomy of the four basic adult tissue types and how they are arranged and utilized in the construction of the major vertebrate organ systems.
Outcomes:
The major learning objectives for this course are (1) to become familiar with the gross and microscopic anatomy of cells, tissues and organs and (2) to understand how these anatomical features correlate with specific physiological functions

BIOL 342 Human Anatomy (4 Credit Hours)
Pre-requisites: BIOL 242, BIOL 243, BIOL 251, BIOL 282; CHEM 222 or CHEM 224 or (CHEM 240 pre-req and CHEM 260 co-req)
A mixed lecture and laboratory course providing an in-depth look at the human body at the level of gross anatomy.
Interdisciplinary Option: Forensic Science
Outcomes:
Students will acquire an advanced understanding of the structure and relationships of major organ systems in the human body

BIOL 344 Microbial Evolution and Human Well-being (3 Credit Hours)
Pre-requisites: BIOL 282
The course explores the many ways, both positive and negative, that the evolution of bacteria, viruses, and other microbes affects humans. Topics include infectious disease, the human microbiome, food production, and environmental microbes. The course is centered around reading and analyzing primary literature.
Outcomes:
Students will apply fundamental evolutionary principles to microbes, understand the broad relevance of microbial evolution to human life, and read and communicate about primary literature on the topic

BIOL 346 Biology of Women (3 Credit Hours)
This course focuses on the anatomy and physiology of women at different and critical times in their life span. This course also addresses social issues that effect women at different points in their life. Topics include the evolution of sex, gender differentiation, and reproduction.
Interdisciplinary Option: Women & Gender Studies
Course equivalencies: BIOL346/WOST346/ANTH346/WSGS
Outcomes:
Students will learn about the biology of the female system, and how it changes with age; Students will also learn through discussions and guest lectures the interplay between society, medicine and gender

BIOL 347 Bird Conservation and Ecology (3 Credit Hours)
Pre-requisites: ENVS 137 or BIOL 102
This engaged-learning course provides an introduction to the theory and practice of avian conservation, ecology and management. Field trips for viewing birds in the wild, observing behavior and collecting data on habitat assessments are highlighted. Students participate in a community service project to gather data for avian conservation and management.
Course equivalencies: X-ENVS 267/BIOL 347
Outcomes:
Students will become skilled in critical reasoning and some bird monitoring techniques, and demonstrate an understanding of the many facets of bird conservation

BIOL 348 Field Ornithology (3 Credit Hours)
Pre-requisites: ENVS 280 & ENVS 286 or BIOL 265 & BIOL 266 (BIOL 215 recommended but not required)
Field ornithology is an intensive 3-week engaged-learning course at the Loyola University Retreat and Ecology Campus during the peak of the migratory season intended to provide an introduction to the theory and practice of field ornithology. Emphasis will be on field identification and song recognition, census techniques, and avian behavior.
Course equivalencies: X- ENVS 369/BIOL 348
Outcomes:
Students will become skilled in critical reasoning, field techniques, and scientific investigation that demonstrate an understanding of knowledge and techniques used in field ornithology

BIOL 349 Conservation and Sustainability of Neotropical Ecosystems (3 Credit Hours)
This course provides an introduction to conservation ecology in Neotropical ecosystems via classroom sessions and experiential learning activities during a Spring-Break field trip to Belize. Students will gain experience in environmental monitoring and biological survey methods. Ecosystems studied: coral reefs, mangrove forests, subtropical rain and dry forests, savannas, rivers, wetlands. Enrollment Conditions: For Biology Majors/Minors: BIOL 265; For Environmental Science Majors: ENVS 280
Course equivalencies: X- ENVS 345/ BIOL 349
Outcomes:
Students will gain an understanding of tropical climates, neotropical terrestrial/aquatic ecosystems and applied conservation and environmental practices such as nature reserve design and management, community-based resource management, ecotourism, and ecoagriculture

BIOL 350 Vertebrate Physiology (3 Credit Hours)
Pre-requisites: BIOL 251, BIOL 282, and (CHEM 180 or CHEM 102 or CHEM 106)
This is an introduction to the physiology of marine, freshwater, and terrestrial vertebrates. Understanding how physiological concepts are manifested by animals facing different environmental challenges is emphasized. Topics to be covered include metabolism and energy balance, nervous and endocrine function, respiration, circulation, water balance and ionic regulation, and excretion.
Outcomes:
Compare and contrast how various vertebrates utilize major organ systems to maintain homeostasis; Describe how common physiological principles are manifested through vertebrates' adaptation to their environments

BIOL 351 Sleep/Circadian Rhythms (3 Credit Hours)
Pre-requisites: BIOL 251, BIOL 282, NEUR 101
We will cover circadian rhythms one very prominent circadian-regulated behavior: sleep. We will investigate these topics at several different levels, spanning from cellular and molecular mechanisms to systems and behavioral approaches, and finally will look at pathologies of these systems that lead to human disorders.
Interdisciplinary Option: Neuroscience
Outcomes:
Students will become familiar with a variety of model systems used to study circadian rhythms, and learn how to critically read primary literature and lead discussions of this reading

BIOL 352 Neurobiology of Feeding in Health and Disease (3 Credit Hours)
Pre-requisites: NEUR 101, BIOL 251
Multiple interconnecting systems, coupling the brain with the rest of the body, signal the need to consume food and when to stop. The overall aim of the course is to understand what drives us to eat and how dysregulation within these brain circuits underlies the contemporary obesity crisis.
Outcomes:
By completing this course, students will achieve an advanced understanding of the fundamental principles that govern the brain's control of energy homeostasis

