PLANT BIOLOGY, ECOLOGY, AND EVOLUTION

The field of plant biology ranges from molecules to ecosystems. The importance of plants to the ecosystem and to humanity cannot be underestimated. They regulate global processes and form complex relationships with other organisms, and have intriguing patterns of development and diversity. Plants provide medicinal compounds, shelter, fuel, food and oxygen, and support the existence of life on Earth. As human population size increases, the need for more and better supplies of food, fiber and biofuels also increases. The study of plant biology underlies the applied sciences such as agronomy, forestry, natural resource management, horticulture and plant pathology.

To major in plant biology a student should have a strong interest in life sciences with a good background in chemistry and mathematics. Majors with a BS degree may choose to specialize by taking Degree Options in Ecology and Evolutionary Biology, Cell Biology and Molecular Genetics, Pre-Pharmacy, and Pre-Law and Environmental Policy, and Pre-Forensics. Graduates with the first option are qualified to hold positions in federal and state agencies in areas such as conservation biology, habitat restoration, environmental biology and plant inspection, with the second option are qualified for various research positions in private industry, such as plant biotechnology and drug development, with the third option with all the courses required for Pharmacy School, with the fourth option with the required courses for Law School, and with the fifth option for further study and employment in the field of biological forensics. All majors are required to do at least one credit hour of research and faculty actively encourage undergraduate research in their labs. Several of the undergraduate courses, including Introduction to Plant Biology (PBIO 1404) have extensive in-class student-led research projects and presentation opportunities.

Facilities used in undergraduate teaching include well-equipped plant physiology and ecology laboratories, environmental chambers, the 160-acre McPherson Preserve and a herbarium with over 150,000 plant specimens. Faculty members teach and do research in their specialty areas of plant biology including ecology, population biology, biodiversity, climate change, evolution, physiology, biochemistry, biophysics, taxonomy and systematics, genetics and development, genomics, and cell and molecular biology.

Courses

PBIO 1052 How Plants Shaped Our World (LN)
Description: This course is an eclectic dive into the world of plants and their influence on human society. Students will experience the importance of plants in almost all societies in human history. From drugs to food to shelter to transport to birth, marriage and death, the role and importance of plants will be stressed and revealed.
Credit hours: 2
Contact hours: Lecture: 1 Lab: 2 Contact: 3
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution
General Education and other Course Attributes: Scientific Investigation, Natural Sciences

PBIO 1404 Plant Biology (LN)
Description: Basic concepts in the biology of plants from the perspective of structure and function, ecology and evolution, and diversity. Students gain experience with the process of science by proposing hypotheses, designing and conducting experiments and interpreting data. Previously offered as BOT 1404, BIOL 1404, BIOL 1403, and BISC 1403.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution
General Education and other Course Attributes: Scientific Investigation, Natural Sciences

PBIO 2890 Honors Experience in Plant Biology
Prerequisites: Honors Program participation and concurrent enrollment in a designated BIOL or PBIO course.
Description: A supplemental Honors experience in Plant Biology to partner concurrently with designated upper-division BIOL or PBIO course(s). The course adds a different intellectual dimension to the designated course. Same course as PBIO 3890.
Credit hours: 1
Contact hours: Lecture: 1 Contact: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Plant Biology Ecol & Evolution
General Education and other Course Attributes: Honors Credit

PBIO 3024 Plant Diversity
Prerequisites: BOT 1404 or equivalent.
Description: Forms and life histories of selected plants with emphasis on some of the less familiar forms. The diversity of plant forms as well as basic similarities in life histories; importance of each form to humans and their environment. Previously offered as BOT 3024.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 3 Contact: 6
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution

PBIO 3114 Plant Taxonomy
Prerequisites: PBIO 1404 or equivalent.
Description: Survey of vascular plant families in a phylogenetic framework, and the morphological characters that define them. Principles and practice of plant classification theory and methods. Lab focuses on the identification of species that comprise the Oklahoma flora. Previously offered as BOT 3114.
Credit hours: 4
Contact hours: Lecture: 2 Lab: 4 Contact: 6
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution
PBIO 3253 Environment and Society (N)
Prerequisites: At least one college level science course strongly recommended.
Description: The environmental impacts of human activities and population growth on the natural world, and possible solutions. Previously offered as BOT 3253.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Plant Biology Ecol & Evolution
General Education and other Course Attributes: Natural Sciences

