# **BIOLOGY (BY)**

#### BY 5002 Medical Microbiology (4)

Prerequisite(s): BY 323 or 283 and approval of instructor.

Study of pathogenic bacteria, viruses, fungi, and parasites of humans and some domestic animals; identification of pathogens, disease processes, and public health emphasized; lecture and laboratory.

# BY 5003 Immunology (3)

Prerequisite(s): BY 373; BY 323 recommended.

Study of immunity and how the immune system responds to specific infectious and non-infectious agents; comparative immunology of invertebrate and vertebrate animals, immunological disorders, and application of immunological techniques.

# BY 5006 Ornithology (4)

Prerequisite(s): BY 332.

History, classification, anatomy, physiology, ecology, and distribution of birds; laboratory emphasis on field identification and ecology; lecture, laboratory, and field studies.

#### BY 5009 Introduction to Forensic Botany (3)

Prerequisite(s): BY 101 and BY 102.

An introduction to the role of plants in criminal investigations, law, and legal matters. The course deals with the study of plants and plant materials collected at scenes of criminal activities. Topics include a survey of basic botany science including plant structure and reproductive biology, plant anatomy, plant diversity, pollen studies, and genetics, with an emphasis on plants as evidence. Another aspect of the course includes simulations of cases and reading and understanding of case studies where forensic botany was applied.

#### BY 5012 Plant Reproduction and Development (4)

Prerequisite(s): BY 322, BY 373; CY 105, CY 106, CY 107, CY 108 recommended.

Study of structural and functional aspects of reproductive and developmental phenomena in vascular plants; lecture and laboratory.

#### BY 5013 Animal Reproduction and Development (4)

Prerequisite(s): BY 322, BY 373; CY 105, CY 106, CY 107, CY 108 recommended.

Study of the structural and functional aspects of reproductive and developmental phenomena in animals with emphasis on the cellular and molecular mechanisms involved; lecture and laboratory.

#### BY 5015 Biometrics (3)

Prerequisite(s): BY 322, 332, or 373 and MS 204.

An introduction into statistics for biology majors. This course will introduce students to appropriate statistics for analyzing biological data including how to select random samples, use basic statistical packages, post-hoc statistical testing and the use of linear regression and will use real-world examples of statistics in ecological, toxicological, and physiological research; lecture and laboratory.

#### BY 5017 Medical Parasitology (3)

This course is designed to give a broad overview of general medical parasitology. Major groups of parasites are studies with an emphasis on those that afflict both domesticated and wild animals. This course provides an understanding of important parasitic diseases including their life cycles, vectors of transmission, distribution, epidemiology, pathophysiology, clinical manifestations, treatment, prevention, and control.

#### BY 5019 Medical Botany (4)

Prerequisite(s): BY 101, BY 102, BY 103, and BY 104.

An introduction to the role of plants in human health and medicine, with an emphasis on their biologically active compounds. Includes a survey of traditional medicines around the world (e.g., Ayurveda, Chinese Medicine) and contemporary clinical methods at the forefront of medical research. Lecture and laboratory. This course may only be taken at the undergraduate level upon approval for participation in the Faster Master's program.

#### BY 5020 Applied Medical Cannabis (3)

Comprehensive overview of medical cannabis. This upper-level course will explore the applications of phytocannabinoids for pain, seizure, psychiatric disorder, cancer, and many other medical indications. Important precautions, contraindications, and cannabis use disorders will be introduced as well as an overview of career opportunities in cannabis medicine.

#### BY 5022 Biology of Cryptogams (4)

Prerequisite(s): BY 332, BY 373.

The study of blue-green algae, algae, slime molds, bryophytes, and lichens; lecture, laboratory, field, and library study. Extensive field and laboratory identifications.

# BY 5034 Animal Systems Physiology (4)

Prerequisite(s): BY 373; CY 105, CY 106, CY 107, CY 108; CY 231, CY 232 and one semester of physics recommended.

Systematic survey of organ system physiology in vertebrates; systems analysis, biophysics, and bioengineering emphasized; lecture and laboratory. This course may only be taken at the undergraduate level upon approval for participation in the Faster Master's program.

#### BY 5035 Landscape Ecology (4)

Prerequisite(s): BY 322, MS 204.

Lecture, laboratory, and field study. Emphasis will be on the role of spatial heterogeneity in terrestrial systems; its detection and description, analysis of pattern formation, landscape dynamics and models, human interactions with heterogeneity, and the implications of heterogeneity of populations, communities, and ecosystems. Landscape ecology provides approaches to fundamental research questions in ecology, as well as new approaches to forest and resource management that consider ecosystem processes at larger spatial and temporal scales.

#### BY 5038 Freshwater Biology (4)

#### Prerequisite(s): BY 332.

Analysis of the unique ecology and biology of the freshwater environment; extensive field work; research project; lecture, laboratory, and field studies.

