Plant Sciences

Division of Plant Science & Technology
College of Agriculture, Food and Natural Resources
52 Agriculture Laboratory
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Division Director: Heike Bücking

The Plant Sciences major is housed within the Division of Plant Science & Technology. The Division has both vibrant and diversified undergraduate and graduate education programs. An emphasis on experiential learning enables students to apply classroom knowledge to real world problems to prepare for future careers. Students completing a B.S. in Plant Sciences are highly competitive for the strong job market in plant breeding, biotechnology, crop management, horticultural science and design.

Faculty

* Graduate Faculty Member - membership is required to teach graduate-level courses, chair master's thesis committees, and serve on doctoral examination and dissertation committees.

** Doctoral Faculty Member - membership is required to chair doctoral examination or dissertation committees. Graduate faculty membership is a prerequisite for Doctoral faculty membership.

Undergraduate

- BS in Plant Sciences (https://catalog.missouri.edu/collegeofagriculturefoodandnaturalresources/plantsciences/bs-plant-sciences/)
  - with emphasis in Breeding, Biology and Biotechnology (https://catalog.missouri.edu/collegeofagriculturefoodandnaturalresources/plantsciences/bs-plant-sciences-emphasis-breeding-biology-biotechnology/)
  - with emphasis in Crop Management (https://catalog.missouri.edu/collegeofagriculturefoodandnaturalresources/plantsciences/bs-plant-sciences-emphasis-crop-management/)
  - with emphasis in Horticultural Science and Design (https://catalog.missouri.edu/collegeofagriculturefoodandnaturalresources/plantsciences/bs-plant-sciences-emphasis-horticultural-science-design/)
- Minor in Plant Sciences (https://catalog.missouri.edu/collegeofagriculturefoodandnaturalresources/plantsciences/minor-plant-sciences/)

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From the manipulation of genes to increasing crop productivity to improving the quality of life by enhancing the landscape, Plant Sciences students are engaged in the science and art of working with plants. Educational opportunities in plant science range from basic (genetics, biotechnology and physiology) to applied (crop production, protection, and landscape design).

Graduate

The Division of Plant Science and Technology offers graduate studies in Plant, Insect and Microbial Sciences (https://catalog.missouri.edu/collegeofagriculturefoodandnaturalresources/plantinsectmicrobialsciences/).

PLNT_SCI 1002: Topics In Plant Science - Biological
Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

Credit Hour: 1-4

PLNT_SCI 1120: Career Development
Introductory course for students planning a career in plant sciences. Includes an overview of each emphasis area, as well as development of professional skills required for a successful career. Graded on A-F basis only.

Credit Hour: 1
Prerequisites: Plant Science majors only

PLNT_SCI 2002: Topics in Plant Science - Biological
Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

Credit Hour: 1-4

PLNT_SCI 2075: Environmental Horticulture
Investigate interrelationships between plants and the environment. Special emphasis placed on improving homeowners' environmental stewardship and their knowledge of sustainable practices. Graded on A-F basis only.

Credit Hours: 3

PLNT_SCI 2110: Who Runs the World? Plants.
Students will develop an understanding of basic plant structure and function, plants as food and drink; plants as community members, historical and current trends and methods in cultivating plants, and the role that plants play in our interior and exterior environments. Contemporary applications and scientific problems related to plants will be highlighted.

Credit Hours: 3

PLNT_SCI 2125: Plant Structure and Function
Introduction to plant anatomy;physiology; how plant structures and processes are involved in growth/development. Labs explore

photosynthesis, mineral nutrition, water relations, growth, and hormonal regulation.

Credit Hours: 4
Prerequisites: BIO_SC 1200 and CHEM 1100 or CHEM 1400 and 1401

PLNT_SCI 2135: Plant Molecular Biology
Molecular biology is a branch of biology involved in explaining biological phenomena in molecular terms. Plant molecular biologists often use biochemical and physical techniques to investigate genetic problems in plants. This course will help you understand the fundamentals of plant molecular biology presented in relation to plant development, nutrition, and response to stress, among other topics. You will use tools to analyze, organize, and visualize plant molecular biology data. Course goals include providing you with a solid understanding of the biology in and between plant cells at the molecular level and familiarize you with the utilization of current experimental plant molecular biology tools. Graded on A-F basis only.

Credit Hours: 4
Prerequisites: BIO_SCI 1200; CHEM 1400 and 1401

PLNT_SCI 2155: Interior Plants
Identification, cultural requirements and use of plants adaptable or capable of becoming acclimated to interior environments. Graded on A-F basis only.

Credit Hour: 1

PLNT_SCI 2195: Grapes and Wines of the World
(same as F_S 2195). Explores the world of wine through study of viticultural principles and practices, wine styles, classifying wine, the winemaking process and New World and Old World wine regions. Learn wine tasting skills and experience wines from around the world. World wine consumption, social and physical health benefits of moderate wine consumption.

Credit Hours: 3

PLNT_SCI 2210: Ornamental Landscape Plants I
Identification and evaluation of woody and herbaceous stemmed ornamental landscape plants.

Credit Hours: 3
Prerequisites: BIO_SC 1200 or instructor's consent

PLNT_SCI 2210H: Ornamental Landscape Plants I - Honors
Identification and evaluation of woody and herbaceous stemmed ornamental landscape plants.

Credit Hours: 3
Prerequisites: BIO_SC 1200 or instructor's consent; Honors eligibility required

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PLNT_SCI 2215: Ornamental Landscape Plants II
Annuals, biennials, perennials, ground covers, and bulbs; their identification, nomenclature classification, culture and use.

Credit Hours: 3
Prerequisites: BIO_SC 1010 or BIO_SC 1500 or BIO_SC 1200

PLNT_SCI 2215H: Ornamental Landscape Plants II - Honors
Annuals, biennials, perennials, ground covers, and bulbs; their identification, nomenclature classification, culture and use.

