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Plant Biology.....1

Plant Biology

Plant Biology is the study of all aspects of plants including their diversity, anatomy, physiology, biochemistry, genetics, evolution, conservation, and ecology. The need for botanical expertise is rapidly increasing in response to habitat loss, species extinctions, invasive species, and global climate change. Additionally, plants provide us with food, shelter, medicines, clothing, and many other products. Thus the demand for plant biologists will never diminish. A degree in Plant Biology will provide a strong foundation for a wide range of careers in plant biology, agriculture, conservation, environmental sciences, health-related fields, and other life science disciplines.

The Plant Biology program is one of only two such programs in Illinois. Our undergraduate curriculum has a number of features that ensure our graduates' success:

1. a flexible undergraduate curriculum that includes both B.A. and B.S. degrees;
2. practical experience and training in modern skills and research techniques;
3. a high degree of personalized faculty mentoring;
4. an atmosphere where undergraduate, graduate students, and faculty interact; and
5. ample opportunities for undergraduates to participate in outreach and service.

Bachelor of Arts (B.A.) in Plant Biology Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements ¹	39
Plant Biology Major Requirements	55-57
BIOL 307	3
PLB 200, PLB 300, PLB 301I, PLB 320, PLB 360, PLB 408, PLB 480 (Three hours included in the UCC Life Science hours)	23
CHEM 200, CHEM 201, CHEM 202 (Three hours included in the UCC Physical Science hours)	2
One additional semester of physical science with laboratory at the 200-level or above from CHEM, GEOG, or PHYS	3-5
Disciplinary Electives chosen in consultation with the student's undergraduate faculty advisor	24
Options available are: General Plant Biology (default if Conservation Biology option is not chosen)	

Degree Requirements	Credit Hours
Conservation Biology	
PLB 451	3
PLB 493A, B, or C for at least 1 credit	1
ZOOL 410	3
At least 13 hours chosen from PLB 444; FOR 202, FOR 341, FOR 351, FOR 413, FOR 415, FOR 423, FOR 451; GEOG 401, GEOG 412, GEOG 428, GEOG 471; ZOOL 444	13
Additional PLB Electives	4
Additional School of Biological Sciences Academic Requirements	7-9
Mathematics - MATH 106 or MATH 108 and MATH 109; or MATH 111 (3 hours included in the UCC Mathematics hours)	1-3
Supportive Skills - CS 200B or CS 201 or CS 202; ENGL 290 or ENGL 291; MATH 282; or any two-semester foreign language sequence	6
Free Electives	15-20
Total	120

¹ The 39-hour requirement may be met in part by taking College of Agricultural, Life, and Physical Sciences or major requirements that are approved advanced University Core Curriculum courses.

Bachelor of Science (B.S) in Plant Biology Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements ¹	39
School of Biological Sciences	7-9
Biological Sciences - completed with major	
Mathematics - MATH 106 or MATH 108 and MATH 109; or MATH 111 (3 hours included in the UCC Mathematics hours)	1-3
Physical Sciences - completed with major	
Supportive Skills - CS 200B or CS 201 or CS 202	

Degree Requirements	Credit Hours
ENGL 290 or ENGL 291; MATH 282; or any two-semester sequence of a foreign language.	6
Plant Biology Major Requirements	61-63
BIOL 211, BIOL 212, BIOL 213	
(3 hours included in the UCC Life Science hours)	9
BIOL 304, BIOL 305, BIOL 306, BIOL 307 (three of the four)	9
PLB 300, PLB 320, PLB 360, PLB 408, PLB 480	19
CHEM 200, CHEM 201, CHEM 202 (Three hours included in the UCC Physical Science hours)	2
Three additional semesters of laboratory at the 200-level or above from Chemistry and/or Physics	12-15
MATH 141	4
Disciplinary Electives chosen in consultation with the student's undergraduate faculty advisor	16
Options available are:	
General Plant Biology	
16 credit hours and at least one course from each of the specializations listed below:	
Ecology Specialization	
BIOL 304 and BIOL 307 are required from the list above.	
At least 12 credit hours chosen from: PLB 416, PLB 435, PLB 444, PLB 451, PLB 452, PLB 490	12
Additional PLB electives.	4
Molecular and Biochemical Physiology	
BIOL 305 and BIOL 306 are required from the list above.	
PLB 419	3

