The Division of Plant Sciences is a consolidation of the disciplines of Agronomy, Entomology, Horticulture, Plant Microbiology and Pathology. Containing both a vibrant and diversified undergraduate and graduate education program, students completing B.S., M.S. or Ph.D. programs are highly competitive for the strong job market in basic or applied careers. In addition to education, the Division of Plant Sciences also provides leadership for plant, insect and microbe-based research, education and Extension programs in the college.

The division is the sole academic program in the state to address issues related to plant production, plant protection and plant biology from the laboratory to the field. We intend to be at the national and international forefront of disciplinary and interdisciplinary research, Extension and education in applied and basic aspects of plant sciences. Division faculty contribute to advances in conventional, sustainable and alternative production systems, plant biology, genetics and breeding, plant protection and pest management, plant-insect/pathogen interactions, and plant-soil relationships.

**Faculty**


**Curators’ Professors** H. T. Nguyen**, G. Stacey**

**Endowed Professors** P. Chen**


**Assistant Professors** H. Naumann*, K. Rice*

**Research Professors** Z. Zhang**

**Distinguished Research Professor** J. Boyer*

**Assistant Research Professors** M. Hall*, A. Scaboo**, M. Stacey*, A. Thomas

**Extension Professors** W. E. Stevens*

**Associate Extension Professors** J. A. Lory*, M. Nathan*

**Assistant Extension Professors** K. Bissonnette*, D. Vollenberg

**Assistant Teaching Professor** M. A. Gowdy*, C. Spinka


**Adjunct Assistant Professors** I. Baxter, J. Benne, M. Kwansiewski, K. S. Shelby*, C. Topp, P. L. Vincent*

**Adjunct Associate Professor Emeritus** M. A. Schaeffer

**Research Associate Professor Emeritus** J. Bruhn


**Associate Professor Emeritus** W. C. Bailey**, C. Starbeck*

**Assistant Professor Emeritus** B. Puttler

**Curators’ Professor Emeritus** C. J. Nelson*

**Endowed Professor Emeritus** J. G. Shannon**

- 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 (http://catalog.missouri.edu/undergraduate/collegeofagriculturefoodandnaturalresources/plantsciences/bs_in_plant_sciences)
  - with emphasis in Breeding, Biology and Biotechnology (http://catalog.missouri.edu/undergraduate/collegeofagriculturefoodandnaturalresources/plantsciences/bs-plant-sciences-emphasis-breeding-biology-biotechnology)
  - with emphasis in Crop Management (http://catalog.missouri.edu/undergraduate/collegeofagriculturefoodandnaturalresources/plantsciences/bs-plant-sciences-emphasis-crop-management)
  - with emphasis in Horticultural Science and Design (http://catalog.missouri.edu/undergraduate/collegeofagriculturefoodandnaturalresources/plantsciences/bs-plant-sciences-emphasis-horticultural-science-design)

- Minor in Plant Sciences (http://catalog.missouri.edu/undergraduate/collegeofagriculturefoodandnaturalresources/plantsciences/minor-plant-sciences)

**Director for Undergraduate Programs**

Bruce Barrett
3-22i Agriculture Building
(573) 882-3446
Fax: (573) 882-1469
BarrettB@missouri.edu

The Plant Sciences undergraduate major is a joint contribution of the disciplines of Agronomy, Entomology, Horticulture and Plant Microbiology and Pathology. From the manipulation of genes to increasing crop productivity to improving the quality of life by enhancing the landscape, plant science 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 and protection, and landscape design).

The division offers the BS degree with a major in Plant Sciences. Students in plant science initially receive a broad education in agriculture, the basic sciences and business. Later, they elect to enroll in a specific emphasis area designed to empower them to be competitive in career opportunities in that area. The emphasis areas are a series of interwoven courses in:

- Crop Management
- Horticultural Science and Design
- Breeding, Biology and Biotechnology
Graduate

- MS in Plant, Insect and Microbial Sciences (http://catalog.missouri.edu/undergraduategraduate/collegeofagriculturefoodandnaturalresources/plantsciences/ms-plant-insect-microbial-sciences)
- PhD in Plant, Insect and Microbial Sciences (http://catalog.missouri.edu/undergraduategraduate/collegeofagriculturefoodandnaturalresources/plantsciences/phd-plant-insect-microbial-sciences)

Division of Plant Sciences
52 Agriculture Laboratory
(573) 882-3001
https://plantsciences.missouri.edu/graduate/

Director of Graduate Studies: James Schoelz

The Division of Plant Sciences offers graduate programs leading to master of science and doctor of philosophy degrees in Plant, Insect and Microbial Sciences. A student can select training from a wide range of courses and research programs to prepare for a career in research, teaching, industry and extension work.