PBIO 3263 Plants and People (N)
Description: Study of how plant use has changed the course of world history. This includes the uses of plants and plant products for food and beverages, shelter, fiber, and medicinal and pharmaceutical purposes. Previously offered as BOT 3263.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Plant Biology Ecol & Evolution
General Education and other Course Attributes: Natural Sciences

PBIO 3273 Medical Botany (N)
Description: Study of plants as a source of medicines, psychoactive compounds and poisons. These topics will be explored in the context of modern western medicine as well as traditional health systems and complementary alternative medicine. Previously offered as BOT 3273.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Plant Biology Ecol & Evolution
General Education and other Course Attributes: Natural Sciences

PBIO 3553 Fungi: Myths and More
Prerequisites: BIOL 1114 or equivalent.
Description: This course explores fungal biology and its roles in the environment and impacts on the health and nutrition of plants, animals and humans. Topics include the ethnomycological and industrial uses of fungi in foods, fermentations, medicines, and intoxicants, and the colorful folklore and myths associated with these diverse, enigmatic organisms. Laboratory instruction includes microscopy, microbiological methods, mushroom cultivation, and identification of microfungi and wild mushrooms. Same course as PLP 3553. Previously offered as BOT 3553.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution

PBIO 3890 Advanced Honors Experience in Plant Biology
Prerequisites: Honors Program participation and concurrent enrollment in a designated BIOL or PBIO course.
Description: A supplemental Honors experience in Plant Biology to partner concurrently with designated upper-division BIOL or PBIO course(s). The course adds a different intellectual dimension to the designated course. Same course as PBIO 2890.
Credit hours: 1
Contact hours: Lecture: 1 Contact: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Plant Biology Ecol & Evolution
General Education and other Course Attributes: Honors Credit

PBIO 4005 Field Botany
Prerequisites: PBIO 1404 or equivalent.
Description: Botanical field techniques, the vegetation of North America, and the flora of Oklahoma. Terminology of description, use of taxonomic keys, techniques of specimen preservation, field recognition of plant taxa and communities and controlling ecological factors, economic and wildlife significance of dominant taxa, principles of classification and nomenclature. Three weekend field trips required. May not be used for degree credit with PBIO 5003. Previously offered as BOT 3005.
Credit hours: 5
Contact hours: Lecture: 3 Lab: 4 Contact: 7
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution

PBIO 4013 Biological Microtechnique
Prerequisites: PBIO 1404 or BIOL 1604.
Description: Theories, principles, and methods related to the usage of the light microscope and to the preparation of biological materials for light microscopic examination. May not be used for degree credit with PBIO 5013. Previously offered as BOT 3013.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 3 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution

PBIO 4233 Plant Anatomy
Prerequisites: BOT 1404 or equivalent.
Description: Structures of cells, tissues and organs of plants and the developmental, phylogenetic, and functional contexts of the structures. May not be used for degree credit with PBIO 5233. Previously offered as BOT 3233.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution

PBIO 4400 Undergraduate Research
Prerequisites: Consent of instructor.
Description: Undergraduate research problems in plant biology. Previously offered as BOT 4400. Offered for variable credit, 1-3 credit hours, maximum of 9 credit hours.
Credit hours: 1-3
Contact hours: Contact: 1-3 Other: 1-3
Levels: Undergraduate
Schedule types: Discussion
Department/School: Plant Biology Ecol & Evolution
PBIO 4423 Plant Mineral Nutrition
Prerequisites: PBIO 4463 or concurrent enrollment.
Description: Uptake, translocation, metabolism, and biochemical function of mineral nutrients in higher plants. May not be used for degree credit with PBIO 5423. Previously offered as BOT 4423.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Plant Biology Ecol & Evolution

PBIO 4462 Plant Physiology Laboratory
Prerequisites: PBIO 4463 or PBIO 5463 or concurrent enrollment.
Description: Skills in techniques for working with plants, experiments involving nutrition, respiration, photosynthesis, water relations, translocation, hormones, growth and development. Previously offered as BOT 3460 and BOT 3462.
Credit hours: 2
Contact hours: Lab: 4 Contact: 4
Levels: Undergraduate
Schedule types: Lab
Department/School: Plant Biology Ecol & Evolution