Degree Requirements	Credit Hours
At least 9 credit hours chosen from PLB 400, PLB 425, PLB 427, PLB 438, PLB 471, PLB 475, PLB 476	9
Systematics and Biodiversity Specialization	
BIOL 304 and BIOL 307 are required from the list above.	
At least 12 credit hours chosen from PLB 400, PLB 401, PLB 435, PLB 438, PLB 451, ZOO 405	12
Free Electives	10-14
Total	121

¹ The 39-hour requirement may be met in part by taking College of Agricultural, Life, and Physical Sciences or major requirements that are approved advanced University Core Curriculum courses.

Plant Biology Minor

A general minor in plant biology consists of a minimum of 16 semester hours, selected from any plant biology offerings except PLB 115, PLB 117, PLB 360, PLB 390, PLB 490, or PLB 492.

Plant Biology Tracked Minors

1. *Plant Biology, with emphasis in Plant Biodiversity*: Consists of 16 credit hours as outlined above, with at least two courses chosen from the following: PLB 300, PLB 401, PLB 408, PLB 451.
2. *Plant Biology, with emphasis in Plant Ecology*: Consists of BIOL 307, either PLB 300 or PLB 408, and 9 credit hours chosen from: PLB 301I, PLB 416, PLB 435, PLB 440, PLB 444, PLB 451, or PLB 490.
3. *Plant Biology, with emphasis in Plant Biotechnology*: Consists of 16 credit hours chosen from: BIOL 305, BIOL 306, PLB 217, PLB 320, PLB 330, PLB 419, PLB 425, PLB 427, PLB 433, or PLB 471.

Technology Fee

The College of Agricultural, Life, and Physical Sciences assesses undergraduate majors a technology fee of \$4.58 per credit hour up to 12 credit hours. The fee is charged Fall and Spring semester.

Plant Biology Courses

PLB115 - General Biology (University Core Curriculum) (Same as ZOO 115) [IAI Course: L1 900L]
Introduction to fundamental biological concepts for non-life science majors interested in learning about interrelationships of human, plant and animal communities. Integrated lecture and laboratory cover topics that include structure and function of living systems, reproduction and inheritance, evolution, biological diversity and environmental biology. Laboratory applies scientific methods to the study of living systems. Lab fee: \$15. Credit Hours: 3

PLB117 - Plants and Society (University Core Curriculum) [IAI Course: L1 901L] A multidisciplinary approach to understanding the relationships between plants and humans: basic botanical principles (cell structure, morphology, anatomy, physiology, genetics, systematics, diversity and ecology); historical and modern uses of plant (fibers, building materials, crops, beverages, medicines), poisonous plants, an Observational and experimental labs reinforce lecture topics. Lab fee: \$15. Credit Hours: 3

PLB200 - General Plant Biology (University Core Curriculum course) An introduction to Plant Biology. Emphasis is placed on structure and reproduction, embryo development, and vital developmental processes needed for plant survival, such as photosynthesis, respiration, water transport and nutrient assimilation. Other topics include cell division, basic Mendelian genetics, DNA, RNA, protein synthesis, taxonomy, evolution, ecology, and conservation. The course also includes a brief overview of medicinal plants and their biologically active compounds. Satisfies University Core Curriculum Science Group II requirement in lieu of PLB 115 or ZOOL 115. Lab fee: \$15. Credit Hours: 4

