

# PLANT BREEDING AND GENETICS

Plant scientists sustain and improve our current and future world as they work with foods, fibers, fuel, flowers, pharmaceuticals, urban forests, soil health, plant pests, and our natural environs. Plant Science students study biology, plant morphology and physiology, chemistry, entomology, physics, soil and water sciences, plant identification, plant pathology, plant propagation, and environmental horticulture.

## About this Program

- **College:** Agricultural and Life Sciences (<http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL>)
- **Degree:** Bachelor of Science
- **Specializations:** General Plant Science ([http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS\\_BS/PLS\\_BS12](http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS_BS/PLS_BS12)) | Greenhouse and Landscape Industries ([http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS\\_BS/PLS\\_BS13](http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS_BS/PLS_BS13)) | Native Plant Conservation ([http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS\\_BS/PLS\\_BS14](http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS_BS/PLS_BS14)) | Plant Breeding and Genetics (p. 1) | Plant Health and Protection ([http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS\\_BS/PLS\\_BS16](http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS_BS/PLS_BS16)) | Soil Management and Plant Productivity ([http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS\\_BS/PLS\\_BS17](http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS_BS/PLS_BS17)) | Sustainable Crop Production ([http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS\\_BS/PLS\\_BS18](http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS_BS/PLS_BS18)) | Turfgrass Science ([http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS\\_BS/PLS\\_BS19](http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/PLS_BS/PLS_BS19))
- **Credits for Degree:** 120
- **More Info**

*To graduate with this major, students must complete all university, college, and major requirements.*

## Related Programs

- Combination Degrees
- Environmental Horticulture Management Certificate
- Environmental Horticulture Minor
- Golf and Sports Turf Management Minor

The plant science degree offers diverse specializations that provide a wide range of professional opportunities. The specializations provide students with an interdisciplinary perspective of these areas and pursue coursework that tracks them into a variety of job opportunities.

The University of Florida offers some of the specializations in this major to transfer students who have the appropriate credentials through the statewide programs at the Fort Lauderdale Research and Education Center in Ft. Lauderdale, the Mid-Florida Research and Education Center in Apopka, or the West Florida Research and Education Center in Milton.

## Course Requirements

All students, regardless of specialization, are required to take an introductory plant science course, an introductory statistics course, an economics course, a technical writing course, a speech course, a soil science course, a plant physiology course, a plant pathology course, a professional development course, and a capstone experience course. All students must also complete an internship related to their area of interest.

Each specialization has a specific set of required core courses and a number of upper-division electives to choose from that represent important interdisciplinary topic areas. Core courses provide students with the knowledge and fundamental concepts essential to the specialization. Upper-division electives are designed to build knowledge, competency and skills applicable to professional development.

Students should meet with an advisor as early as possible in their academic careers to choose their specialization and to plan their course of study.

## Specializations

### General Plant Science

This specialization focuses on the biology and science of growing plants. It combines courses in propagation, plant identification and use, soils and plant nutrition, plant diseases, weed identification, and insects to give students a well-rounded background on plant management. This specialization develops skills that allow students to increase plant productivity and improve plant quality with less labor while controlling pests and weeds safely and effectively. Career opportunities include research and development, plant management, plant production, and preparation for graduate school. Employment opportunities exist in laboratories, government agencies, and commercial operations.

### Greenhouse and Landscape Industries

This specialization provides skills and training for employment in the diverse ornamental horticulture industry, including theme parks, plant production facilities, and landscape management and landscape design firms. It studies the improvement of the human environment through proper selection, propagation, production, and placement of plants in the exterior and interior landscapes. It also combines business and plant production courses to provide the skills needed to manage a plant production facility or landscape firm.

### Native Plant Conservation

This specialization prepares students to apply concepts of plant conservation and ecology to control invasive plants and establish, manage, and protect native plant communities, primarily in natural areas. Students also develop skills necessary for native plant propagation for ecological restoration and sustainable landscapes.

### Plant Breeding and Genetics

Plant breeding and genetics play a critical role in enhancing the world's future food, fiber, and fuel supplies in response to challenges like climate change and population growth. Students will obtain a solid grounding in genetics and molecular genetics, plant processes and function, types and causes of plant stress and learn how this is applied for crop improvement and conservation of genetic resources. Modern plant breeding is an increasingly sophisticated, high-investment business. The majority of commercial plant breeding takes place within the private sector. Plant breeders are employed in plant breeding or agricultural biotechnology companies or academic institutions with the main goal to develop improved varieties or educate the general population about genetic techniques for plant improvement.