#### BY 5042 General Entomology (4)

Prerequisite(s): BY 332.

Lecture, laboratory, and field study of insects and other arthropods, with an emphasis on the taxonomy, morphology, physiology, and ecology of the insects. This course may only be taken at the undergraduate level upon approval for participation in the Faster Master's program.

#### BY 5043 Medical Entomology (3)

Prerequisite(s): BY 332.

Arthropods of medical and veterinary importance, how they affect their hosts and transmit disease.

# BY 5045 Ecotoxicology (4)

#### Prerequisite(s): BY 332, BY 373.

Recommended: BY 322. This course is a survey of ecotoxicology. The study of the integration of the major processes involved with transport, exposure and response of biological systems to xenobiotics, how toxicants mediate interactions between organisms and their biotic and abiotic environments and, the impact and toxic effects of pollutants on diversity, growth and metabolism of living organisms, populations, communities, and the ecosystem; lecture, laboratory and field study.

#### BY 5050 Molecular Biology (4)

Prerequisite(s): BY 322 or approval of instructor.

Study of the processes involved in the expression of biological information at the molecular level; lecture and laboratory. This course may only be taken at the undergraduate level upon approval for participation in the Faster Master's program.

#### BY 5051 Plant Anatomy (4)

#### Prerequisite(s): BY 373.

Study of the comparative structural organization of the vegetative and reproductive parts of seed plants, from cells to tissues to systems; lecture and laboratory.

#### BY 5052 Plant Taxonomy (4)

Prerequisite(s): BY 322 or BY 332.

Survey of plant nomenclature, identification systems, description, evolution, and classification; vascular plants emphasized; lecture, library, laboratory, and field studies.

# BY 5053 Dendrology (4)

Prerequisite(s): BY 332.

Lecture, laboratory, and field study. The identification, taxonomy, ecological characteristics, distribution, and economic importance of trees native to North America and ornamentals.

#### BY 5058 Herpetology (4)

#### Prerequisite(s): BY 332.

Recommended: BY 320. Taxonomy, ecology, physiology, and external anatomy of amphibians and reptiles; conservation and field methodology emphasized; lecture, laboratory and field studies. This course may only be taken at the undergraduate level upon approval for participation in the Faster Master's program.

#### BY 5060 Icthyology (4)

#### Prerequisite(s): BY 332.

An overview of the evolution, ecology, behavior, physiology, and conservations of fishes. Preparation and presentation of an original library or lab/field research project required. Lecture, laboratory, and field study.

#### BY 5070 Neurobiology (3)

Prerequisite(s): BY 373 or permission of instructor.

Survey of major concepts in neurophysiology, as well as the anatomy of the central and peripheral divisions of the nervous system. The mammalian nervous system will serve as the primary model for this course. Specific topics covered will include neuron structure/function, action potential propagation, synaptic transmission, sensory neurons, motor neurons, central nervous system development, and cognition.

# BY 5072 Virology (3)

# Prerequisite(s): BY 373.

This course focuses on the principles of viral infection and pathogenicity. Topics include the classification of viruses, virus entry, genome replication and assembly, emphasis placed on virus-host cell interactions and common features between viral families.

# BY 5073 Advanced Cell Biology (4)

#### Prerequisite(s): BY 373.

Recommended: BY 322, CY 231, CY 232, CY 362, CY 363. A study of molecular aspects of cell structures and their functions using both descriptive and biochemical approaches. Lecture and laboratory.

# BY 5076 Invertebrate Zoology (4)

#### Prerequisite(s): BY 332.

Systematics, ecology, physiology, and phylogenic relationships of invertebrate animals; lecture, laboratory, and field studies.

#### BY 5077 Cell and Tissue Culture (4)

Prerequisite(s): BY 101, BY 102, BY 103, BY 104, BY 373, CY 105-CY 108. Recommended: BY 322, 412, 431 and CY 231. Cell and Tissue Culture is an advanced biology course dealing with in vitro manipulation of cells, organs, and tissues; both solid and suspension culture and their application to biotechnology. Lecture and laboratory. This course may only be taken at the undergraduate level upon approval for participation in the Faster Master's program.

# BY 5078 Endocrinology (3)

Prerequisite(s): BY 373 and CY 231.

General introduction to vertebrate endocrine systems and the variety of chemical messengers involved in the regulation of physiological processes. Topics will include discussions of the history and methodologies of endocrinology, hormone synthesis, physiological effects of hormones, and the mechanisms of actions for various hormones.

# BY 5079 Plant Physiology (4)

Prerequisite(s): BY 373; BY 451 recommended. Mineral nutrition, water relations, photosynthesis, metabolism and transport in vascular plants; lecture and laboratory.