BIOL 353 Natural History of Vertebrates (4 Credit Hours)
Pre-requisites: BIOL 265
The objective of the course is to provide an in-depth study of the vertebrates in the Midwestern U.S. Topics will include the origin and evolution of vertebrates, and their ecology, behavior and specializations. The lab will focus on identification of vertebrate taxa and learning wildlife sampling techniques.
Outcomes:
Understand specifics of ecology, behavior, life history, evolution and conservation of all vertebrate taxa; Read, analyze, interpret, and discuss peer-reviewed literature

BIOL 354 Mammalian Reproduction (3 Credit Hours)
Pre-requisites: BIOL 251
Anatomy and physiology of male and female reproductive systems, fertilization, implantation, pregnancy, and birth; immunological aspects of reproduction.
Outcomes:
Students will understand structure/function relationships in reproductive biology and how reproductive systems are regulated at cellular levels

BIOL 355 Parasitology Lec/Lab (4 Credit Hours)
A study of animal parasites, their distribution, structure, adaptations, life cycles, and host relationships.
Outcomes:
Students will learn to recognize the major groups of animal parasites, be able to explain their life cycles and describe the mechanisms that hosts use to ward off parasite infestation

BIOL 356 The Evolution of Animal Sex (3 Credit Hours)
Pre-requisites: BIOL 251 and BIOL 282
Among animals, sex cannot be simplified down to X's and Y's, or even males and females. Sex is diverse and dynamic. The class will discuss modern research around three themes: 1) sexual differentiation, 2) animal weapons and ornaments, and 3) reproduction and mating systems.
Outcomes:
Students will gain a deeper appreciation of the sexual diversity among animals at genetic, physiological, morphological and behavioral levels

BIOL 357 Neural Disease, Degeneration, and Regeneration (3 Credit Hours)
Pre-requisites: BIOL 251, BIOL 282, NEUR 101
This course offers an overview of cellular and molecular mechanisms underlying common neurodegenerative disorders. Mechanisms of neuronal cell death and application of stem cells in CNS regeneration will also be covered. Students will learn by reading assigned background materials and research articles, and participating in class discussions.
Interdisciplinary Option: Neuroscience
Outcomes:
Students will understand current advances of genetic, developmental, molecular, and cellular mechanisms underlying the neurodegenerative diseases; Students will also learn how disease mechanisms affect neural function, cognition, and behavior

BIOL 358 Developmental Neurobiology (3 Credit Hours)
Pre-requisites: BIOL 251, BIOL 282, NEUR 101
This course focuses on cellular and molecular underpinnings of the development of neuronal features of the nervous system. Topics include neural induction and subsequent differentiation events, regulation of neuronal survival, axon guidance, target selection, and synaptogenesis.
Interdisciplinary Option: Neuroscience
Outcomes:
Students will become familiar with principles of neural development and the studies that led to those principles; Students will also learn how to critically read primary research papers and present these papers to the class

BIOL 359 Paleopathology (3 Credit Hours)
Pre-requisites: BIOL 251 and ANTH 326 or BIOL 326
Normal bone tissue and normal bone alterations and the impact of various disease processes on skeletal tissue. Students will be taught to assess and interpret patterns of human disease in processual rather than typological terms.
Course equivalencies: X-ANTH359/BIOL359
Outcomes:
Students will have command of biological anthropological approaches towards the understanding of human disease and will be familiar with theoretical issues germane to the field of paleopathology, biases and ethical issues, and the role that disease has played throughout human history

BIOL 360 Field Biology (3 Credit Hours)
Pre-requisites: BIOL 265 and permission of chair
Ecological study of an area in North America outside Midwest. Includes a field trip to a specific region. Trip is at student expense."
Outcomes:
Students will become familiar with an ecosystem outside the Chicago Region; gain a first-hand understanding of the interrelationships of living things and their environment; develop a loving appreciation of "wilderness

BIOL 362 Neurobiology (3 Credit Hours)
Pre-requisites: NEUR 101 and BIOL 251
The purpose of this course is to introduce major principles and concepts of modern neurobiology. An emphasis is placed upon an understanding of the electrophysiology of the neuron and the manner in which groups of neurons are organized into functional nervous systems subserving sensory, motor or integrative functions.
Interdisciplinary Option: Neuroscience
Outcomes:
Student will gain a sold foundation in nervous system structure and function

BIOL 363 Entomology Lec/Lab (4 Credit Hours)
Pre-requisites: BIOL 265
An introductory course that covers the morphology, metamorphosis, classification and biology of the major insect groups. The laboratory includes dissection and the use of analytical keys and figures to identify insect taxa. Field trips and student collections add to the laboratory experience.
Outcomes:
Students will learn to identify major insect groups in the field and in the laboratory; They will also learn to distinguish immature insects from adult insects and to recognize the numerous beneficial insects as well as the small number that are detrimental

BIOL 365 Writing a Scientific Manuscript (3 Credit Hours)
Pre-requisites: BIOL 102, BIOL 112
A Process from Data Collection to Writing a Scientific Manuscript. This course is designed for upper level students interested in practicing the scientific process; including hypothesis construction, experimental design, data collection, and writing of a scientific paper detailing Introduction, Methods, Results and Discussion.
Outcomes:
Students would learn to develop hypotheses, design experiments based on those hypotheses, analyze data, and learn to construct and peer-review a scientific manuscript