The Division of Plant Sciences maintains excellent graduate programs with classroom instruction and research supervision provided by leading scientists in the field. A student can select training in one of several Graduate Program Areas. Students can follow a traditional curriculum or take advantage of the cross-disciplinary expertise that exists within the Division.

Programmatic Interactions

Students also benefit from interaction with closely allied academic units on and off campus. Students work with scientists in two campus-based USDA research units associated with the division: the Plant Genetics Unit and the Biological Control of Insects Research Laboratory. Additional opportunities exist for interaction with scientists at the Donald Danforth Plant Science Center in St. Louis. Numerous USDA and Danforth Center scientists hold adjunct appointments in the DPS. Students in the DPS are encouraged to interact with interdisciplinary programs on campus such as the Interdisciplinary Plant Group, the Molecular Biology Program, the Genetics Area Program, the Center for Agroforestry and the Missouri Precision Agriculture Center.

Areas of Study

A student can select training from a wide range of courses and research programs to prepare for a career in research, teaching, industry and extension work. Students may complete their graduate degrees through any of the Graduate Program Areas:

- Crop, Soil and Pest Management
- Entomology
- Horticulture
- Plant Breeding, Genetics and Genomics
- Plant Stress Biology

PLNT_S 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_S 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_S 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_S 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_S 2100: Introduction to Soils
(same as SOIL 2100). Introduction to soil sciences with emphasis placed on physical, biological, and chemical properties and application to land use, plant growth and environmental problems.

Credit Hours: 3
Recommended: 3 hrs of Chemistry

PLNT_S 2110: Plants and their Cultivation
Principles of plant growth with emphasis on anatomy, physiology, and response to environmental factors. Production and protection of economically important crop and horticulture species.

Credit Hours: 3

PLNT_S 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: 3

PLNT_S 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_S 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_S 2210: Ornamental Woody Plants
Identification and evaluation of trees and shrubs for landscape use.

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

PLNT_S 2215: Ornamental Herbaceous Plants
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_S 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

PLNT_S 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_S 2220

PLNT_S 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: ART_DRAW 1050

PLNT_S 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_S 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_S 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_S 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_S 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_S 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_S 2110 or BIO_SC 1200

PLNT_S 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 FW 1100.

Credit Hours: 3

PLNT_S 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_S 2220 and PLNT_S 2221 with grade of B or above in both

PLNT_S 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_S 2220 and PLNT_S 2221 with grade of B or above in both

PLNT_S 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_S 2220 and PLNT_S 2221
PLNT_S 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_S 2220 and PLNT_S 2221

PLNT_S 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_S 2110 or equivalent

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

Credit Hours: 3

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

Credit Hours: 3

PLNT_S 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_S 2195; or PLNT_S 2100; or PLNT_S 2110; or PLNT_S 2125

PLNT_S 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

PLNT_S 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_S 2210 or instructor's consent

PLNT_S 3254: Landscape AutoCAD
AutoCAD is the most widely utilized computer aided drafting software program in the professional landscape design industry. This course will teach students how to utilize AutoCAD to transform their landscape design skills into a digital format and investigate the benefits of utilizing technology as a design tool. We will also explore other industry utilized software, and their functionality, with focus on landscape design and presentation. Additional software will include, but not be limited to, AutoDesk Revit; Adobe Photoshop; and Sketchup. Graded on A-F basis only.