Credit Hours: 3
Prerequisites: BIO_SC 1010 or BIO_SC 1500 or BIO_SC 1200; Honors eligibility required

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PLNT_SCI 2220: Introduction to Floral Design
Introduction to the basics of floral design with special emphasis on design mechanics, flower processing, care and handling. Graded on A-F basis only.

Credit Hours: 2
Prerequisites: Some sections of this course may be restricted to Plant Science Majors Only and/or students with 75 credit hours or less

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PLNT_SCI 2220H: Introduction to Floral Design - Honors
Introduction to the basics of floral design with special emphasis on design mechanics, flower processing, care and handling. Graded on A-F basis only.

Credit Hours: 2
Prerequisites: Honors eligibility required; Some sections of this course may be restricted to Plant Science Majors Only and/or students with 75 credit hours or less

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PLNT_SCI 2221: Everyday Floral Design
Intermediate floral design course expanding skills from introductory floral design with emphasis on the elements and principles of design. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 2220

PLNT_SCI 2221H: Everyday Floral Design - Honors
Intermediate floral design course expanding skills from introductory floral design with emphasis on the elements and principles of design. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 2220; Honors eligibility required

PLNT_SCI 2240: Landscape Graphic Communication
Landscape design is a blend of art and science. This course is designed to help students expand their artistic skills, including graphic communications. Topics included to achieve this goal are drawing mediums and techniques, coloring mediums and techniques, symbol usage, and elevation drawings. Graded on A-F basis only.

Credit Hours: 2
Recommended: ARTDR_VS 1050

PLNT_SCI 2250: Landscape Site Analysis
In order to effectively design what a site can become a landscape designer must first be able to accurately see what it is. This course presents a detailed look at obtaining, calculating, and manipulating a site's topography and features while offering a glimpse into the methods and means required for implementation of the final landscape design. Graded on A-F basis only.

Credit Hours: 2
Recommended: MATH 1100 or equivalent

PLNT_SCI 2254: Landscape Design
An introduction into the processes, principles, and practices of landscape design, this course begins with site analysis and moves through the drawing and presentation of your landscape concepts.

Credit Hours: 3
Prerequisites: Completion of 30 hours

PLNT_SCI 2355: Lawns and the Urban Environment
This course is designed to emphasize the important roles our lawns play in our environment, and to help students learn hands-on skills for managing residential lawns with minimal impact to our environment. Statistics show that homeowners spent more money on a per acreage basis than superintendents who manage golf courses. Most of the money homeowners spent are unnecessary, and sometimes jeopardize the safety of our environment. Today's students will likely become homeowners in the future, and it is critical for every citizen to be mindful regarding how their lawncare practices could impact our environment. Graded on A-F basis only.

Credit Hours: 3

PLNT_SCI 2370: Vegetable Garden Production
This course will introduce students to the basics of growing vegetable crops. This will include soil and growth requirements, fertility and plant spacing, basic pest management, and proper harvesting techniques. Graded on A-F basis only.

Credit Hours: 3
Recommended: Introductory science course

PLNT_SCI 3002: Topics in Plant Science - Biological
Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

Credit Hour: 1-4

PLNT_SCI 3110: Horticultural Drainage and Irrigation Systems
This course is designed to provide practical knowledge of drainage and irrigation systems for golf courses, sports fields, lawns, landscapes, greenhouses, nurseries and vineyards. Graded on A-F basis only.

Credit Hours: 2

PLNT_SCI 3130: Undergraduate Seminar in Plant Science
Discussion of assigned or selected topics in Plant Science, including participation in a panel debate and individual seminar oral presentations.

Credit Hour: 1
Prerequisites: Completion of 60 credit hours

PLNT_SCI 3210: Principles of Weed Science
Introduction to principles of weed growth, reproduction, and impact on human activities. Discussion of weed control techniques and technology, weed identification, and developing weed management strategies.

Credit Hours: 4
Prerequisites: PLNT_SCI 2110 or BIO_SC 1200

PLNT_SCI 3210W: Principles of Weed Science - Writing Intensive
Introduction to principles of weed growth, reproduction, and impact on human activities. Discussion of weed control techniques and technology, weed identification, and developing weed management strategies.

Credit Hours: 4
Prerequisites: PLNT_SCI 2110 or BIO_SC 1200

PLNT_SCI 3213: Genetics of Agricultural Plants and Animals
(same as AN_SCI 3213). Concepts of molecular, transmission, and population and quantitative genetics. Emphasis given to breeding and biotechnological applications in plant and animal agriculture. Prerequisites: MATH 1100 or higher and one of the following: BIO_SC 1100 or BIO_SC 1200 or BIO_SC 1500 or F_W 1100.

Credit Hours: 3

PLNT_SCI 3220: Special Occasion Floral Design
Advanced floral design course with emphasis in silk décor, sympathy design and public ceremony design. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 2220 and PLNT_SCI 2221 with grade of B or above in both

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PLNT_SCI 3221: Wedding Floral Design
Advanced floral design course with emphasis in wedding floral design and personal pieces design. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 2220 and PLNT_SCI 2221 with grade of B or above in both

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PLNT_SCI 3222: Retail Floral Management
Course focusing on all areas of retail floral management: business finance, marketing, products and services, employee management, and customer service. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 2220 and PLNT_SCI 2221

PLNT_SCI 3222W: Retail Floral Management - Writing Intensive
Course focusing on all areas of retail floral management: business finance, marketing, products and services, employee management, and customer service. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 2220 and PLNT_SCI 2221

PLNT_SCI 3225: Plant Breeding and Genetics
Mendelian genetic principles and related genetic developments applicable in plant breeding. Discussion of established and new plant breeding procedures applicable to cultivar development.