PLB217 - Cannabis Biology, Industry, and Medicine A survey of scientifically, historically, and empirically verifiable information on cannabis, with emphasis on its biological features, chemical constituents, and biochemical effects. Students will learn the different kinds and uses of cannabis, a variety of industrial and medicinal products derived from the plant, the bioactive constituents and their effects of human health. The course will cover cannabis history, foliage and shoot architecture, sex determination, growth and development, ecological interactions, production and processing, endocannabinoids, and sustainability. Credit Hours: 3

PLB300 - Diversity of Plants, Algae, and Fungi This course surveys the history and diversity of algae, land plants, and fungi-branches of the tree of life that are of immense importance both to the ecosystem and to human interests. Emphasis is on evolution, ecology, symbiotic relationships, life cycles, and adaptive morphology. Three lectures and one 2-hour laboratory per week. Prerequisite: either BIOL 213 or PLB 200 with a grade of C- or better. Lab fee: \$50. Credit Hours: 4

PLB301I - Environmental Issues (University Core Curriculum) Fundamental biological and ecological processes important in the individual, population and community life of organisms integrating with the philosophical and ethical relationships of the contemporary, domestically diverse human society are examined. Emphasis is placed on a pragmatic understanding of environmental issues. Lab fee: \$15. Credit Hours: 3

PLB317 - Introduction to Medical Botany A survey of plants affecting human health and how they are used historically and in modern times, with emphasis on the biologically active constituents. Laboratory experiments will introduce students to techniques in production, isolation, chemical analysis and biological testing of medical compounds from plants. Two lectures and 4 hours of laboratory per week. Prerequisites: BIOL 211, BIOL 212, and BIOL 213, CHEM 140A or CHEM 200 and CHEM 201. Lab fee: \$25. Credit Hours: 4

PLB320 - Elements of Plant Physiology The processes used by plants to meet their basic needs and to control growth and development. Three lectures and two laboratory hours per week. Prerequisite: BIOL 211 and BIOL 213 or PLB 200; CHEM 200 and CHEM 201 with grades of C- or better. Lab fee: \$50. Credit Hours: 4

PLB330 - Forensic Botany Exploration of the use of botanical evidence in forensic investigations. Students will learn how botanical evidence is identified, collected, and analyzed in criminal cases. How 'real' are Hollywood forensics cases that use plants? Students will read critique legal case studies and the current scientific literature. There will be a field trip to the State Crime Lab. Prerequisite: At least one of the following life science courses with lab: BIOL 211, BIOL 212, BIOL 213, PLB 200, PLB 117, PLB 115, or ZOOL 115. Field trip fee: \$15. Credit Hours: 3

PLB351 - Ecological Methods (Same as ZOOL 351) Basic ecological field techniques for analysis of community structure and functional relationships. Two 4-hour laboratories per week. Prerequisite: BIOL 307. Laboratory/field trip fee: \$25. Credit Hours: 3

PLB360 - Introductory Biostatistics (Same as ZOOL 360) Introduction to basic statistical concepts and methods as applied to biological data. Includes descriptive techniques such as measures of central tendency, variability, hypothesis testing, analysis of variance and simple linear regression and correlation.

Analysis of computer generated output and report writing required. This course does not fulfill the College of Science Biological Sciences requirement. Prerequisite: MATH 108. Credit Hours: 3

PLB390 - Readings in Plant Biology Individually assigned readings in botanical literature. Every semester. Special approval needed from the departmental chair. Credit Hours: 1-3

PLB400 - Plant Morphology and Anatomy This course is an introduction to the differentiation, diversification and structure of plant tissues, organs and external forms, with emphasis on seed plants. Laboratory will include instruction in basic techniques of microscopy used in the study of plant structure. Two lectures and two laboratories per week. Prerequisite: BIOL 213 or PLB 200 with grades of C- or better. Lab fee: \$50. Credit Hours: 4