BIOL 366 Cell Physiology & Biochemistry (3 Credit Hours)
Pre-requisites: Bioinformatics majors: CHEM 224 or CHEM 222 or (CHEM 240 pre-req and CHEM 260 co-req); All other majors: BIOL 251 & CHEM 224 or CHEM 222 or (CHEM 240 pre-req and CHEM 260 co-req)
An introduction to biochemical principles as they relate to major biological themes such as the relationship between cellular structure and function, metabolism, thermodynamics, regulation, information pathways, and evolution. BIOL 366 is cross-listed with CHEM 361.
Interdisciplinary Option: Forensic Science
Course equivalencies: X-BIOL366/BIOI366/CHEM361
Outcomes:
Students will study the basic concepts of biochemistry and will understand how thermodynamics govern biochemical processes; Catalytic strategies, as well as the major pathways of both anabolism and catabolism, will also be learned

BIOL 366L Cell Physiology & Biochemistry Lab (3 Credit Hours)
Introduction to modern techniques and instrumentation with an emphasis on cellular metabolism and protein biochemistry including purification and quantitation methods and enzyme kinetics.
Interdisciplinary Option: Forensic Science
This course satisfies the Engaged Learning requirement.
Outcomes:
Proficiency in performing a variety of biochemical assays and the ability to write up results as a formal lab report

BIOL 367 Bioimaging (4 Credit Hours)
Pre-requisites: BIOL 251 and BIOL 282; PHYS 112 or PHYS 114; Instructor Permission
This course focuses on light microscopy but also includes a section on Electron Microscopy. Topics include basic optical theory, history, sample preparation, microscope operation, digital image acquisition and analysis.
Outcomes:
Students will become adept at producing publication quality images using a variety of imaging techniques; Students will also learn how to correctly interpret results and properly present their data

BIOL 368 Plant Ecology Lec/Lab (4 Credit Hours)
Pre-requisites: BIOL 265
Focuses on plant population dynamics; plant-animal interactions, including herbivory, pollination, dispersal; plant community dynamics, such as the processes of succession; and the effect of global climate on the distribution of major vegetation types. The laboratory is divided between weekend field trips to local forests, prairies and bogs, and laboratory studies.
Outcomes:
Students will achieve familiarity with major vegetation types and especially with local vegetation and natural areas; understand the dynamics of plant communities; understand the nature of research in plant ecology and gain familiarity with the primary literature; understand environmental issues as they relate to plant ecology

BIOL 369 Invertebrate Biology (3 Credit Hours)
Broad survey of invertebrates including morphology, physiology, ecology, evolution, and systematics.

BIOL 370 Ichthyology Lec/Lab (4 Credit Hours)
Pre-requisites: BIOL 265
Lecture and laboratory and/or field trips. Systematics, phylogeny, anatomy, physiology, behavior, functional morphology and ecology of fishes. Includes field collecting trips in Lake Michigan and local streams and lakes and individual projects/research papers.
Outcomes:
Students will develop a detailed understanding of a range of topics in fish biology, with special emphasis on evolutionary relationships

BIOL 373 Laboratory in Neuroscience I (4 Credit Hours)
Pre-requisites: NEUR 101, BIOL 251; and students must be either a Molecular/Cellular Neuroscience Major, a Cognitive/Behavioral Neuroscience major, or a Neuroscience Minor
Students will be trained in various anatomical, physiological, behavioral, and neurobiological modeling techniques used to study the nervous system and the brain in the laboratory. This course is cross-listed as NEUR 301 & PSYC 388.
Interdisciplinary Option: Neuroscience
Course equivalencies: X-NEUR301/PSYC388/BIOL373
Outcomes:
Students will demonstrate understanding of several research designs and methodologies of use in neuroscience research and will gain experience with basic neuroscience laboratory techniques

BIOL 375 Aquatic Insects Lecture & Laboratory (4 Credit Hours)
Pre-requisites: BIOL 265
This course focuses on the classification and ecology of insects that have become fully or partially adapted to the aquatic environment. Emphasis will be on the ecology and biology (behavior, physiology and phylogeny) of aquatic insects. The course includes laboratory field trips to local and upper Midwest aquatic habitats.
Outcomes:
Students will acquire an understanding of the ecological relationships between aquatic insects and their physical and biological environment, including their interactions with humans

BIOL 376 Seminar in Molecular/Cellular Neuroscience (3 Credit Hours)
Pre-requisites: BIOL 282 and BIOL 362
This lecture/discussion will span synaptic plasticity, modern approaches to studying neural circuits, and the therapeutic potential of neural stem cells. Students become familiar with principles of molecular/cellular approaches to the study of the nervous system through review articles and the primary literature.
Interdisciplinary Option: Neuroscience
Outcomes:
Students will become familiar with principles of molecular/cellular approaches to the study of the nervous system; Students will also learn how to evaluate primary literature

BIOL 377 Molecular Pathogenesis (3 Credit Hours)
Introduction to the molecular mechanisms of disease pathology and therapeutic and control strategies, using a particular disease as model.
Outcomes:
Students will be able to explain the molecular basis for particular disease symptoms, understand therapeutic strategies, and use experimental results to form conclusions about disease molecular mechanisms

BIOL 378 Dental Anthropology (0 Credit Hours)
Pre-requisites: ANTH 101 or any 100-level Biology course
This course examines teeth with an anthropological perspective. By using evolution by natural selection as our theoretical framework, students will learn dental anatomy, morphology, and variation. The course then focuses on embryology, dental development and eruption, and the biocultural ways humans use their teeth.
Course equivalencies: X- ANTH 327/BIOL 378
Outcomes:
Students will gain factual knowledge of teeth from an evolutionary perspective and will develop specific hands-on skills needed by dental anthropologists, dentists, and oral biologists including dental molding, casting, and wear scoring