Credit Hours: 3
Prerequisites: PLNT_SCI 2110 or PLNT_SCI 2125

PLNT_SCI 3230: Plant Propagation
Principles and practices of propagation of horticultural plants. Prerequisites: One of the following: PLNT_SCI 2075, BIO_SC 1200, or BIO_SC 1500 or Instructor's consent.

Credit Hours: 3

PLNT_SCI 3230W: Plant Propagation - Writing Intensive
Principles and practices of propagation of horticultural plants. Prerequisites: One of the following: PLNT_SCI 2075, BIO_SC 1200, or BIO_SC 1500 or Instructor's consent.

Credit Hours: 3

PLNT_SCI 3240: Principles of Viticulture I
(same as F_S 3240). Grapevine growth, development, selection, propagation, training systems, pruning, and harvesting; vineyard site selection, design, and development. Graded on A-F basis only.

Credit Hours: 4
Prerequisites: F_S 1010 and F_S 2195 or PLNT_SCI 2195; or PLNT_SCI 2100; or PLNT_SCI 2110; or PLNT_SCI 2125

PLNT_SCI 3250: Green Industry Bidding
Principles of interpreting drawings, estimating labor, equipment, materials and other costs and recordkeeping for preparation of competitive green industry bids. Graded on A-F basis only.

Credit Hours: 2
Prerequisites: Plant Science major and completion of 30 credit hours

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PLNT_SCI 3252: Arboriculture and Pruning
Concepts for establishment and management of urban trees. Emphasis on planting, fertilization, pruning, disease, hazard assessment and components of a municipal trees ordinance.

Credit Hour: 1
Prerequisites: PLNT_SCI 2210 or instructor's consent

PLNT_SCI 3254: Digital Landscape Graphics
This course will help students explore the latest design software available to transform their design concepts into a digital format and investigate the benefits of utilizing technology as a design tool. Technology can help designers elevate their skills to the highest level of professionalism while bringing excitement and clarity to the presentation of their concepts. Programs utilized will include, but not be limited to AutoCAD; Adobe Photoshop; Google Sketchup; and Lumion. Graded on A-F basis only.

Credit Hours: 3
Recommended: PLNT_S 2250 and PLNT_S 2254

PLNT_SCI 3260: Greenhouse Management
Greenhouse design, environmental control and equipment. Practices associated with plant nutrition management, greenhouse pest control, postproduction handling and marketing of greenhouse crops, and greenhouse management are also covered.

Credit Hours: 4
Prerequisites: PLNT_SCI 2075 or instructor's consent

PLNT_SCI 3270: Forage Crops
(same as AN_SCI 3270). An introduction to principle forage crops, including identification, anatomy, physiology, and growth characteristics. Pasture production and management, grazing systems, and forage preservation and utilization will also be covered.

Credit Hours: 3

PLNT_SCI 3275: Grain Crops
Lecture and discussion covering production and utilization, plus growth and development of a wide range of grain crops, including Missouri crops. Problem solving tasks include agronomics, economics and environmental factors.

Credit Hours: 3
Prerequisites: PLNT_SCI 2110 or PLNT_SCI 2125

PLNT_SCI 3355: Introductory Turfgrass Management
Characteristics of turf materials, principles of establishment and maintenance.

Credit Hours: 3
Prerequisites: PLNT_SCI 2100 or instructor's consent

PLNT_SCI 3385: Problems in Plant Science
Not accepted as a substitute for any regularly scheduled course. Problems arranged with individual faculty member in specific matter area.

Credit Hour: 1-4
Prerequisites: consent required

PLNT_SCI 3510: Biology of Fungi
(same as BIO_SC 3510). The diverse roles of fungi in the biosphere will be explored by considering fungi we eat, fungi which destroy our food, fungi in folklore and fungi as global nutrient recyclers.

Credit Hours: 3
Prerequisites: BIO_SC 1200 or BIO_SC 1500 or equivalent

PLNT_SCI 3710: Introductory Entomology
(same as BIO_SC 3710). Emphasizes the role insects play in the scheme of life. Topics include insect structure, development, diversity, ecology, communication and behavior, and management. Prerequisites: Completion of 60 credit hours and one of the following: BIO_SC 1100 (or F_W 1100) or BIO_SC 1200, or BIO_SC 1500.

Credit Hours: 3

PLNT_SCI 3715: Insect Diversity
(same as BIO_SC 3715). Laboratory exercises emphasizing external insect anatomy, classification, and identification (to family level). Preparation of an insect collection is required.

Credit Hours: 2
Prerequisites or Corequisites: PLNT_SCI 3710 (or BIO_SC 3710)

PLNT_SCI 4002: Topics in Plant Science - Biological
Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

Credit Hour: 1-4

PLNT_SCI 4003: Topics in Plant Science - Biological- Lab
Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

Credit Hour: 1-4

PLNT_SCI 4225: Principles of Plant Breeding
(cross-leveled with PLNT_SCI 7225). This is an introductory course exploring the principles of plant breeding where we examine the application of genetics and the plant sciences to the breeding and improvement of field crops, focusing on conventional plant breeding principles. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 2110 or PLNT_SCI 2125 or BIO_SC 1200

PLNT_SCI 4270: Laboratory Techniques in Forage Analysis
(cross-leveled with PLNT_SCI 7270). This course explores the analysis of forages for yield and nutritive value. Students will learn how to properly collect forage samples in the field, followed by proper preservation and processing techniques. Students will perform all of teh laboratory analyses necessary to determine the full nutritive value of their sampled forages (dry matter yield, crude protein, fiber and digestibility), learning the what, how and why behind each analysis performed along the way. Lastly, students will learn how to compare different forage samples and draw conclusions based on their results. Students will be prepared for employment in the feed and forage analysis industry following completion of this course. Graded on A-F basis only.

Credit Hours: 2
Prerequisites or Corequisites: PLNT_SCI 3270

PLNT_SCI 4313: Soil Fertility and Plant Nutrition
(same as SOIL 4313; cross-leveled with PLNT_SCI 7313, SOIL 7313). Explanation of principles of delivery of plant nutrients to plants, discussion of the role of each essential nutrient in crop plants and introduction to the management of soil amendments.