PLB401 - Curation of Collections This course will be an introduction to the curation of biological collections and strongly involve experiential learning through participatory activities with collections. This will involve an overview of museums, collection procedures, and the long-term features of high quality curation of specimens and will examine how a broad range of organisms is curated. Lab/Field trip fee: \$50. Credit Hours: 2

PLB408 - Plant Systematics and Identification This course covers the principles of plant classification including history, nomenclature, specimen collection and preservation, current systematic methodologies, and a survey of major plant families. Two lectures and four hours of lab per week. Prerequisites: BIOL 213 or PLB 200 with grades of C- or better. Lab fee: \$50. Credit Hours: 4

PLB416 - Limnology (Same as ZOO 415) Lakes and inland waters; the organisms living in them, and the factors affecting these organisms. Two lectures and one 4-hour laboratory alternate weeks. Prerequisite: BIOL 307 with a grade of C- or better. Laboratory/Field Trip fee: \$15. Credit Hours: 3

PLB419 - Plant Molecular Biology (Same as PSAS 419, CSEM 419) A survey of molecular phenomena unique to plant systems. Topics will include: genome organization and synteny between plant genomes, transcriptional and post-transcriptional control of gene expression, signal transduction, epigenetics, plant-pathogen interactions and responses to biotic- and abiotic-stresses. Prerequisite: BIOL 305 or CSEM 305. Restricted to junior standing. Credit Hours: 3

PLB425 - Advanced Plant Physiology and Ecophysiology Advanced topics in plant physiology. Abiotic factors such as light, water, temperature, and nutrients, as well as emerging man-made pollutants such as nanoparticle contamination. Biotic factors such as plant-microbe signaling and the rhizosphere microbiome, plant-plant signaling, and competition for resources. These topics are covered at molecular and organismal levels, as well as the physiological ecology of these processes on a larger scale. This course offers a perspective of how these processes work in nature, as well as how they are or might be manipulated for crop or agriculture practice improvement. Undergraduate Prerequisite: PLB 320 or PSAS 409. Lab fee: \$35. Credit Hours: 5

PLB427 - Plant Biochemistry (Same as CSEM 427 and PSAS 427) Exploration of fundamental biochemical pathways in plants with an emphasis upon carbon and nitrogen metabolism. Prerequisite: PLB 320 or consent of instructor. Lab fee: \$35. Credit Hours: 5

PLB433 - Introduction to Agricultural Biotechnology (Same as AGSE 433, ANS 433, CSEM 433, HORT 433, PSAS 433) This course will cover the basic principles of plant and animal biotechnology using current examples; gene mapping in breeding, transgenic approaches to improve crop plants and transgenic approaches to improve animals will be considered. Technology transfer from laboratory to marketplace will be considered. An understanding of gene mapping, cloning, transfer, and expression will be derived. Credit Hours: 3-7

PLB435 - Pollination Ecology (Same as ZOO 435) This course will be an evolutionary and ecological examination of the interactions between plants and pollinators. Topics include pollination syndromes, plant breeding systems, pollinator foraging, learning, and behavior, specialized vs. generalized relationships, coevolution/cospeciation, chemical ecology, honey beekeeping & agricultural pollination, and conservation implications of pollinator relationships. Labs will provide hands-on experience in methods of investigating plant breeding systems, plant reproductive ecology, pollinator behavior and efficacy, pollen analysis, floral scent chemistry, and floral phenology. Prerequisite: BIOL 307 (General

Ecology) with a grade of C- or better or equivalent. For graduate students and senior undergraduates. Lab fee: \$75. Credit Hours: 3

PLB438 - Plant and Animal Molecular Genetics Laboratory (Same as AGSE 438, CSEM 438, PSAS 438, ZOOL 438) Arabidopsis and Drosophila model organisms, lab-based training in laboratory safety, reagent preparation, phenotype analysis, genetics, DNA and RNA analysis, PCR, cDNA construction, cloning and sequencing of genes. Includes plant and bacterial transformation, and a population level analysis of genetic variation using RAPD markers in grasses and Alu insertion in humans. Two 2-hr labs and one 1-hr lecture per week. Prerequisite: BIOL 305 or equivalent or consent of instructor. Lab fee: \$30. Credit Hours: 3