BIOL 378B Biological Topics for Bioethics Minor Capstone (3 Credit Hours)
Pre-requisites: Two prior science courses and two prior ethics courses required
The interdisciplinary team-taught Bioethics capstone course examines a topic in bioethics from both scientific and ethical points of view. Topics may include bio-technologies, concepts of race and gender, the environment, reproduction, and others. This course number provides an elective for Biology students when the Bioethics capstone's topic is biological.
Interdisciplinary Option: Bioethics
Outcomes:
Students will understand the connection between ethical and biological issues with regard to the special topic in biology

BIOL 379B Biological Topics for Bioethics Minor Capstone (3 Credit Hours)
Pre-requisites: Two prior science courses and two prior ethics courses
The interdisciplinary team-taught Bioethics capstone course examines a topic in bioethics from both scientific and ethical points of view. Topics may include biotechnologies, concepts of race and gender, the environment, reproduction, and others. This course number provides an elective for Biology students when the Bioethics capstone's topic is biological.
Interdisciplinary Option: Bioethics
Outcomes:
Students will understand the connection between ethical and biological issues with regard to the special topic in biology

BIOL 380 Genetics and Evolution of Development (3 Credit Hours)
This course explores the evolution of the embryo and the patterns of gene regulation and morphogenesis that drive early development. Topics include evolution of nervous system patterning, shared human, mouse and frog regulatory systems and evolution of human genetic syndromes.
Outcomes:
Students will master the stages and regulation of development in a number of organisms through use of primary literature; Evidence of their mastery will be seen through grant writing exercises, in class presentations and conventional exams

BIOL 381 Epigenetics (3 Credit Hours)
Pre-requisites: BIOL 251 and BIOL 282; CHEM 222 or CHEM 224 or (CHEM 240 pre-req and CHEM 260 co-req)
This course will introduce students to epigenetic mechanisms operating throughout life, which include chromatin regulation, DNA methylation, histone modifications and non-coding RNAs. Students will gain an appreciation of how different cell types can maintain drastically different gene expression patterns yet share the exact same DNA sequences.
Outcomes:
Students will understand epigenetic mechanisms, apply insights gained to evaluate the effect of epigenetic changes in development, disease and aging, and learn how to lead a class discussion

BIOL 382 Molecular Genetics (3 Credit Hours)
Pre-requisites: BIOL 251 and 282; CHEM 222 or CHEM 224 or (CHEM 240 pre-req and CHEM 260 co-req)
This course covers the molecular details of genetic processes such as DNA replication, RNA and protein synthesis, gene regulation and genome organization.
Outcomes:
Students will be able to demonstrate a detailed understanding of (1) basic molecular techniques, (2) the macromolecules involved in genetic processes, and (3) published experiments that underlie our knowledge of these processes

BIOL 383 Population Genetics (3 Credit Hours)
Pre-requisites: BIOL 282 and MATH 132 or MATH 162; BIOL 235 is recommended
Fundamental principles of population, ecological, and evolutionary genetics, including molecular evolution and analysis of the genetic structure of populations.
Outcomes:
Students develop knowledge and awareness of population genetic theory and information; They learn how to apply basic tools of population genetic analysis

BIOL 384 Microbial Pathogenesis of Infectious Disease (3 Credit Hours)
Pre-requisites: BIOL 251 (Cell Biology) and BIOL 282 (Genetics) each with a C or higher
The course is focused on teaching students the way bacteria, viruses, fungi, and pathogens, can adhere, invade, replicate, and cause damage and disease in their hosts. The course focuses on the techniques used by researchers to ask questions about these processes.
Outcomes:
Students will understand the ways pathogens cause disease, read and review primary literature, and apply techniques used in a grant proposal on a topic of their interest

BIOL 385 Prin Electron Microscopy Lec/Lab (4 Credit Hours)
Pre-requisites: Permission of instructor, BIOL 341 recommended
This course focuses on the various areas of Electron Microscopy, both Scanning and Transmission. Topics include sample preparation, microscope operation, image acquisition using photographic and digital techniques, history and development, and new and special techniques.
Outcomes:
Student will become adept with the various techniques needed to produce research quality electron micrographs; Students will also learn how to correctly interpret their results, and properly present their data

BIOL 386 Human Genetics (3 Credit Hours)
Pre-requisites: BIOL 282
Students will learn the foundations of human complex trait genetics in this course-based undergraduate research experience. They will analyze and discuss primary literature in human genetics, understand how our genes do and do not influence human differences, apply software tools used in the field, and gain experience in oral and written presentation of research.
This course satisfies the Engaged Learning requirement.
Outcomes:
Learn the foundations of human complex trait genetics; Analyze and discuss primary literature in human genetics; Begin applying the scripting and software tools used in the field; Design, implement, and evaluate a guided genome-wide analysis of a human phenotype; Gain experience in oral and written presentations of research

BIOL 387 Genomics (3 Credit Hours)
Genomics is the compilation, characterization, and evaluation of DNA sequence information and its integration with established methods and genetic knowledge. This course will introduce the students to the study of genome structure and function and its application to biomedicine, agriculture, and evolution.
Interdisciplinary Option: Bioinformatics
Course equivalencies: X-BIOL387/BIOI387
Outcomes:
Students will acquire an in-depth knowledge of the nature of gene and genome structure, function, and evolution as well as the methods used to obtain and evaluate this knowledge; Students will be able to create meaningful web-based database search strategies and interpret the significance of results