Credit Hours: 3
Prerequisites: SOIL 2100 or instructor's consent

PLNT_SCI 4315: Crop Physiology
(cross-leveled with PLNT_SCI 7315). Basic course on crop growth and development. Emphasis is on physiological processes and morphology of crop plants, and their application to crop breeding and management decisions.

Credit Hours: 3
Prerequisites: PLNT_SCI 2125 or equivalent

PLNT_SCI 4320: Molecular Plant Physiology
(same as BIO_SC 4320; cross-leveled with BIO_SC 7320, PLNT_SCI 7320). Modern physiology of higher plants using common cultivated plants as examples. Prerequisites: CHEM 1400 and CHEM 1401 and one of the following: BIO_SC 1500 or BIO_SC 1200.

Credit Hours: 3

PLNT_SCI 4325: Advanced Plant Breeding
(cross-leveled with PLNT_SCI 7325). Will introduce students to the application of genetics and the plant sciences to the breeding and improvement of self-pollinated field crops. Classical, current and innovative plant breeding techniques will be addressed.

Credit Hours: 3
Prerequisites: PLNT_SCI 2110 or PLNT_SCI 2125, and PLNT_SCI 3213 (or equivalent), and PLNT_SCI 3225 (or equivalent)

PLNT_SCI 4340: Principles of Viticulture II
(same as F_S 4340). Environmental and biological factors influencing vine physiology and winegrape quality. Irrigation, canopy management, pest and disease control, budgets and current trends in viticulture. Graded on A-F basis only.

Credit Hours: 4
Prerequisites: F_S 3240 or PLNT_SCI 3240

PLNT_SCI 4345: Principles of Viticulture and Winemaking
(same as F_S 4345; cross-leveled with PLNT_SCI 7345, F_S 7345). This course will cover the basics needed by viticulturists and winemakers to understand grape vine growth and vineyard considerations along with winemaking principles. Viticultural topics will include grapevine growth and development, vineyard design and development, cultivar selection, grapevine propagation, training systems, and harvest and pruning. Winemaking topics will include sensory analysis of grapes, chemical, microbiological and technological aspects of winemaking, and the analytical methods used for juice and wine analysis. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: BIO_SC 1010 or BIO_SC 1020 or BIO_SC 1030

PLNT_SCI 4355: Advanced Turfgrass Management
(cross-leveled with PLNT_SCI 7355). Provides turfgrass majors a more informative and applicable look at mathematics of turfgrass management, application techniques, cultural practices, and soil/water relationships applicable to careers in golf course and sports turf management, lawn care, and professional grounds maintenance.

Credit Hours: 3
Prerequisites: PLNT_SCI 3355 or instructor's consent

PLNT_SCI 4360: Precision Agriculture Basics
(same as AG_S_TCH 4360, SOIL 4360; cross-leveled with AG_S_TCH 7360, PLNT_SCI 7360, SOIL 7360). Precision agriculture is an information-based approach to farming whereby variability is managed to optimize crop production and reduce environmental pollution. This course provides an overview of precision agriculture technologies (like GIS, GNSS, remote sensing), mapping methods, and case studies illustrating decisions and management.

Credit Hours: 3
Prerequisites: SOIL 2100, or PLNT_SCI 2110; MATH 1100; AG_S_TCH 1040

PLNT_SCI 4365: Greenhouse Crops Production
(cross-leveled with PLNT_SCI 7365). Production management decision and commercial culture of the major floriculture crops.

Credit Hours: 4
Prerequisites: PLNT_SCI 3260 or instructor's consent

PLNT_SCI 4385: Problems in Plant Science
Special problem in plant pathology designed for the minor program in Plant Pathology. Problems arranged on an individual student basis.

Credit Hours: 3

PLNT_SCI 4400: Plant Anatomy
(same as BIO_SC 4400; cross-leveled with PLNT_SCI 7400, BIO_SC 7400). Comparative structure, growth of meristems; development, structure of important cell types, tissues systems; comparative anatomy of stem, root, leaf. Emphasizes anatomy of gymnosperms, angiosperms. Includes lab. Graded on A-F basis only.

Credit Hours: 4
Prerequisites: BIO_SC 1200 or equivalent

PLNT_SCI 4500: Biology and Pathogenesis of Plant-Associated Microbes
(cross-leveled with PLNT_SCI 7500). Diagnosis of diseases of plants caused by fungi, nematodes, viruses and bacteria Environmental and genetic factors leading to disease development and strategies for disease management, including biotechnology. Prerequisites: 5 hours from the following courses: BIO_SC 1010, BIO_SC 1020, BIO_SC 1030, BIO_SC 1100, BIO_SC 1200 or BIO_SC 1500; and completion of 60 credit hours.

Credit Hours: 4

PLNT_SCI 4520: Environmental Microbiology
Fundamental knowledge of selected microbial processes that are important in agriculture, environmental detoxification, and microbial biotechnology. Emphasis is on molecular, genetic and physiological aspects of nitrogen metabolism, bioconversions, antibiosis and biocontrol.

Credit Hours: 3

PLNT_SCI 4550: Plant Biotechnology
(cross-leveled with PLNT_SCI 7550). This course will explore widely used molecular technologies in plant biotechnology. The course will target Plant Science undergraduate and graduate students, who want to learn more about molecular biology and how it can be applied in plant biotechnology. Students will master the basic concepts of molecular biology and use these skills to design experiments and to reading current literature. In the laboratory, students will gain hands-on experiences in molecular techniques and have the opportunity to apply these technologies to their own research projects. Prerequisites: PLNT_SCI 2125 and one of the following: PLNT_SCI 3213, or BIO_SC 2200 or BIO_SC 2300.