### Plant Health and Protection

This specialization is designed for students who want to pursue careers related to plant health management in the public or private sector. It will prepare students for entry into the workplace in insect and disease control, plant diagnostics, crop production management, plant pathology and entomology research, plant growth consulting, integrated pest

management, cooperative extension or to pursue advanced degrees in plant pathology, entomology, plant medicine, or other related disciplines.

### Soil Management and Plant Productivity

This specialization closely integrates the study of soil science core disciplines with production agriculture and horticulture. Coursework focuses on foundational principles related to soil health, productivity, and fertility in relation to sustainable plant growth and agricultural practices. Among the principal outcomes of the program is to prepare students for certification as both Associate Professional Soil Scientists and Certified Crop Advisors to better position graduates for employment in related fields.

### Sustainable Crop Production

This specialization prepares students for professions related to crop production and management. Students will explore and understand production practices that meet present world food needs without compromising quality of life for future generations. Courses emphasize crop ecosystem function, aquatic and terrestrial weed management, the importance of insects to crops and optimizing management techniques including energy utilization, nutrient management, and soil and water conservation.

### Turfgrass Science

This specialization combines the study of grasses, soils, water, and pests affecting turf with the study of business and management. Career opportunities include work with golf courses, sports turf facilities, lawn-care companies, parks, agrichemical industries, cemeteries, environmental consulting firms, sod farms, government agencies, and preparation for graduate school.

## Plant Breeding and Genetics

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### Critical Tracking

Critical Tracking records each student's progress in courses that are required for progress toward each major. Please note the critical-tracking requirements below on a per-semester basis.

Equivalent critical-tracking courses as determined by the State of Florida Common Course Prerequisites (<http://www.flvc.org/cpp/displayRecord.jsp?cip=011101&track=01>) may be used for transfer students.

### Semester 1

- Complete 2 of 6 critical-tracking courses, excluding labs: BOT 2010C or BSC 2010/BSC 2010L; BOT 2011C or BSC 2011/BSC 2011L; CHM 2045/CHM 2045L; CHM 2046/CHM 2046L; ECO 2013; MAC 1147

- 2.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

### Semester 2

- Complete 1 additional critical-tracking course, excluding labs
- 2.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

### Semester 3

- Complete 2 additional critical-tracking courses, excluding labs
- 2.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

### Semester 4

- Complete 1 additional critical-tracking course, excluding labs
- 2.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

### Semester 5

- Complete all critical-tracking courses, including labs
- 2.0 GPA required for all critical-tracking courses
- 2.0 upper division GPA required
- 2.0 UF GPA required

### Semester 6

- Complete AGR 4320 and BCH 3025 or BCH 4024
- 2.0 upper division GPA required
- 2.0 UF GPA required

### Semester 7

- Complete PLP 3002C and PLS 3223 and PLS 3223L
- 2.0 upper division GPA required
- 2.0 UF GPA required

### Semester 8

- Complete AEB 4126 and PLS 4950
- 2.0 upper division GPA required
- 2.0 UF GPA required

### Model Semester Plan

To remain on track, students must complete the appropriate critical-tracking courses, which appear in bold. These courses must be completed by the terms as listed above in the Critical Tracking criteria.

*This semester plan represents an example progression through the major. Actual courses and course order may be different depending on the student's academic record and scheduling availability of courses. Prerequisites still apply.*

| Course              | Title   | Credits |
|---------------------|---|---------|
| <b>Semester One</b> |   |         |
| Select one:         |   | 3-4     |
| BOT 2010C           | Introductory Botany ( <b>Critical Tracking</b> ; State Core Gen Ed Biological Sciences and Physical Sciences) |         |