PBIO 4463 Plant Physiology
Prerequisites: BOT 1404 or equivalent.
Description: Plant subcellular structure, water relations, water absorption and ascent of sap, translocation, gaseous exchange, nutrition, enzymes, respiration, photosynthesis, growth, development, reproduction, tropisms, hormones, dormancy and seed germination. May not be used for degree credit with PBIO 5463. Previously offered as BOT 3463.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Plant Biology Ecol & Evolution

PBIO 4524 Biological Laboratory Instrumentation
Prerequisites: CHEM 1515 or equivalent and (BOT 1404 or MICR 2123 or BIOL 1604 or equivalents or consent of instructor).
Description: Lecture and laboratory course in biological instrumentation use, theory, experimental design, maintenance, and troubleshooting. Topics include liquid handling systems, pH/ISE meters, electrophoresis, microcontrollers, spectrophotometers, centrifuges, chromatography, thermacyclers, and DNA sequencers. Same course as BIOL 4524, MICR 4524.
Credit hours: 4
Contact hours: Lecture: 2 Lab: 4 Contact: 6
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution

PBIO 4553 Molecular Phylogenetic Analysis
Prerequisites: Undergraduate genetics strongly recommended.
Description: Covers the use of molecular sequence data to construct evolutionary trees. It integrates theory and computer applications to answer questions involving species relationships, gene evolution, molecular evolution and morphological change, co-evolution, and biogeographic relationships. May not be used for degree credit with PBIO 5553.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution

PBIO 4800 Senior Honors Thesis
Prerequisites: Departmental invitation, senior standing, Honors Program participation.
Description: A research project under the direction of a faculty member resulting in a written report to be judged by a second faculty member as well. An oral presentation made at a departmental seminar. Required for graduation with departmental honors in plant biology. Previously offered as BOT 4993.
Credit hours: 1-3
Contact hours: Contact: 1-3 Other: 1-3
Levels: Undergraduate
Schedule types: Discussion
Department/School: Plant Biology Ecol & Evolution
General Education and other Course Attributes: Honors Credit

PBIO 4910 Internship in Plant Biology
Prerequisites: Specified hours of documented plant biology work experience.
Description: Supervised experience in an approved work situation related to future career in the plant biology field.
Credit hours: 1-3
Contact hours: Contact: 1-3 Other: 1-3
Levels: Undergraduate
Schedule types: Discussion
Department/School: Plant Biology Ecol & Evolution

PBIO 4990 Independent Study in Plant Biology
Prerequisites: Consent of instructor.
Description: Independent study under the supervision of a faculty member. This will include readings and discussion on a selected topic agreed upon between the student and instructor. Previously offered as BOT 4990.
Credit hours: 1-3
Contact hours: Contact: 1-3 Other: 1-3
Levels: Undergraduate
Schedule types: Discussion
Department/School: Plant Biology Ecol & Evolution

PBIO 5000 Master’s Thesis
Description: Thesis work for the MS degree. Previously offered as BOT 5000. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Discussion
Department/School: Plant Biology Ecol & Evolution

PBIO 5003 Field Botany
Prerequisites: PBIO 1404 or equivalent.
Description: Botanical field techniques, the vegetation of North America, and the flora of Oklahoma. Terminology of description, use of taxonomic keys, techniques of specimen preservation, field recognition of plant taxa and communities and controlling ecological factors, economic and wildlife significance of dominant taxa, principles of classification and nomenclature. Three weekend field trips required. May not be used for degree credit with PBIO 4005.
Credit hours: 3
Contact hours: Lecture: 1 Lab: 4 Contact: 5
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution
PBIO 5013 Biological Microtechnique
Prerequisites: PBIO 1404 or BIOL 1604.
Description: Theories, principles, and methods related to the usage of the light microscope and to the preparation of biological materials for light microscopic examination. May not be used for degree credit with PBIO 4013.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution

PBIO 5104 Mycology
Prerequisites: Graduate standing.
Description: A systematic study of the fungi, with emphasis on taxonomy, comparative morphology, and fungal biology. Same course as PLP 5104. Previously offered as BOT 5104.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution

PBIO 5110 Special Topics in Plant Biology
Prerequisites: Consent of instructor.
Description: Special studies in any area of plant biology. Previously offered as BOT 5110. Offered for variable credit, 1-5 credit hours, maximum of 24 credit hours.
Credit hours: 1-5
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Discussion
Department/School: Plant Biology Ecol & Evolution

PBIO 5210 Research in Plant Biology
Prerequisites: Consent of instructor.
Description: Independent research in any area of plant biology. Previously offered as BOT 5210. Offered for variable credit, 1-6 credit hours, maximum of 12 credit hours.
Credit hours: 1-6
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Discussion
Department/School: Plant Biology Ecol & Evolution

PBIO 5233 Plant Anatomy
Prerequisites: PBIO 1404.
Description: Structures of cells, tissues and organs of plants and the developmental, phylogenetic, and functional contexts of the structures. May not be used for degree credit with PBIO 4233.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution

PBIO 5423 Plant Mineral Nutrition
Prerequisites: BOT 4463 or concurrent enrollment.
Description: Uptake, translocation, metabolism, and biochemical function of mineral nutrients in higher plants. May not be used for degree credit with PBIO 4423. Previously offered as BOT 5423.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Plant Biology Ecol & Evolution

PBIO 5463 Plant Physiology
Prerequisites: PBIO 1404 or equivalent.
Description: Plant subcellular structure, water relations, water absorption and ascent of sap, translocation, gaseous exchange, nutrition, enzymes, respiration, photosynthesis, growth, development, reproduction, tropisms, hormones, dormancy and seed germination. Previously offered as BOT 3463. May not be used for degree credit with PBIO 4463.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Plant Biology Ecol & Evolution

PBIO 5541 Phylogenomics
Description: Current topics in the theory and application of genome and transcriptome sequencing to phylogenetics, prediction of gene function, and evolution of genes. Previously offered as BOT 5541.
Credit hours: 1
Contact hours: Contact: 1 Other: 1
Levels: Graduate
Schedule types: Discussion
Department/School: Plant Biology Ecol & Evolution

PBIO 5553 Molecular Phylogenetic Analysis
Prerequisites: Undergraduate genetics strongly recommended.
Description: Covers the use of molecular sequence data to construct evolutionary trees. It integrates theory and computer applications to answer questions involving species relationships, gene evolution, molecular evolution and morphological change, co-evolution, and biogeographic relationships. May not be used for degree credit with PBIO 4553. Previously offered as BOT 5553.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Plant Biology Ecol & Evolution
PBIO 5563 Plant Ecological Genetics  
**Prerequisites:** Two of the following courses or their equivalent: BIOL 3023, BIOL 3034, and BIOL 4133.  
**Description:** Basic concepts in plant population and quantitative genetics, focusing on techniques that reveal the genetic structure and the adaptive value of ecologically relevant traits. Previously offered as BOT 5563.  
**Credit hours:** 3  
**Contact hours:** Lecture: 3 Contact: 3  
**Levels:** Graduate  
**Schedule types:** Lecture  
**Department/School:** Plant Biology Ecol & Evolution

PBIO 5813 Plant Developmental Genetics  
**Prerequisites:** BIOL 3023 or equivalent.  
**Description:** Discussion of the genetic and molecular factors that regulate reproductive and vegetative development in flowering plants. Emphasis on recent publications that deal with model genetic systems and plants of economic significance. Previously offered as BOT 5813.  
**Credit hours:** 3  
**Contact hours:** Lecture: 3 Contact: 3  
**Levels:** Graduate  
**Schedule types:** Lecture  
**Department/School:** Plant Biology Ecol & Evolution

PBIO 5850 Plant Biology Seminar  
**Description:** Weekly one-hour seminar series of invited and internal speakers. Plant Sciences MS and Plant Sciences (Plant Biology) PhD students are required to present a minimum of two seminars, including one on thesis or dissertation results. Previously offered as BOT 5850. Offered for fixed credit, 1 credit hour, maximum of 6 credit hours.  
**Credit hours:** 1  
**Contact hours:** Lecture: 1 Contact: 1  
**Levels:** Graduate  
**Schedule types:** Lecture  
**Department/School:** Plant Biology Ecol & Evolution