Credit Hours: 4

PLNT_SCI 4600: Eukaryotic Single Cell -Omics
(cross-leveled with PLNT_SCI 7600). The development of multi-cellular eukaryotic organisms and their response to environmental stresses are under the control of orchestrated genetic programs characterized by the differential expression of specific sets of genes, and the regulation of protein activity and metabolomic pathways. Hence, the qualitative and quantitative characterization of biomolecules and an understanding of their associated regulatory mechanisms is critical to support the functional characterization of genes and proteins involved in a biological process. This course will focus on revealing the diversity of these genetic programs, and on understanding these regulatory mechanisms and their evolution. Acknowledging that the cellular complexity of eukaryotes and the unique biological functions of cell-types hinder our understanding of these mechanisms, this course will also offer a unique perspective on the emerging field of single-cell resolution -omics. Both the experimental and the analytical aspects of single cell biology will be introduced to the students. To provide the most updated knowledge on these different fields of biological science and at different scales of analysis (i.e., from a single cell to a whole organism), the students will benefit from a series of lectures, readings, oral presentations, open conversations, and hands-on activities in single cell biology and various omics (e.g., genomic, comparative genomic, epigenomic, transcriptomic, proteomic, and metabolomic). Graded on A-F basis only. Prerequisites: One of the following courses: BIOCHM 2480, AN_SCI 3213, PLNT_SCI 3213, PLNT_SCI 4550, or AN_SCI 4324. Or instructor's consent required (one-page evaluation quiz).

Credit Hours: 3

PLNT_SCI 4720: Aquatic Entomology
(cross-leveled with PLNT_SCI 7720). Identification, life histories, ecology of aquatic insects. Grading is based on lecture, lab, and a collection. For students of wildlife, fisheries management, aquatic biology, advanced entomology.

Credit Hours: 3
Prerequisites: PLNT_SCI 3710 or PLNT_SCI 3715 or equivalent, or instructor's consent

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PLNT_SCI 4730: Insect Pest Management for Plant Protection
(cross-leveled with PLNT_SCI 7730). History and concepts of Integrated Pest Management of insect pests, emphasizing complementary use of biological control, plant resistance, environmental manipulations, genetic manipulations, and selective use of insecticides.

Credit Hours: 3
Prerequisites: PLNT_SCI 3710 or instructor's consent

PLNT_SCI 4940: Internship in Plant Science
Combines study, observation, and employment with an industry or government agency in area of agronomy or horticulture. Written and oral reports and faculty evaluation.

Credit Hours: 3
Prerequisites: Completion of 75 hours including two courses in department and instructor's consent

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PLNT_SCI 4945: Experiential Learning in Industry Internship in Plant Science
Learning experience combining observation, application, and reflection in a discipline-based industry internship. Course appears on transcript for zero credit and does not count toward full-time enrollment. No tuition or fees are charged. Graded on S/U basis only.

Credit Hours: 0
Prerequisites: instructor's consent

PLNT_SCI 4950: Undergraduate Research in Plant Science
Capstone experience consisting of investigations in Plant Science in support of an undergraduate thesis or special project portfolio.

Credit Hours: 3
Prerequisites: Completion of 75 credit hours and Plant Science Majors only

PLNT_SCI 4955: Experiential Learning in Research in Plant Science
A supervised learning experience contributing to faculty research. Course appears on transcript for zero credit and does not count toward full-time enrollment. No tuition or fees are charged. Graded on S/U basis only. Requires instructor's consent.

Credit Hours: 0

PLNT_SCI 4965: Special Readings in Plant Pathology
Independent readings and discussions of topics in entomology selected in consultation with supervising faculty member. Paper required.

Credit Hour: 1-99

PLNT_SCI 4970: Readings in Plant-Insect Interactions
(cross-leveled with PLNT_SCI 7970). This course is designed to provide graduate and advanced undergraduate students with skills to critically read and evaluate the primary scientific literature using the current primary literature in the field of plant-herbivore interactions. The rich history of chemical, physiological, population, and multi-trophic ecology studies on plant-insect interactions has produced an exciting, fast-paced interdisciplinary field at the forefront of ecology. This course is an ideal way to help students working in this field, or other areas of plant stress, to understand what is currently known, to experience the breadth of questions asked, and to think critically about what's published. Learning to evaluate the literature and prepare well-written critiques will help students to participate effectively in the important peer-review process of science. Graded on S/U basis only.

Credit Hour: 1

PLNT_SCI 4975: Advanced Landscape Design
(cross-leveled with PLNT_SCI 7975). This course continues to develop the landscape design skills, tools, and technology learned in the introductory courses, while refining these abilities to a more professional level. We will utilize practical and true to life site design applications to increase the design skills of our students while introducing them to the intricacies involved with more specific elements of contemporary landscape design principles and practices.

Credit Hours: 4
Prerequisites: PLNT_SCI 2254 and PLNT_SCI 3254 or instructor's consent
Recommended: PLNT_SCI 2210, PLNT_SCI 2215, and PLNT_SCI 2250

PLNT_SCI 7001: Topics
Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

Credit Hour: 1-4

PLNT_SCI 7002: Topics- Lab
Initial offering of a course(s) in a specific subject matter area. Offered when proposed by a faculty member in that area of expertise.

Credit Hour: 1-4

PLNT_SCI 7085: Problems
Advanced studies not expected to terminate in thesis. Problems arranged with individual faculty member in specific matter area.

Credit Hour: 1-3
Prerequisites: instructor's consent

PLNT_SCI 7087: Seminar
In-depth development of advanced aspects of plant, insect, or microbial sciences through reviews of results of research in progress and current scientific publications. Graded on S/U basis only.