BIOL 388 Bioinformatics (3 Credit Hours)
Students will engage in the applications of computer-based tools and database searching to better understand the fields of genetics, genomics, evolutionary biology, and personalized medicine. Students will be introduced to scripting programming languages for analyzing biological data sets.
Interdisciplinary Option: Bioinformatics
Course equivalencies: X-BIOL388/COMP381/BIOI388
Outcomes:
Students will be able to appropriately use computer software and databases to accurately analyze biological data and interpret the results, applying their understanding of genetic processes

BIOL 389 Introduction to Pharmacology (3 Credit Hours)
Pre-requisites: BIOL 243, BIOL 251, BIOL 282; CHEM 222 or CHEM 224 or (CHEM 240 pre-req & CHEM 260 co-req)
Principles and mechanisms of drug action. Topics discussed include drug-receptor interaction, pharmacokinetics, drug distribution, metabolism, and neuro-transmission, blood-brain barrier, and toxicology.
Outcomes:
Students will be able to describe the cellular and molecular mechanisms of action for a variety of the most commonly used drugs in current medical use

BIOL 390 Molecular Biology Laboratory (4 Credit Hours)
Pre-requisites: Bioinformatics majors: BIOL 282 & BIOL 283 and CHEM 222 or CHEM 224 or (CHEM 240 pre-req and CHEM 260 co-req); All other majors: BIOL 251, BIOL 282, BIOL 283 and CHEM 222 or CHEM 224 or (CHEM 240 pre-req and CHEM 260 co-req)
This course is an intensive laboratory course in the basic principles and techniques of molecular biology, including bacterial cloning, polymerase chain reaction, restriction mapping, agarose gel electrophoresis, and DNA sequencing.
Interdisciplinary Option: Bioinformatics, Neuroscience
This course satisfies the Engaged Learning requirement.
Course equivalencies: X-BIOL390/BIOI390
Outcomes:
Students will be able to demonstrate basic molecular biology skills including manipulation of bacterial cultures and DNA, plasmid minipreps, gel electrophoresis, cloning, polymerase chain reaction, and other molecular techniques that may be specific to their chosen independent projects

BIOL 391 Forensic Molecular Biology Lecture and Lab (5 Credit Hours)
Pre-requisites: BIOL 282, BIOL 283 & FRSC-BS Major
This course prepares students to work in forensic DNA analysis. The lectures cover the basic aspects of DNA structure and function while the laboratory gives students experience with the techniques and instruments used in forensic DNA analysis.
Interdisciplinary Option: Forensic Science
Course equivalencies: BIOL 391/FRSC 371
Outcomes:
Students will have a strong theoretical understanding of STR marker origin, population biology, and legal uses, and will be able to isolate and process DNA for STR scoring

BIOL 392 Metagenomics (3 Credit Hours)
Pre-requisites: BIOL 282
Exploration of next-generation sequencing technologies for assessing microbial diversity in ecological niches.
Interdisciplinary Option: Bioinformatics
This course satisfies the Engaged Learning requirement.
Outcomes:
Students will gain hands-on experience with metagenomic methodologies while working in an interdisciplinary, collaborative setting

BIOL 394 Special Topics in Biology Laboratory (1-4 Credit Hours)
Laboratory. Special areas of study outside the usual curriculum, that vary each time the course is offered.
Outcomes:
Students will master a unique topic in biology

BIOL 394E Special Topics in Biology Laboratory (Ecology Emph) (1-4 Credit Hours)
Laboratory. Special areas of study related to ecology outside the usual curriculum, that vary each time the course is offered.
Outcomes:
Students will master a unique topic in biology related to ecology

BIOL 394M Special Topics in Biology Laboratory (Molecular Emph) (1-4 Credit Hours)
Laboratory. Special areas of study related to molecular biology outside the usual curriculum, that vary each time the course is offered.
Outcomes:
Students will master a unique topic in biology related to molecular biology

BIOL 395 Special Topics in Biology (3 Credit Hours)
Special areas of study outside the usual curriculum, that vary each time the course is offered.
Outcomes:
Students will master a unique topic in biology

BIOL 395E Special Topics in Biology (Ecology Emph) (3 Credit Hours)
Special areas of study related to ecology outside the usual curriculum, that vary each time the course is offered.
Outcomes:
Students will master a unique topic in biology related to ecology

BIOL 395L Special Topics Laboratory (1-4 Credit Hours)
Laboratory. Special areas of study outside the usual curriculum, that vary each time the course is offered.
Outcomes:
Students will master a unique topic in biology

BIOL 395M Special Topics in Biology (Molecular Emph) (3 Credit Hours)
Special areas of study related to molecular biology outside the usual curriculum, that vary each time the course is offered.
Outcomes:
Students will master a unique topic in biology related to molecular biology

BIOL 396 Research (3 Credit Hours)
Pre-requisites: BIOL 296 (minimum 1 credit), Permission of Instructor; Contract Required
Laboratory or field research under faculty guidance emphasizing hypothesis testing, literature searches, experimental design, and use of appropriate techniques.
Interdisciplinary Option: Neuroscience
This course satisfies the Engaged Learning requirement.
Course equivalencies: BIOL299/BIOL396
Outcomes:
Students will learn the full set of research skills required in doing an independent project and reporting the results

BIOL 396E Research (Ecology Emph) (3 Credit Hours)
Pre-requisites: BIOL 296 (minimum 1 credit), Permission of Instructor; Contract Required
Laboratory or field research related to ecology under faculty guidance emphasizing hypothesis testing, literature searches, experimental design, and use of appropriate techniques.
This course satisfies the Engaged Learning requirement.
Outcomes:
Students will learn the full set of research skills required in doing an independent project related to ecology and reporting the results