PLB440 - Grassland Ecology This course examines grassland structure and function in relation to various biotic and abiotic factors. Field trips will visit local grasslands. Two lectures and one 4-hour lab per week. Prerequisite: BIOL 307 or consent of instructor. Lab fee: \$50. Credit Hours: 3

PLB444 - Ecological Analysis of Communities (Same as ZOOL 444) Includes concepts and methods pertaining to the analysis of ecological data. Approaches will include a variety of methods for analyzing multivariate ecology, diversity, pattern, and spatial data. Laboratory will include the computer application of these concepts and methods to field situations. Two lectures and one 4 hour lab per week. Prerequisite: PLB/ZOOL 360, BIOL 307. Lab fee: \$15. Credit Hours: 4

PLB451 - Flora of Southern Illinois Exposure to the major upland and lowland communities of southern Illinois with an emphasis on the identification, distribution and ecology of the natural and introduced floristic components. This is a field-based course wherein the students travel to local areas for plant identification. Each week, 4-8 hours per weekly session is spent in field work and travel to specific field sites is required via a university vehicle. Prerequisite: PLB 408 with a grade of C- or better or consent of instructor. Field Trip fee not to exceed \$160. Credit Hours: 3

PLB452 - Plant Population Ecology This course covers principles and research techniques of plant population ecology including the spatial, age, size and genetic structures of plant populations. The origin of these different aspects of population structure, their influences upon each other and their temporal dynamics are also examined. Two lectures and one 4-hour lab per week. Prerequisite: BIOL 307 or consent of instructor. Lab fee: \$35. Credit Hours: 4

PLB471 - Introduction to Systems Biology (Same as ZOOL 472) The bioinformatic analysis of large genomic and post-genomic data sets. Integration of gene regulation, protein interaction, metabolite and hormonal signaling provides an understanding of basic cellular circuitry networks. Examine redundancy, robustness and decision making in biological systems. Lab includes databases, tools, and manipulation of large data sets. Prerequisite: BIOL 305 or CS 330. Lab fee: \$15. Credit Hours: 3

PLB475 - Advanced Cell Biology Cell structure at molecular and cytological levels. Includes discussions of research methods, plasma membrane, cell exterior and recognition, the endomembrane system and related organelles, self-replicating organelles, the cytoskeleton, nuclear structure and function in cell replication, cell differentiation and response, and eukaryotic cell evolution. Prerequisite: BIOL 306 or equivalent. Credit Hours: 3

PLB476 - Advanced Cell Biology Laboratory Laboratory course to accompany Plant Biology 475. Light and electron microscopy, cell culturing, biochemical methods, and experimental protocols are used to study the structure of cell membranes, intracellular organelles, including the Golgi apparatus, ER, mitochondria, plastids, lysosomes, the cytoskeleton, and nucleus. Prerequisite: PLB 475 or concurrent enrollment. Credit Hours: 2

PLB480 - Senior Seminar Reading, writings, discussions and presentations of current research topics in plant biology. Not for graduate credit. Restricted to senior standing or consent of instructor. Credit Hours: 1

PLB490 - Energetics, Food Webs, and Ecosystems (Same as ZOOL 490) This course places conservation of particular species into the context of community and ecosystem management. Approaches to quantifying energy needs of individual species will be extended to models of trophic networks among multiple species. Food web structure and function, species interactions, and resilience

to species loss species invasions, and environmental changes will be examined in light of landscape processes. Prerequisite: BIOL 307 or consent of instructor. Credit Hours: 3

PLB492 - Honors in Plant Biology Individual research problems available to qualified juniors and seniors. Special approval needed from the department chair. Credit Hours: 2-6