#### BY 5080 Advanced Topics in Biology I (1)

Prerequisite(s): BY 322 or BY 332 or BY 373. Lecture and discussion; topics to be posted in the Biology Department.

#### BY 5081 Advanced Topics in Biology II (1)

Prerequisite(s): BY 322 or BY 332 or BY 373.

Lecture and discussion; topics to be posted in the Biology Department.

#### BY 5084 Restoration Ecology (4)

Prerequisite(s): BY 322 or permission of instructor.

Lecture and Laboratory. This course will apply ecological principles to restoration of severely impacted communities. Topics to be included are fire ecology, management of invasive species, and monitoring techniques among others. An emphasis in laboratory will be on upland, wetland, and aquatic ecosystems of the Valley and Ridge of Alabama.

#### BY 5101 Graduate Student Success (1)

All Master's students in their first semester as graduate students in the department must take BY 5101: Graduate Student Success. Students will achieve course objectives related to their overall adjustment to being a successful graduate student in Biology at JSU. Grades: Pass/Fail.

#### BY 5102 Scientific Literacy and Communication (3)

This course is designed to give students experience in accurately and effectively interpreting scientific literature, rigorously assessing popular media reporting on scientific topics, and factually and constructively communicating scientific topics to varying audiences, both in an academic/learning environment and to the broader public.

#### BY 5110 Introduction to Spatial Analysis (3)

An overview of geographic information systems and a foundation in map coordinate systems, map projections, and map scale. GIS 5510 is crosslisted with BY 5110, and only one course may be taken for credit.

# BY 5125 Physiological Adaptations (3)

Prerequisite(s): BY 5034 or its equivalent.

An in depth survey of selected topics in comparative physiology. Interactions between organisms and their environments will be examined with an emphasis on molecular and cellular adaptations. Phenotypic differences in adaptations will serve as a central theme for this course. The course is designed to expose students to the various topics through lecture, primary literature, and lab presentations/activities.

#### BY 5133 Advanced Plant Biology (3)

Study of plant biology consisting of lectures, discussions, investigative laboratory exercises on the topics of Plant Classification, Plant Anatomy and Reproduction, Plant Growth, and Development, the Physiology and Biochemistry of Plants, Plants Genetics and Molecular Biology, Plants Interactions with their Environments, and the Impacts of Plants to our Society.

#### BY 5134 Cultivating Cannabis: Science of Applied Horticulture (3)

An advanced course in biology that explores the application of botanical concepts to cannabis science. The course is a combination of lectures, laboratory exercises, and greenhouse activities. Some of the topics covered in the course include Naming and Classifying Horticultural Plants, Cannabis Plant Growth and Development, Plant Nutritional Requirements, Cannabis Cultivation in Various Growth Environments, and Micropropagation and Maintenance of Cannabis Plants.

#### BY 5135 Functional Vertebrate Anatomy (3)

Prerequisite(s): BY 320 or equivalent or permission of the instructor. Lecture and demonstration. This course will emphasize the adaptations of vertebrate animals as revealed by morphology and will study the anatomy of vertebrates, as it relates to topics such as locomotion, reproduction, digestion, and physiology. In addition, molecular and morphological phylogeny of vertebrate groups using datasets will be studied.

#### BY 5137 Botany for Teachers (3)

Lecture, discussion, laboratory, and on-campus field trips. The course will emphasize on botanical topics in the context they are supposed to be delivered to middle and high school students. These topics will include plant growth and development, plant cells and tissue structures and functions, plant morphology, plant reproduction, plants interactions with their environments, and how plants impact human lives.

#### BY 5138 Population and Community Ecology (3)

This course addresses theoretical and applied issues at both the population and community levels. Topics include population and community structure/stability, trophic relations, population interactions, population and community dynamics, landscape ecology, and others. Discussion of primary literature will be a large part of this course. Lecture and lab.

#### BY 5140 Invertebrate Relationships (3)

Prerequisite(s): Permission of the instructor.

An analysis of recently published research in the anatomy, morphology, phylogeny, and physiology of invertabrate animals. The major invertebrate phyla (including parasitic forms) will be emphasized; lecture, discussion, presentation, and lab exercises.

# BY 5142 Biodiversity: Kingdoms of Living Things (3)

Prerequisite(s): BY 332 or its equivalent.

Lectures and demonstrations. Biodiversity emphasizing systematic, phylogeny, structure, function, life cycles, ecology, and economics.

#### BY 5146 Molecular Genetics (3)

Prerequisite(s): BY 322 or its equivalent or permission of the instructor. A survey of molecular genetics focusing on the analysis of genomes, genes, and chromosomes. Discussion of modern genetic analysis techniques will be integrated into these topics. Biotechnology topics will include nucleic acid isolation methods, PCR, gene expression analysis, gene cloning, expression systems, proteomics, DNA sequencing, and molecular phylogenetic analysis.