BIOL 396M Research (Molecular Emph) (3 Credit Hours)
Pre-requisites: BIOL 296 (minimum 1 credit), Permission of Instructor; Contract Required
Laboratory or field research related to molecular biology under faculty guidance emphasizing hypothesis testing, literature searches, experimental design, and use of appropriate techniques.
This course satisfies the Engaged Learning requirement.
Outcomes:
Students will learn the full set of research skills required in doing an independent project related to molecular biology and reporting the results

BIOL 397 Course-Based Undergraduate Research Experience in Biology (1-4 Credit Hours)
Laboratory. Special areas of study outside the usual curriculum, that vary each time the course is offered. Students will be working on research contributing to current scientific questions in the noted special topic area.
This course satisfies the Engaged Learning requirement.
Course equivalencies: Biol 397H /Biol 397
Outcomes:
Students will plan and execute appropriate experimental or observational methods, and evaluate the results to address a research question or explore a biological phenomenon; Students will review the scientific literature, and then use the appropriate language and style to communicate their findings effectively to targeted audiences

BIOL 397E Course-based Undergraduate Research Experience in Biology (Ecology Emph) (1-4 Credit Hours)
Laboratory. Special areas of study outside the usual curriculum related to ecology, that vary each time the course is offered. Students will be working on research contributing to current scientific questions in the noted special topic area.
This course satisfies the Engaged Learning requirement.
Outcomes:
Students will plan and execute appropriate experimental or observational methods, and evaluate the results to address a research question or explore a biological phenomenon related to ecology; Students will review the scientific literature, and then use the appropriate language and style to communicate their findings effectively to targeted audiences

BIOL 397M Course-based Undergraduate Research Experience in Biology (Molecular Emph) (1-4 Credit Hours)
Laboratory. Special areas of study outside the usual curriculum related to molecular biology, that vary each time the course is offered. Students will be working on research contributing to current scientific questions in the noted special topic area.
This course satisfies the Engaged Learning requirement.
Outcomes:
Students will plan and execute appropriate experimental or observational methods, and evaluate the results to address a research question or explore a biological phenomenon related to molecular biology; Students will review the scientific literature, and then use the appropriate language and style to communicate their findings effectively to targeted audiences

BIOL 398 Internship in Biology (1-3 Credit Hours)
Pre-requisites: Permission of Instructor; Contract required
A supervised field placement intended to give students training or work experience in aspects of biology that cannot be obtained on campus.
This course satisfies the Engaged Learning requirement.
Outcomes:
Students will acquire practical experience in biology-related job settings

BIOL 398E Internship in Biology (Ecology Emph) (1-3 Credit Hours)
Pre-requisites: Permission of Instructor; Contract required
A supervised field placement intended to give students training or work experience in aspects of biology related to ecology that cannot be obtained on campus.
This course satisfies the Engaged Learning requirement.
Outcomes:
Students will acquire practical experience in ecology-related job settings

BIOL 398M Internship in Biology (Molecular Emph) (1-3 Credit Hours)
Pre-requisites: Permission of Instructor; Contract required
A supervised field placement intended to give students training or work experience in aspects of biology related to molecular biology that cannot be obtained on campus.
This course satisfies the Engaged Learning requirement.
Outcomes:
Students will acquire practical experience in molecular biology-related job settings

BIOL 399 Individual Study (1-3 Credit Hours)
Directed study of a specific topic by an individual student studying with a single faculty member.
Outcomes:
Students will master a unique topic in biology

BIOL 399E Individual Study (Ecology Emph) (1-3 Credit Hours)
Directed study of a specific topic related to ecology by an individual student studying with a single faculty member.
Outcomes:
Students will master a unique topic in biology related to ecology

BIOL 399M Individual Study (Molecular Emph) (1-3 Credit Hours)
Directed study of a specific topic related to molecular biology by an individual student studying with a single faculty member.
Outcomes:
Students will master a unique topic in biology related to molecular biology

BIOL 401 Medical Literature and Ethics (3 Credit Hours)
The course will include lectures on the foundational concepts of modern ethics, in class discussions of ethics primarily centered on discussion of cases from different ethical perspectives, quizzes to assess reading mastery and familiarity with material to qualify students on how to discuss cases and formal case presentations by student working groups.
Outcomes:
Understand and articulate the philosophical basis for different ethical frameworks; Have a firm command of the "four principles" of Benevolence, Non-maleficence, Justice and Autonomy and their clinical applications; Be able to resolve clinical ethical issues and back up your reasoning

BIOL 402 Microbiology (3 Credit Hours)
Lecture and laboratory. Fundamental concepts of microbial life, physiology, and metabolism.
Outcomes:
Students will learn the differences between the 3 domains of life and will comprehend the biochemistry, morphology, growth characteristics, structure and ecology of microbes

BIOL 405 Advanced Development (3 Credit Hours)
Developmental Biology draws from Genetics, Molecular Biology, Genomics, and Embryology and is a foundational science for understanding problems in Humans ranging from birth defects to cancer. Because of its multidisciplinary foundation, Developmental Biology is best thought of as a SYSTEM OF IDEAS, EXPERIMENTS AND OBSERVATIONS, as such you will greatly expand your scientific vocabulary and problem solving abilities during the course of this semester. Often you will need to draw on your stored knowledge from many disciplines to understand the topics we will cover. The course will comprise lectures on general development, evolution and developmental genetics, followed by discussions of papers on particular topics, and student presentations.