PLB493A - Research Topics in Plant Biology-Ecology Individual laboratory or field research under supervised direction. Does not count for thesis (PLB 599) or dissertation (PLB 600) credit. Special approval needed from the departmental chair. Credit Hours: 1-4

PLB493B - Research Topics in Plant Biology-Systematics Individual laboratory or field research under supervised direction. Does not count for thesis (PLB 599) or dissertation (PLB 600) credit. Special approval needed from the departmental chair. Credit Hours: 1-4

PLB493C - Research Topics in Plant Biology-Physiology/Molecular Biology Individual laboratory or field research under supervised direction. Does not count for thesis (PLB 599) or dissertation (PLB 600) credit. Special approval needed from the departmental chair. Credit Hours: 1-4

Plant Biology Faculty

Anterola, Aldwin M., Associate Professor, Ph.D., Washington State University, 2001; 2005. Metabolic pathways, medicinal compounds, nutraceuticals, biosynthesis of natural products.

Da Cunha Leme Filho, Jose F., Assistant Professor, Ph.D., Virginia Polytechnic Institute and State University, 2020. Controlled environment agriculture, vertical farm, cannabis biology, plant physiology, secondary metabolites, plant biostimulants.

Gage, Karla L., Associate Professor, Ph.D., Southern Illinois University Carbondale, 2013; 2015. Weed science, weed ecology, agroecology, integrated pest management, herbicide resistance, invasive species.

Geisler, J.B. Matthew, Associate Professor, Ph.D., The Ohio State University, 1999; 2006. Gene expression and protein interaction patterns, mathematical gene modeling, arabidopsis, yeast and drosophila interactomes.

Jayakody, Lahiru N., Assistant Professor, Ph.D., Kagoshima University, 2014; 2019. Biotechnology, molecular biology, metabolic engineering, synthetic microbiology, systems biology.

Neubig, Kurt M., Associate Professor, Ph.D., University of Florida, 2012; 2015. Plant systematics, phylogenetics, floristics, DNA barcoding and pollination biology.

Sipes, Sedonia D., Associate Professor, Ph.D., Utah State University, 2001; 2001. Plant-insect interactions, evolutionary ecology, chemical ecology, and systematics.

Weber, Jennifer., Assistant Professor, Ph.D., University of CA, Irvine, 2012; 2020. Evolutionary ecology, including breeding system evolution, pollination biology, population genetics and climate change biology.

Wood, Andrew J., Professor, Ph.D., Purdue University, 1994; 1996. Biotechnology, biochemistry, desiccation, drought, genetics, horticulture, plant physiology, stress.

Emeriti Faculty

Bozzola, John J., Professor, Emeritus, Ph.D., Southern Illinois University, 1975.

Crandall-Stotler, Barbara C., Professor, Emerita, Ph.D., University of Cincinnati, 1968.

Gibson, David J., Distinguished Professor, Emeritus, Ph.D., University of Wales, 1985; 1992.

Matten, Lawrence C., Professor, Emeritus, Ph.D., Cornell University, 1965

Mohlenbrock, Robert H., Distinguished Professor, Emeritus, Ph.D., Washington University, 1957.

Nickrent, Daniel L., Distinguished Research Professor, Emeritus, Ph.D., Miami University, Ohio, 1984.

Renzaglia, Karen S., Distinguished Research Professor, Emerita, Ph.D., SIUC, 1981.

Richardson, John A., Associate Professor, Emeritus, M.F.A., Ohio University, 1969.

Robertson, Philip A., Professor, Emeritus, Ph.D., Colorado State University, 1968.

Tindall, Donald R., Professor, Emeritus, Ph.D., University of Louisville, 1966.

Vitt, Dale H., Distinguished Professor, Emeritus, Ph.D., University of Michigan, 1970.

Yopp, John H., Professor, Emeritus, Ph.D., University of Louisville, 1969.

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