Credit Hour: 1

PLNT_SCI 7225: Principles of Plant Breeding
(cross-leveled with PLNT_SCI 4225). This is an introductory course exploring the principles of plant breeding where we examine the application of genetics and the plant sciences to the breeding and improvement of field crops, focusing on conventional plant breeding principles. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 2110 or PLNT_SCI 2125 or BIO_SC 1200

PLNT_SCI 7270: Laboratory Techniques in Forage Analysis
(cross-leveled with PLNT_SCI 4270). This course explores the analysis of forages for yield and nutritive value. Students will learn how to properly collect forage samples in the field, followed by proper preservation and processing techniques. Students will perform all of the laboratory analyses necessary to determine the full nutritive value of their sampled forages (dry matter yield, crude protein, fiber and digestibility), learning the what, how and why behind each analysis performed along the way. Lastly, students will learn how to compare different forage samples and draw conclusions based on their results. Students will be prepared for

employment in the feed and forage analysis industry following completion of this course. Graded on A-F basis only.

Credit Hours: 2

PLNT_SCI 7313: Soil Fertility and Plant Nutrition
(same as SOIL 7313; cross-leveled with PLNT_SCI 4313, SOIL 4313). Explanation of principles of delivery of plant nutrients to plants, discussion of the role of each essential nutrient in crop plants and introduction to the management of soil amendments.

Credit Hours: 3
Prerequisites: SOIL 2110 or instructor's consent

PLNT_SCI 7315: Crop Physiology
(cross-leveled with PLNT_SCI 4315). Basic course on crop growth and development. Emphasis is on physiological processes and morphology of crop plants, and their application to crop breeding and management decisions.

Credit Hours: 3
Prerequisites: PLNT_SCI 2125 or equivalent

PLNT_SCI 7320: Molecular Plant Physiology
(same as BIO_SC 7320; cross-leveled with PLNT_SCI 4320, BIO_SC 4320). Modern physiology of higher plants using common cultivated plants as examples. May be taken with or without laboratory.

Credit Hours: 3
Prerequisites: BIO_SC 1500 or BIO_SC 1200 and five hours of chemistry

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PLNT_SCI 7325: Advanced Plant Breeding
(cross-leveled with PLNT_SCI 4325). Will introduce students to the application of genetics and the plant sciences to the breeding and improvement of self-pollinated field crops. Classical, current and innovative plant breeding techniques will be addressed.

Credit Hours: 3
Prerequisites: PLNT_SCI 2110 or PLNT_SCI 2125, and PLNT_SCI 3213 (or equivalent), and PLNT_SCI 3225 (or equivalent)

PLNT_SCI 7345: Principles of Viticulture and Winemaking
(same as F_S 7345; cross-leveled with PLNT_SCI 4345, F_S 4345). This course will cover the basics needed by viticulturists and winemakers to understand grape vine growth and vineyard considerations along with winemaking principles. Viticultural topics will include grapevine growth and development, vineyard design and development, cultivar selection, grapevine propagation, training systems, and harvest and pruning. Winemaking topics will include sensory analysis of grapes, chemical, microbiological and technological aspects of winemaking, and the analytical methods used for juice and wine analysis. Graded on A-F basis only.

Credit Hours: 3

PLNT_SCI 7355: Advanced Turfgrass Management
(cross-leveled with PLNT_SCI 4355). Provides turfgrass majors a more informative and applicable look at mathematics of turfgrass management, application techniques, cultural practices, and soil/water relationships applicable to careers in golf course and sports turf management, lawn care, and professional grounds maintenance. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 3355 or instructor's consent

PLNT_SCI 7360: Precision Agriculture Basics
(same as AG_S_TCH 7360, SOIL 7360; cross-leveled with PLNT_SCI 4360, AG_S_TCH 4360, SOIL 7360). Precision agriculture is an information-based approach to farming whereby variability is managed to optimize crop production and reduce environmental pollution. This course provides an overview of precision agriculture technologies (like GIS, GNSS, remote sensing), mapping methods, and case studies illustrating decisions and management.

Credit Hours: 3
Prerequisites: SOIL 2100, or PLNT_SCI 2110; MATH 1100; AG_S_TCH 1040

PLNT_SCI 7365: Greenhouse Crops Production
(cross-leveled with PLNT_SCI 4365). Production management decision and commercial culture of the major floriculture crops.

Credit Hours: 4
Prerequisites: PLNT_SCI 3260 or instructor's consent

PLNT_SCI 7370: Small Fruit and Vegetable Production
Emphasizes production, management and marketing practices for small fruit and vegetable crops.

Credit Hours: 3
Prerequisites: PLNT_SCI 2100, PLNT_SCI 3230, and PLNT_SCI 3235

PLNT_SCI 7400: Plant Anatomy
(same as BIO_SC 7400; cross-leveled with PLNT_SCI 4400, BIO_SC 4400). Comparative structure, growth of meristems; development, structure of important cell types, tissue systems; comparative anatomy of stem, root, leaf. Emphasized anatomy of gymnosperms, angiosperms. Includes lab. Graded on A-F basis only.

Credit Hours: 4
Prerequisites: BIO_SC 1200 or equivalent

PLNT_SCI 7500: Biology and Pathogenesis of Plant-Associated Microbes
(cross-leveled with PLNT_SCI 4500). Diagnosis of disease of plants caused by fungi, nematodes, viruses and bacteria. Environmental and genetic factors leading to disease development and strategies for disease management, including biotechnology.

Credit Hours: 4
Prerequisites: 5 hours BIO_SC

PLNT_SCI 7550: Plant Biotechnology
(cross-leveled with PLNT_SCI 4550). This course will explore widely used molecular technologies in plant biotechnology. The course will target Plant Science undergraduate and graduate students, who want to learn more about molecular biology and how it can be applied in plant biotechnology. Students will master the basic concepts of molecular biology and use these skills to design experiments and to reading current literature. In the laboratory, students will gain hands-on experiences in molecular techniques and have the opportunity to apply these technologies to their own research projects.