Credit Hours: 3
Recommended: PLNT_S 2250 and PLNT_S 2254

PLNT_S 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_S 2075 or instructor's consent

PLNT_S 3270: Forage Crops
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
Prerequisites: PLNT_S 2125 or instructor's consent

PLNT_S 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_S 2110 or PLNT_S 2125

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

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

PLNT_S 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_S 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_S 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_S 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_S 3710 (or BIO_SC 3710)

PLNT_S 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_S 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_S 4225: Principles of Plant Breeding
(cross-leveled with PLNT_S 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_S 2110 or PLNT_S 2125 or BIO_SC 1200

PLNT_S 4270: Laboratory Techniques in Forage Analysis
(cross-leveled with PLNT_S 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 these 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_S 3270

PLNT_S 4313: Soil Fertility and Plant Nutrition
(same as SOIL 4313; cross-leveled with PLNT_S 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_S 4315: Crop Physiology
(cross-leveled with PLNT_S 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_S 2125 or equivalent

PLNT_S 4320: Molecular Plant Physiology
(same as BIO_SC 4320; cross-leveled with PLNT_S 7320, BIO_SC 7320). Modern physiology of higher plants using common cultivated plants as examples. Prerequisites: CHEM 1320 or CHEM 1330 and one of the following: BIO_SC 1500 or BIO_SC 1200.

Credit Hours: 3

PLNT_S 4325: Advanced Plant Breeding
(cross-leveled with PLNT_S 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_S 2110 or PLNT_S 2125, and PLNT_S 3213 (or equivalent), and PLNT_S 3225 (or equivalent)

PLNT_S 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_S 3240

PLNT_S 4345: Principles of Viticulture and Winemaking
(same as F_S 4345; cross-leveled with PLNT_S 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_S 4355: Advanced Turfgrass Management
(cross-leveled with PLNT_S 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_S 3355 or instructor's consent
PLNT_S 4360: Precision Agriculture Science and Technology
(same as AG_S_M 4360, SOIL 4360; cross-leveled with PLNT_S 7360, AG_S_M 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, GPS, remote sensing), mapping methods, and case studies illustrating decisions and management.

Credit Hours: 3
Prerequisites: PLNT_S 2100 or SOIL 2100, or PLNT_S 2110, or instructor's consent

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

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

PLNT_S 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_S 4400: Plant Anatomy
(same as BIO_SC 4400; cross-leveled with PLNT_S 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_S 4500: Biology and Pathogenesis of Plant-Associated Microbes
(cross-leveled with PLNT_S 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_S 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, antibiotics and biocontrol.

Credit Hours: 3

PLNT_S 4550: Plant Biotechnology
(cross-leveled with PLNT_S 7550). Principles of gene expression, metabolic pathway analysis and data mining, plant tissue culture and transformation, transgene integration and expression analysis, plant epigenome, emerging transgenic technologies, etc. Prerequisites: PLNT_S 2125 and one of the following: PLNT_S 3213, or BIO_SC 2200 or BIO_SC 2300.

Credit Hours: 4

PLNT_S 4720: Aquatic Entomology
(cross-leveled with PLNT_S 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_S 3710 or PLNT_S 3715 or equivalent, or instructor's consent

PLNT_S 4730: Insect Pest Management for Plant Protection
(cross-leveled with PLNT_S 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_S 3710 or instructor's consent

PLNT_S 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

PLNT_S 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 Hour: 1-3
Prerequisites: Completion of 75 credit hours and Plant Science Majors only

PLNT_S 4975: Advanced Landscape Design
(cross-leveled with PLNT_S 7975). Development of project presentation techniques by analysis of the social, cultural, historical and ecological aspects of landscape design.

Credit Hours: 4
Prerequisites: PLNT_S 2254 or instructor's consent

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

Credit Hours: 1
Prerequisites: instructor's consent

PLNT_S 7225: Principles of Plant Breeding
(cross-leveled with PLNT_S 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_S 2110 or PLNT_S 2125 or BIO_SC 1200

PLNT_S 7313: Soil Fertility and Plant Nutrition
(same as SOIL 7313; cross-leveled with PLNT_S 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_S 7315: Crop Physiology
(cross-leveled with PLNT_S 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_S 2125 or equivalent

PLNT_S 7320: Molecular Plant Physiology
(same as BIO_SC 7320; cross-leveled with PLNT_S 4320, BIO_SCI 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

PLNT_S 7325: Advanced Plant Breeding
(cross-leveled with PLNT_S 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_S 2110 or PLNT_S 2125, and PLNT_S 3213 (or equivalent), and PLNT_S 3225 (or equivalent)

PLNT_S 7355: Advanced Turfgrass Management
(cross-leveled with PLNT_S 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_S 3355 or instructor's consent

PLNT_S 7360: Precision Agriculture Science and Technology
(same as AG_S_M 7360 and SOIL 7360; cross-leveled with PLNT_S 4360, AG_S_M 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, GPS, remote sensing), mapping methods, and case studies illustrating decisions and management.