PBIO 5880 Plant Biology Research  
**Description:** Independent research for the doctoral dissertation. Previously offered as BOT 6000. Offered for variable credit, 1-15 credit hours, maximum of 60 credit hours.  
**Credit hours:** 1-15  
**Contact hours:** Contact: 1-15 Other: 1-15  
**Levels:** Graduate  
**Schedule types:** Discussion  
**Department/School:** Plant Biology Ecol & Evolution

**Undergraduate Programs**

- Plant Biology, BS (http://catalog.okstate.edu/arts-sciences/plant-biology-ecology-evolution/plant-biology-bs)
- Plant Biology: Cell Biology and Molecular Genetics, BS (http://catalog.okstate.edu/arts-sciences/plant-biology-ecology-evolution/cell-biology-molecular-genetics-bs)
- Plant Biology: Ecology and Evolutionary Biology, BS (http://catalog.okstate.edu/arts-sciences/plant-biology-ecology-evolution/ecology-evolutionary-biology-bs)
- Plant Biology: Pre-Forensics, BS (http://catalog.okstate.edu/arts-sciences/plant-biology-ecology-evolution/pre-forensics-bs)
- Plant Biology: Pre-Law Environmental Policy, BS (http://catalog.okstate.edu/arts-sciences/plant-biology-ecology-evolution/pre-law-environmental-policy-bs)
- Plant Biology: Pre-Pharmacy, BS (http://catalog.okstate.edu/arts-sciences/plant-biology-ecology-evolution/pre-pharmacy-bs)

**Graduate Programs**

Programs of research and study leading to the degrees of Master of Science in Plant Biology and Doctor of Philosophy in Plant Science.

**Prerequisites**

Applicants for admission must have received a baccalaureate degree from an accredited college and should have had 40 semester hours (or equivalent) in upper-division courses in the biological and physical sciences. A grade-point average of 3.00 (on a 4.00 scale) or above is required for unconditional admission. All applicants are required to submit scores for the Aptitude portion of the Graduate Record Examination.

Prerequisites for graduate degrees include successful completion of courses in the two broad areas of:

1. ecology and evolution, and  
2. cell and molecular biology.

Students with an undergraduate major in biology or plant science will have completed a substantial portion of these courses; those with a less closely related major may be required to take some background courses.

Final authority for each student’s plan of study resides with the student’s advisory committee.

**Degree Requirements**

Demonstrated research competence through submission and acceptance of a thesis or dissertation is required for all plant biology graduate degrees. A minimum of one semester teaching experience is required of all MS and PhD candidates. This requirement may also be satisfied by enrollment in a college teaching practicum course (GRAD 5990 Special Problems in Graduate Education).

All graduate students are expected to attend and participate in all departmental seminars.

**The Master of Science Degree**

Plans of study must include 30 credit hours including six credit hours of thesis and two credit hours of seminar. At least 21 semester credit hours numbered 5000 or above are required. A minimum of three graduate courses must be taken.

**The Doctor of Philosophy Degree in Plant Science**

The Department of Plant Biology, Ecology, and Evolution offers a PhD in Plant Science. To receive the PhD in plant science, students must enroll in a minimum of 70 or a total of 90 credit hours beyond the BS or 60 credit hours beyond the MS. No fewer than 36 or more than 60 hours of PBIO 6000-level are allowed in the plan of study. Two hours of seminar (PBIO 5850) must also be included in the plan of study. Students may specialize in either cellular and molecular, organismal, or ecological plant science. After a PhD candidate has completed most of the coursework,
qualifying examinations are scheduled that cover major areas of the student's plan of study and relevant subdisciplines of plant science.

Faculty

Andrew Doust, PhD—Professor and Head

Regents Professor: Michael W. Palmer, PhD (emeritus); David W. Meinke, PhD (emeritus)

Professors: Mark Fishbein, PhD; Keith Garbutt, PhD; William J. Henley, PhD; Ronald J. Tyrl, PhD (emeritus); Linda Watson, PhD

Associate Professors: Ming Yang, PhD

Assistant Professors: Henry Adams, PhD

Clinical Instructor: Chris Wood, MS