BIOL 408 Writing for the Medical Professions (3 Credit Hours)
This course will be required for the Master of Arts in Medical Sciences (MAMS) program. It will include readings related to developing the student's physician persona, and writings that are required for the medical school application process. Pre-requisites: Admission to the MA in Medical Sciences program.
Outcomes:
Students will be prepared to write effective primary and secondary essays for their medical school applications; communicate clearly their motivation to pursue a career in medicine and the relevance of their experiences to their pre-medical preparation

BIOL 409 Advanced Genetics (3 Credit Hours)
Pre-requisites: Restricted to students in the MAMS Program (Note: MAMS = MSCI-MA)
The course will comprise formal discussions on the molecular basis of information storage and retrieval in the cell, the role of genetics in human development and homeostasis, the mapping of human genes in familial or population contexts, and modern understanding of the connection between genotype, phenotype and human traits.

BIOL 410 Advanced Cell Biology (3 Credit Hours)
This course explores, in depth, the life cycle and activities of a typical eukaryotic cell. Some of the topics covered are cell polarity, cytoskeleton, plasma membrane, protein modifications and trafficking, extracellular matrix and cell death. Competencies to be gained in this course: To develop the skill of reading and analyzing the primary literature on topics pertaining to cell biology. Judging whether a conclusion is supported by sufficient data. Identifying the controls in published experiments. Exam-taking skill improvement using short reading passages from the scientific literature as topics.

BIOL 413 Advanced Immunology (3 Credit Hours)
Introduces innate and adaptive immunity, lymphocyte development, T-cell and B-cell mediated immunity, leukocyte trafficking, immunological memory hyperimmune reactions, autoimmunity, tumor and transplant immunity. Must be enrolled in the Master of Arts in Medical Sciences (MAMS) program.
Outcomes:
Students will acquire an overview of the human immune system that prepares them for success in a medical school immunology class

BIOL 415 Advanced Parasitology (4 Credit Hours)
Lecture and laboratory. A study of animal parasites, their distribution, structure, adaptations, life cycles, and host relationships.
Outcomes:
Students will learn to recognize the major groups of animal parasites, be able to explain their life cycles and describe the mechanisms that hosts use to ward off parasite infestation

BIOL 416 Limnology Lec/Lab (4 Credit Hours)
Lecture and laboratory. An introduction to the structure and function of lake and stream ecosystems. The course includes the integration of physical, chemical, and biological parameters. Laboratories include weekend field trips to aquatic habitats. Students will learn to evaluate the trophic status and health of a lake by the end of the course.
Outcomes:
Students will learn methods of sampling and analyzing physical, chemical and biological factors in lake and stream ecosystems, and how to integrate these complex data sets to answer ecosystem process-level questions

BIOL 417 Wetland Ecology Lec/Lab (4 Credit Hours)
Lecture and laboratory. An introduction to the study of wetlands habitats. This course includes discussion of physical and chemical factors, biota, production and community dynamics. Laboratories include several field trips to regional wetland habitats.
Outcomes:
Students will understand the functioning of wetlands, become aware of the variety of wetlands and become familiar with wetland biota, especially wetland plants

BIOL 418 Aquatic Insects Lecture & Laboratory (4 Credit Hours)
Lecture and laboratory. This course focuses on the classification and ecology of insects that have become fully or partially adapted to the aquatic environment. Emphasis will be on the ecology and biology (behavior, physiology and phylogeny) of aquatic insects. The course includes laboratory field trips to local and upper Midwest aquatic habitats.
Outcomes:
Students will acquire an understanding of the ecological relationships between aquatic insects and their physical and biological environment, including their interactions with humans

BIOL 422 Research (1-6 Credit Hours)
Laboratory or field research under faculty guidance emphasizing hypothesis testing, literature searches, experimental design, and use of appropriate techniques.
Outcomes:
Students will learn the full set of research skills required in doing an independent project and reporting the results

BIOL 426 Entomology Lec/Lab (4 Credit Hours)
Lecture and laboratory. An introductory course that covers the morphology, metamorphosis, classification and biology of the major insect groups. The laboratory includes dissection and the use of analytical keys and figures to identify insect taxa. Field trips and student collections add to the laboratory experience. They will also learn to distinguish immature insects from adult insects and to recognize the numerous beneficial insects as well as the small number that are detrimental.
Outcomes:
Students will learn to identify major insect groups in the field and in the laboratory

BIOL 430 Virology (3 Credit Hours)
This course covers the molecular details of viral infection and the diverse strategies used by these pathogens to invade cells and avoid immune clearance. The focus will be on mammalian viruses of biomedical relevance.
Outcomes:
Students will be able to demonstrate detailed understanding of basic viral structure, basic viral replication/infection cycles, and specific examples of viruses and their infection strategies

BIOL 450 Advanced Bioinformatics (2 Credit Hours)
Pre-requisites: BIOL 388 or BIOL 488
Students will study fundamental bioinformatics algorithms and emerging software tools in the field. The course will include the study of primary literature and design and implementation of bioinformatics algorithms.
Course equivalencies: X- BIOI 500 /BIOL 450
Outcomes:
Students can describe, design, implement, and evaluate bioinformatics algorithms

BIOL 451 Bioinformatics Seminar (1 Credit Hour)
Pre-requisites: BIOL 388 or BIOL 488
The seminar will introduce students to current topics in bioinformatics through presentations given by leaders in bioinformatics research. This course will also include more formal training in scientific presentation skills. Students can summarize, critique, and present bioinformatics research.
Course equivalencies: X-BIOI501/BIOL451

BIOL 452 Human Anatomy and Physiology I (3 Credit Hours)
The course objectives are to learn the gross anatomical structures of the human body. To organize the relationships between these structures and systems using patterns of innervation and development. To be able to apply anatomical knowledge in ways pertinent to clinical issues.