Credit Hours: 3
Prerequisites: SOIL 2100, PLNT_S 2110 or instructor's consent

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

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

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

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

PLNT_S 7400: Plant Anatomy
(same as BIO_SC 7400; cross-leveled with PLNT_S 4400, BIO_SCI 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_S 7500: Biology and Pathogenesis of Plant-Associated Microbes
(cross-leveled with PLNT_S 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_S 7550: Plant Biotechnology
(cross-leveled with PLNT_S 4550). Principles of gene expression, metabolic pathway analysis and data mining, plant tissue culture and transformation, transgene integration and expression analysis, plant epigenome, emerging transgenic technologies, etc.
PLNT_S 7710: Systematic Entomology
(cross-leveled with PLNT_S 4710). Taxonomy of insects: emphasizes biology and classification of orders and suborders in lecture, and major families in lab. Insect collection required.

Credit Hours: 4
Prerequisites: PLNT_S 3710 and PLNT_S 3715 or 10 hours Biological Sciences

PLNT_S 7720: Aquatic Entomology
(cross-leveled with PLNT_S 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_S 3710 or equivalent or instructor's consent

PLNT_S 7730: Insect Pest Management for Plant Protection
(cross-leveled with PLNT_S 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_S 3710 or equivalent or instructor's consent

PLNT_S 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_S 3710, PLNT_S 3715 and PLNT_S 7810 or equivalent

PLNT_S 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_S 7970: Readings in Molecular Ecology of Herbivory
(cross-leveled with PLNT_S 4970). The application of molecular biology tools to the rich history of chemical, physiological, population, and multi-trophic ecology studies on plant herbivore interactions has made for an exciting, fast-paced field at the forefront of ecology, 'functional biology' and 'systems biology'. Graded on S/U basis only.

Credit Hour: 1
Prerequisites: Instructor's consent

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

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

PLNT_S 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_S 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_S 8330: Molecular Breeding and Translational Genomics
Development of Molecular Breeding, Evolution of Transgenics, Transformation and Gene Transfer Methods, Transgenics in the Food Supply Genetics and Marker Technology, Genotyping Methods for Marker Assisted Selection (MAS, and Emerging Transgenic and Genotyping Technologies. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PLNT_S 3710, PLNT_S 3715 and PLNT_S 7810 or equivalent

PLNT_S 8362: Introduction to Plant Metabolism
(same as BIO_SC 8362 and 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_S 8365: Introduction to Molecular Cell Biology
(same as BIOCHM 8365 and 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_S 8410: Advanced Weed Science
Discussion of weed 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_S 3210

PLNT_S 8420: Herbicide Mode of Action and Symptomology
Designed for graduate students to gain understanding of the in-depth processes by which herbicides interrupt plant growth and development at a tissue, cellular, and enzymatic level while learning to diagnose visual symptoms associated with herbicide injury. Course may be repeated for credit. Graded on A-F basis.
Credit Hours: 2  
Prerequisites: PLNT_S 3210; instructor's consent

PLNT_S 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_S 8505: Introduction to Plant Stress Biology  
(same as BIO_SC 8505) This course is part of a series that aims to  
provide a solid conceptual foundation to 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  
stress biology. Graded on A-F basis only.

Credit Hours: 2

PLNT_S 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_S 7500 and PLNT_S 7510 or PLNT_S 7315, or  
PLNT_S 7320, or equivalent

PLNT_S 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,  
kayrship and reproduction, and social behavior.

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

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

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

PLNT_S 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_S 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_S 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_S 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

PLNT_S 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_S 4330, STAT 4510, STAT 4530, AN_SCI 9423, or  
equivalent

PLNT_S 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_S 7500 and PLNT_S 7510, one course each in  
Biochemistry and Genetics

PLNT_S 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_S 3710 and PLNT_S 3715, STAT 1400 and  
BIO_SC 3650 or instructor's consent