Credit Hours: 4
Prerequisites: BIO_SC 2960 or equivalent; BIO_SC 2200 or equivalent; BIO_SC 2300 or equivalent; PLNT_SCI 2125

PLNT_SCI 7600: Eukaryotic Single Cell -Omics
(cross-leveled with PLNT_SCI 4600). The development of multi-cellular eukaryotic organisms and their response to environmental stresses are under the control of orchestrated genetic programs characterized by the differential expression of specific sets of genes, and the regulation of protein activity and metabolomic pathways. Hence, the qualitative and quantitative characterization of biomolecules and an understanding of their associated regulatory mechanisms is critical to support the functional characterization of genes and proteins involved in a biological process. This course will focus on revealing the diversity of these genetic programs, and on understanding these regulatory mechanisms and their evolution. Acknowledging that the cellular complexity of eukaryotes and the unique biological functions of cell-types hinder our understanding of these mechanisms, this course will also offer a unique perspective on the emerging field of single-cell resolution -omics. Both the experimental and the analytical aspects of single cell biology will be introduced to the students. To provide the most updated knowledge on these different fields of biological science and at different scales of analysis (i.e., from a single cell to a whole organism), the students will benefit from a series of lectures, readings, oral presentations, open conversations, and hands-on activities in single cell biology and various omics (e.g., genomic, comparative genomic, epigenomic, transcriptomic, proteomic, and metabolomic). Graded on A-F basis only. Prerequisites: One of the following courses: BIOCHM 2480, AN_SCI 3213, PLNT_SCI 3213, PLNT_SCI 4550, PLNT_SCI 7550, AN_SCI 4324 or AN_SCI 7324. Or instructor's consent required (one-page evaluation quiz).

Credit Hours: 3

PLNT_SCI 7710: Systematic Entomology
(cross-leveled with PLNT_SCI 4710). Taxonomy of insects: emphasizes biology and classification of orders and suborders in lecture, and major families in lab. Insect collection required.

Credit Hours: 5
Prerequisites: PLNT_SCI 3710 and PLNT_SCI 3715 or 10 hours Biological Sciences

PLNT_SCI 7720: Aquatic Entomology
(cross-leveled with PLNT_SCI 4720). Identification, life histories, ecology of aquatic insects. Grading is based on lecture, lab, and a collection. For students of wildlife, fisheries management, aquatic biology, advanced entomology.

Credit Hours: 3
Prerequisites: PLNT_SCI 3710, PLNT_SCI 3715 or equivalent or instructor's consent

PLNT_SCI 7730: Insect Pest Management for Plant Protection
(cross-leveled with PLNT_SCI 4730). History and concepts of Integrated Pest Management for insects pests, emphasizing complementary use of biological control, plant resistance, environmental manipulations, genetic manipulations, and selective use of insecticides.

Credit Hours: 3
Prerequisites: PLNT_SCI 3710 or instructor's consent

PLNT_SCI 7820: Principles of Insect Physiology
Major concepts of insect physiology emphasizing functions of organ-systems sensory physiology hormones in development, nutrition.

Credit Hours: 4
Prerequisites: PLNT_SCI 3710, PLNT_SCI 3715 and PLNT_SCI 7810 or equivalent

PLNT_SCI 7965: Readings in Plant Stress Biology
Independent readings and discussion of recent research publications. Topics selected in consultation with supervisory faculty member.

Credit Hour: 1-9
Prerequisites: instructor's consent

PLNT_SCI 7970: Readings in Plant-Insect Interactions
(cross-leveled with PLNT_SCI 4970).This course is designed to provide graduate and advanced undergraduate students with skills to critically read and evaluate the primary scientific literature using the current primary literature in the field of plant-herbivore interactions. The rich history of chemical, physiological, population, and multi-trophic ecology studies on plant-insect interactions has produced an exciting, fast-paced

interdisciplinary field at the forefront of ecology. This course is an ideal way to help students working in this field, or other areas of plant stress, to understand what is currently known, to experience the breadth of questions asked, and to think critically about what's published. Learning to evaluate the literature and prepare well-written critiques will help students to participate effectively in the important peer-review process of science. Graded on S/U basis only.

Credit Hour: 1
Prerequisites: Instructor's consent

PLNT_SCI 7975: Advanced Landscape Design
(cross-leveled with PLNT_SCI 4975). This course continues to develop the landscape design skills, tools, and technology learned in the introductory courses, while refining these abilities to a more professional level. We will utilize practical and true to life site design applications to increase the design skills of our students while introducing them to the intricacies involved with more specific elements of contemporary landscape design principles and practices.

Credit Hours: 4
Prerequisites: PLNT_SCI 2254 and PLNT_SCI 3254 or instructor's consent
Recommended: PLNT_SCI 2210, PLNT_SCI 2215, and PLNT_SCI 2250

PLNT_SCI 8001: Topics
Instruction in specific subject matter areas in plant, insect or microbial sciences.

Credit Hour: 1-4
Prerequisites: instructor's consent

PLNT_SCI 8010: Professionalism and Ethics
Ethical issues in the conduct of scientific research including data integrity, plagiarism, and intellectual property. Scientific writing, lab management, peer review and other professional skills for the life sciences. Graded on A-F basis only.

Credit Hours: 2

PLNT_SCI 8090: Thesis Research
Original investigations in plant, insect or microbial science in support of thesis for master's candidates. Graded on S/U basis only.

Credit Hour: 1-10

PLNT_SCI 8330: Molecular Breeding and Genomic Technology
Development of molecular plant breeding, including genome sequencing, molecular markers, genotyping methods, and genome editing. The course provides the principles and application of marker-assisted trait introgression, genomics-assisted selection, and fundamental and methodology of genome editing for crop improvement. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 4325 or equivalent

PLNT_SCI 8362: Introduction to Plant Metabolism
(same as BIO_SC 8362, BIOCHM 8362). This course is part of a series that aims to provide a solid conceptual foundation in interdisciplinary plant biology for graduate students with a research emphasis in plant biology. This course examines the basic concepts and techniques used to understand plant metabolism. Graded on A-F basis only.