#### BY 5162 Symbiotic Associations (3)

Prerequisite(s): BY 322, BY 332, BY 373 or equivalent and one 400 level organismal courses.

Analysis of the nature and mechanism of symbiotic associations, including commensalism, mutualism, parasitism, that involve interactions between organisms.

#### BY 5163 General Toxicology (4)

Prerequisite(s): BY 373 and CY 106.

The study of basic toxicology and ecotoxicology, including how toxic substances are taken up in the organisms, distributed, biotransformed and excreted, how toxic substances react with biomolecules and downstream consequences for the organism, as well as knowledge about toxic substances, e.g. pharmaceuticals, metals, organic contaminants, and pesticides. The course aims to provide a holistic view of the topic by bridging human toxicology and ecotoxicology; lecture, laboratory and field study.

#### BY 5701 Seminar in Cannabis Science and Medicine (2)

Prerequisite(s): BY 420 or BY 5020 or approval of instructor. Presentation, discussion, and analysis of recently published research cannabis science and medicine; independent library research required.

#### BY 5770 Seminar in Developmental Biology (2)

Prerequisite(s): Approval of the instructor.

Presentation, discussion, and analysis of recently published research in developmental biology of cells, tissues, and organ systems in plants, animals, or microbes; independent library research required.

# BY 5771 Seminar in Organismal Biology (2)

Prerequisite(s): Approval of instructor.

Presentation, discussion, and analysis of recently published research focusing on specific groups of organisms; independent library research required.

#### BY 5772 Seminar in Ecology (2)

Prerequisite(s): Approval of instructor.

Presentation, discussion, and analysis of recently published research in plant, animal, or microbial ecology; independent library research required.

#### BY 5773 Seminar in Cell Biology (2)

Prerequisite(s): Approval of instructor. Presentation, discussion, and analysis of recently published research in cellular biology; independent library research required.

#### BY 5774 Seminar in Evolutionary Biology (2)

Prerequisite(s): Approval of instructor.

Presentation, discussion, and analysis of recently published research in evolutionary biology; independent library research required.

#### BY 5775 Seminar in Genetics (2)

Prerequisite(s): Approval of instructor.

Presentation, discussion, and analysis of recently published research in plant, animal, or microbial genetics; independent library research required.

# BY 5776 Seminar in Physiology (2)

# Prerequisite(s): Approval of instructor.

Presentation, discussion, and analysis of recently published research in plant, animal, or microbial physiology; independent library research required.

# BY 5777 Seminar in Systematics (2)

Prerequisite(s): Approval of instructor. Presentation, discussion, and analysis of recently published research in systematic biology; independent library research required.

# BY 5827 Independent Studies in Biology (1)

Laboratory or field research investigation dealing with an aspect of biological sciences; biology sponsor required for topic approval and supervision. Grades: Pass/Fail.

# BY 5884 Biology Research Methods (1)

## Prerequisite(s): Approval of instructor.

Introduction to diverse research methods and literature in the biological sciences. Includes topics such as, but not limited to, techniques in environmental analysis, microscopy, protein and nucleic acid analysis, biometry and population dynamics, and physiology.

# BY 5885 Research Project (3)

Prerequisite(s): BY 5884, completion of at least 20 hours of graduate study in biology, and approval of instructor.

Completion of an acceptable original research paper; non-thesis option only. May be duplicated for credit for a total of 6 semester hours. Grades: Pass/Fail.

# BY 5888 Research (1-3)

Prerequisite: Approval of Application for Thesis Option, BY 5884 and approval of instructor. (1-3) (1-3). Master's thesis research. May be duplicated for credit for a total of 6 semester hours. Grades: Pass/Fail.

# BY 5893 Special Problems in Biology (2)

Special topics approved by instructor after consideration of students background. Grades: Pass/Fail.

# BY 5894 Problems in Biology (1)

Special topics approved by instructor after consideration of students background. Grades: Pass/Fail.

# BY 5950 Biology Graduate Internship (1-3)

Prerequisite: Permission of instructor, program director or Department Head required. Supervised practical work experience in an approved field with a business, non-profit organization, or governmental agency. The student will gain the exposure and competence necessary to develop knowledge and understanding in the practical application of relevant skills to problems in a non-classroom situation. Each 1 hour of credit requires 40 hours of internship work. A minimum of 40 internship hours should be completed by the end of the internship. A total of 120 internship hours minimum is required for 3 credits for the semester. This course may be duplicated for credit for a total of 9 graduate semester hours. Subject to availability. Additional on-site application may be required. Grades: Pass/Fail.

# BY 5990 Thesis (3)

Prerequisite(s): Dean's Approval and Approval of Application for Thesis Option.

See "Thesis Option and Procedures." May be duplicated for credit for a total of 6 semester hours. Grades: Pass/Fail.