BIOL 453 Human Anatomy and Physiology II (3 Credit Hours)
Pre-requisites: Restricted to students in the MAMS Program
This is the second semester of a 2 semester course. We will cover the physiology of the cardiovascular, respiratory, digestive, renal, reproductive, and endocrine systems, in addition to acid-base and fluid balance, temperature regulation, and exercise physiology. Functioning will be discussed from a systems level to a molecular level.

BIOL 455 Advanced Neuroscience (3 Credit Hours)
This course will focus on the cellular, anatomical, and functional organization of the human nervous system that range in topics from ion channel physiology to cognition. Students will survey the elements of the nervous system necessary for a foundation for medical school. An understanding of pathologies presented in disease, dysfunction, and injury will be included.
Outcomes:
Learn foundational neurological concepts presented to first year medical students; Learn the pathology of neurological disease, dysfunction, and injury through clinical cases; Understand the neurological basis of higher-order functions

BIOL 458 Developmental Neurobiology (3 Credit Hours)
This course focuses on cellular and molecular underpinnings of the development of neuronal features of the nervous system. Topics include neural induction and subsequent differentiation events, regulation of neuronal survival, axon guidance, target selection, and synaptogenesis. Students will also learn how to critically read primary research papers and present these papers to the class.
Outcomes:
Students will become familiar with principles of neural development and the studies that led to those principles

BIOL 461 Advanced Neurobiology (3 Credit Hours)
The purpose of this course is to introduce major principles and concepts of modern neurobiology. An emphasis is placed upon an understanding of the electrophysiology of the neuron and the manner in which groups of neurons are organized into functional nervous systems subserving sensory, motor or integrative functions.
Outcomes:
Student will gain a sold foundation in nervous system structure and function

BIOL 466 Advanced Biochemistry (3 Credit Hours)
Life is based on four principle cellular components: proteins, lipids, carbohydrates, and nucleic acids. Biochemistry is concerned with the structure, function, and interactions of these compounds with one another and their environment. As such biochemistry plays a vital part in all aspects of the medical sciences since it not only helps us to understand how the (human) cell works on a molecular level but also how to decipher and possibly counter pathogenic conditions. Consider that almost all drugs used in medical treatment target proteins or groups of proteins to modulate their biochemical properties.

BIOL 470 Biostats & Exp Design Lec/Lab (4 Credit Hours)
This course is designed for students who are in, or plan to attend, graduate or professional school, and thus, will be working with their own data or critically analyzing existing data. This course will emphasize the theory and application of commonly used statistics in biology.

BIOL 479 Biology AP Workshop (3 Credit Hours)
No course description is available

BIOL 482 Advanced Molec Genetics (3 Credit Hours)
This course covers the molecular details of genetic processes such as DNA replication, RNA and protein synthesis, gene regulation and genome organization.
Outcomes:
Students will be able to demonstrate a detailed understanding of (1) basic molecular techniques, (2) the macromolecules involved in genetic processes, and (3) published experiments that underlie our knowledge of these processes

BIOL 483 Pop Genetics (3 Credit Hours)
Fundamental principles of population, ecological, and evolutionary genetics, including molecular evolution and analysis of the genetic structure of populations. They learn how to apply basic tools of population genetic analysis.
Outcomes:
Students develop knowledge and awareness of population genetic theory and information

BIOL 485 Prin Electron Microscopy Lec/Lab (4 Credit Hours)
Lecture and laboratory. This course focuses on the various areas of Electron Microscopy, both Scanning and Transmission. Topics include sample preparation, microscope operation, image acquisition using photographic and digital techniques, history and development, and new and special techniques. Students will also learn how to correctly interpret their results, and properly present their data.
Outcomes:
Student will become adept with the various techniques needed to produce research quality electron micrographs

BIOL 488 Bioinformatics (3 Credit Hours)
Students will engage in the applications of computer-based tools and database searching to better understand the fields of genetics, genomics, evolutionary biology, and personalized medicine. Students will be introduced to scripting programming languages for analyzing biological data sets.
Outcomes:
Students will be able to appropriately use computer software and databases to accurately analyze biological data and interpret the results, applying their understanding of genetic processes

BIOL 493 Directed Reading (1-4 Credit Hours)
Student investigates a current topic in biology.

BIOL 495 Special Topics (1-4 Credit Hours)
Special areas of study outside the usual curriculum, that vary each time the course is offered.
Outcomes:
Students will master a unique topic in biology

BIOL 495L Special Topics Lab (0 Credit Hours)
Laboratory. Special areas of study outside the usual curriculum, that vary each time the course is offered. Outcome: Students will master a unique topic in biology.

BIOL 500 Scientific Logic (3 Credit Hours)
The Scientific Logic course is designed to teach scientific literacy in terms of writing grant proposals, reading scientific literature, scientific presentations and debate. The course is framed within an evolutionary foundation.
Outcomes:
Students will gain knowledge in advanced evolutionary topics, while preparing a grant proposal and developing skills with respect to critical thinking and scientific inquiry

BIOL 501 Seminar (1 Credit Hour)
Students present specific, current research topics including their own research to the class and faculty.

BIOL 502 Department Seminar (1 Credit Hour)
Students meet and discuss the research presented by seminar speakers.

BIOL 510 Instructions in Teaching Biology (1 Credit Hour)
Introduction to the fundamentals of teaching biology.

BIOL 511 Biology Teaching Practicum (2 Credit Hours)
Students gain firsthand teaching experience by assisting in undergraduate courses.

BIOL 595 Thesis Supervision (0 Credit Hours)
Students conduct thesis research under the direction of their Thesis Director.

BIOL 605 Master's Study (0 Credit Hours)
Students conduct thesis research under the direction of their Thesis Director.