|   |  |       |
|---|--|-------|
| BSC 2010 & 2010L  | Integrated Principles of Biology 1 and Integrated Principles of Biology Laboratory 1 ( <b>Critical Tracking</b> ; State Core Gen Ed Biological Sciences and Physical Sciences)   |       |
| ENC 1101  | Expository and Argumentative Writing (State Core Gen Ed Composition ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> ); Writing Requirement: 6,000 words) | 3     |
| MAC 1147  | Precalculus Algebra and Trigonometry ( <b>Critical Tracking</b> ; State Core Gen Ed Mathematics)   | 4     |
| MUL 2010  | Experiencing Music (State Core Gen Ed Humanities and International)  | 3     |
|   | Credits  | 13-14 |
| <b>Semester Two</b>   |  |       |
| Quest 1 (Gen Ed Humanities)                                   |  | 3     |
| Select one:   |  | 4     |
| BOT 2011C   | Plant Diversity ( <b>Critical Tracking</b> ; Gen Ed Biological Sciences and Physical Sciences)   |       |
| BSC 2011 & 2011L  | Integrated Principles of Biology 2 and Integrated Principles of Biology Laboratory 2 ( <b>Critical Tracking</b> ; Gen Ed Biological Sciences and Physical Sciences)  |       |
| ENC 2210  | Technical Writing (Gen Ed Composition; Writing Requirement: 6,000 words)   | 3     |
| STA 2023  | Introduction to Statistics 1 (Gen Ed Mathematics)  | 3     |
|   | Credits  | 13    |
| <b>Semester Three</b>   |  |       |
| Quest 2 (Gen Ed Social and Behavioral Sciences and Diversity) |  | 3     |
| AEC 3030C or SPC 2608   | Effective Oral Communication or Introduction to Public Speaking  | 3     |
| CHM 2045 & 2045L  | General Chemistry 1 and General Chemistry 1 Laboratory ( <b>Critical Tracking</b> ; State Core Gen Ed Biological and Physical Sciences)  | 4     |
| ECO 2013  | Principles of Macroeconomics ( <b>Critical Tracking</b> ; State Core Gen Ed Social and Behavioral Sciences)  | 4     |
|   | Credits  | 14    |
| <b>Semester Four</b>  |  |       |
| AGR 3303  | Genetics   | 3     |
| CHM 2046 & 2046L  | General Chemistry 2 and General Chemistry 2 Laboratory ( <b>Critical Tracking</b> ; Gen Ed Biological Sciences and Physical Sciences)  | 4     |
| SWS 3022 & 3022L  | Introduction to Soils in the Environment and Introduction to Soils in the Environment Laboratory   | 4     |
| Approved elective   |  | 3     |
|   | Credits  | 14    |
| <b>Summer After Semester Four</b>                             |  |       |
| CHM 2210  | Organic Chemistry 1  | 3     |
| Elective (Writing Requirement: 6,000 words)                   |  | 3     |
|   | Credits  | 6     |
| <b>Semester Five</b>  |  |       |
| CHM 2211 & 2211L  | Organic Chemistry 2 and Organic Chemistry Laboratory   | 5     |
| PLS 3004C   | Principles of Plant Science  | 3     |

|   |  |     |
|---|--|-----|
| Ethical and social issues elective      |  | 3   |
| Production agriculture elective         |  | 3   |
|   | Credits  | 14  |
| <b>Semester Six</b>                     |  |     |
| AGR 4320                                | Plant Breeding ( <b>Critical Tracking</b> )  | 3   |
| BCH 3025 or BCH 4024                    | Fundamentals of Biochemistry ( <b>Critical Tracking</b> ) or Introduction to Biochemistry and Molecular Biology  | 4   |
| MCB 3020 & 3020L                        | Basic Biology of Microorganisms and Laboratory for Basic Biology of Microorganisms   | 4   |
| Molecular biology and genetics elective |  | 3   |
|   | Credits  | 14  |
| <b>Summer After Semester Six</b>        |  |     |
| PLS 4941                                | Practical Work Experience  | 3   |
|   | Credits  | 3   |
| <b>Semester Seven</b>                   |  |     |
| PLP 3002C                               | Fundamentals of Plant Pathology ( <b>Critical Tracking</b> )   | 4   |
| PLS 3223 & 3223L                        | Plant Propagation and Plant Propagation Laboratory ( <b>Critical Tracking</b> )  | 3   |
| Ecology and the environment elective    |  | 3   |
| Molecular biology and genetics elective |  | 3   |
| Production agriculture elective         |  | 3   |
|   | Credits  | 16  |
| <b>Semester Eight</b>                   |  |     |
| AEB 4126                                | Agricultural and Natural Resource Ethics ( <b>Critical Tracking</b> ; Gen Ed Humanities or Social and Behavioral Sciences; Writing Requirement: 6,000 words) | 3   |
| AGR 4304                                | Plant Chromosomes and Genomes  | 3   |
| AGR 4512                                | Physiology and Ecology of Crops  | 3   |
| PLS 4950                                | Plant Science Capstone ( <b>Critical Tracking</b> )  | 3   |
| ORH 4933                                | Professional Seminar in Environmental Horticulture   | 1   |
|   | Credits  | 13  |
|   | Total Credits  | 120 |

## Approved Electives | Minimum 21 Credits

Choose courses from each focus area; minimum credits for each area listed below. Students must consult with their advisor for assistance in selecting the designated listed electives in order to take applicable and appropriate courses for the students' job and career aspirations. Consult an advisor for other options, which may include study abroad courses.