Credit Hours: 2

PLNT_SCI 8365: Introduction to Molecular Cell Biology
(same as BIOCHM 8365, BIO_SC 8365). This course is part of a series that aims to provide a solid conceptual foundation in interdisciplinary plant biology for graduate students with a research emphasis on plant biology. This course examines the basic concepts and techniques used to understand molecular cell biology. Graded on A-F basis only.

Credit Hours: 2

PLNT_SCI 8410: Advanced Weed Science
Discussion of herbicide physiology and fate in the environment, current development in weed science theory and methodology, and application of analytical procedures in weed research.

Credit Hours: 3
Prerequisites: PLNT_SCI 3210

PLNT_SCI 8420: Herbicide Mode of Action and Symptomology
Designed for graduate students to gain an understanding of the in-depth processes by which herbicides interrupt normal plant growth and development at a tissue, cellular, and enzymatic level while learning to diagnose visual symptoms associated with herbicide injury. Course maybe repeated for credit. Graded on A-F basis.

Credit Hours: 2
Prerequisites: PLNT_SCI 3210; instructor's consent

PLNT_SCI 8430: Introduction to Bioinformatics Programming
(same as AN_SCI 8430). This course provides the basics of programming and database development to students in the life sciences who have little prior programming experience. It covers Unix/Linux, Perl, MySQL, the relational database design process, and common data formats used in genome informatics. Students will learn how programming skills can enhance their ability to analyze large biological

datasets, and will gain hands on experience with examples focused on genomics and bioinformatics. Graded on A-F basis only.

Credit Hours: 4
Prerequisites: Instructor's consent
Recommended: Undergraduate or graduate course in Genetics

PLNT_SCI 8441: Statistical Applications in Agriculture
(same as AN_SCI 8441). Techniques of experimentation, with application to livestock production and management. Exercises in methods of planning, conducting, analyzing, evaluating and reporting research.

Credit Hours: 3
Prerequisites: STAT 4530/STAT 7530 or equivalent or instructor's consent

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PLNT_SCI 8505: Plant Stress Biology
(same as BIO_SC 8505). This course will introduce the basic concepts of abiotic and biotic plant stress agents and discuss how to conduct research with plant stress agents alone or in combination. Graded on A-F basis only.

Credit Hours: 3

PLNT_SCI 8530: Research with Plant Stress Agents
Students will learn key research strategies for abiotic and biotic plant stress agents. Students will complete two focused hands-on projects. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_SCI 7500 and PLNT_SCI 7510 or PLNT_SCI 7315, or PLNT_SCI 7320, or equivalent

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PLNT_SCI 8720: Insect Behavior
An examination of the breadth of behaviors found in insects, such as orientation mechanisms, communication, dispersal and migration, defensive mechanisms, lost location, feeding strategies, pollination, courtship and reproduction, and social behavior.

Credit Hours: 3
Prerequisites: PLNT_SCI 3710 and PLNT_SCI 3715 or 10 hours of Biological Sciences

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PLNT_SCI 8980: Non-Thesis Research
In order to complete the non-thesis option, the student must complete an independent project under a faculty advisor approved by the department. This project is carried out by enrolling in this 1-credit course (Non-Thesis Research). This project is documented and presented to a faculty committee of at least three graduate faculty members and defended in a public defense as part of a final oral examination. Graded on S/U basis only.

Credit Hour: 1
Prerequisites: Enrollment requires the approval of the director of graduate studies

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PLNT_SCI 9001: Topics
Instruction in specific subject matter areas in plant, insect or microbial sciences.

Credit Hour: 1-4
Prerequisites: instructor's consent

PLNT_SCI 9087: Seminar in Plant Science
In-depth development of advanced aspects of plant, insect and microbial sciences through reviews of results of research in progress and current scientific publications. Graded on A-F or S/U basis dependent on section.

Credit Hour: 1

PLNT_SCI 9090: Dissertation Research
Original investigations in plant, insect or microbial science in support of dissertation for doctoral candidates. Graded on a S/U basis only.

Credit Hour: 1-10

PLNT_SCI 9310: Ecology of Grazing Lands Systems
Students travel to grazing lands ecosystems to learn: the components and function of grazing lands; research techniques in soil-plant-animal research; forage-livestock ecology; and the role of forages in conservation practices, wildlife habitat, and sustainable agriculture.

Credit Hours: 3
Prerequisites: instructor's consent

PLNT_SCI 9415: Advanced Plant Physiology
Advanced course in the physiology of plant growth and development. Discussion of current and classical studies in plant physiology with emphasis on responses to environmental variation.

Credit Hour: 1-3
Prerequisites: PLNT_S 4315 or PLNT_S 4320 or equivalent. Instructor's consent required

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PLNT_SCI 9440: Applied Quantitative and Statistical Genetics
Estimation of genetic effects using means and variances, diallel analysis, environmental stability responses, index selection, and gain from selection.

Credit Hours: 3

Prerequisites: PLNT_SCI 4330, STAT 4510, STAT 4530, AN_SCI 9423, or equivalent

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PLNT_SCI 9540: Genetics of Plant-Microorganism Interaction
Molecular and general genetics of the interactions between plants and pathogenic or symbiotic microorganisms.

Credit Hours: 3
Prerequisites: PLNT_SCI 7500 and PLNT_SCI 7510, one course each in Biochemistry and Genetics

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PLNT_SCI 9810: Insect Ecology
Ecological aspects of insect populations and communities including population dynamics, predator-prey interactions, competition, diversity and stability. Quantitative methods are emphasized.

Credit Hours: 3
Prerequisites: PLNT_SCI 3710 and PLNT_SCI 3715, STAT 1400 and BIO_SC 3650 or instructor's consent

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