### Molecular Biology and Genetics | Minimum 6 Credits

| Code      | Title   | Credits |
|-----------|---|---------|
| HOS 3305  | Introduction to Plant Molecular Biology         | 3       |
| HOS 4313C | Laboratory Methods in Plant Molecular Biology   | 2       |
| MCB 4304  | Genetics of Microorganisms                      | 3       |
| MCB 4320C | The Microbiome                                  | 3       |
| MCB 5305L | Microbial Genetics and Biotechnology Laboratory | 2       |
| PCB 4522  | Molecular Genetics                              | 3       |

## Production Agriculture | Minimum 6 Credits

| Code             | Title  | Credits |
|------------------|--|---------|
| AGR 4212         | Alternative Cropping Systems   | 3       |
| AGR 4214C        | Applied Field Crop Production  | 3       |
| AGR 4231C        | Forage Science and Range Management  | 4       |
| AGR 4932         | Agronomy Topics (Tropical Cropping Systems)  | 3       |
| AOM 3734         | Irrigation Principles and Practices in Florida   | 3       |
| AOM 4434         | Precision Agriculture  | 3       |
| AOM 4455         | Agricultural Operations and Systems  | 3       |
| HOS 3281C        | Organic and Sustainable Crop Production  | 3       |
| HOS 4283C        | Advanced Organic and Sustainable Crop Production   | 3       |
| PLS 4242C        | Micropropagation of Horticultural Crops  | 4       |
| SWS 3022 & 3022L | Introduction to Soils in the Environment and Introduction to Soils in the Environment Laboratory | 4       |

## Ecology and the Environment | Minimum 3 Credits

| Code      | Title                                  | Credits |
|-----------|--|---------|
| ALS 3133  | Agricultural and Environmental Quality | 3       |
| ALS 3153  | Agricultural Ecology                   | 3       |
| ALS 4154  | Global Agroecosystems                  | 3       |
| EES 4103  | Applied Ecology                        | 2       |
| EVS 3000  | Environmental Science                  | 3       |
| PCB 3601C | Plant Ecology                          | 3       |
| PCB 4043C | General Ecology                        | 4       |

## Ethical and Social Issues | Minimum 3 Credits

| Code     | Title                                 | Credits |
|----------|---------------------------------------|---------|
| AEB 4123 | Agricultural and Natural Resource Law | 3       |
| AGG 3501 | Environment, Food and Society         | 3       |
| IDS 2154 | Facets of Sustainability              | 3       |
| PHM 3032 | Ethics and Ecology                    | 3       |
| POT 3503 | Environmental Ethics and Politics     | 3       |

## Other Advisor-Approved Electives | Minimum 3 Credits

### Academic Learning Compact

The plant science major, offered jointly by the departments of Agronomy and Plant Pathology, enables students to apply principles associated with production and improvement of agronomic crops. Students will acquire knowledge about the scientific fundamentals of plant growth of field and forage crops. They will acquire knowledge about fungi, bacteria and viruses, as well as environmental factors that cause plant disease. This program prepares students to work in the lab and field settings and to develop applied skills for research and extension.

## Before Graduating Students Must

- Complete a research paper and an oral presentation with satisfactory faculty evaluation.
- Achieve minimum grades of C in AEC 3030C and AEC 3033C. These courses are graded using rubrics developed by a faculty team.
- Complete requirements for the baccalaureate degree, as determined by faculty.

## Students in the Major Will Learn to Student Learning Outcomes (SLOs)

### Content

1. Describe plant growth and development in terms of plant morphology and physiology and evaluate the abiotic and biotic factors that impact plant growth and management.
2. Recommend practices that growers and managers can implement to address the abiotic and biotic components of their cropping system.

### Critical Thinking

3. Analyze and apply science-based data to solve problems in plant production, distribution and/or utilization.
4. Design and evaluate a project that addresses a problem or challenge related to their area of interest.

### Communication

5. Create, interpret and analyze written text and multimedia presentations.
6. Communicate effectively through oral and multimedia presentations.

## Curriculum Map

*I = Introduced; R = Reinforced; A = Assessed*

| Courses    | SLO 1 | SLO 2 | SLO 3 | SLO 4 | SLO 5   | SLO 6   |
|------------|-------|-------|-------|-------|---------|---------|
| AEC 3030C  |       |       |       |       |         | I, R, A |
| AEC 3033C  |       |       |       |       | I, R, A |         |
| PLS 3004C  | I     | I     | I     |       |         |         |
| PLS 4932 A | A     | A     | A     | A     | A       | A       |
| PLS 4941 R | R     | R     | R     | R     | R       | R       |

## Assessment Types

- Standardized post-test
- Capstone and individual projects
- Final grades