Botany and Plant Sciences

Subject abbreviation: BPSC
College of Natural and Agricultural Sciences

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Professors
Edith B. Allen, Ph.D. Community/Restoration Ecology
Julia N. Bailey-Serres, Ph.D. Genetics
Xuemei Chen, Ph.D. Plant Cell and Molecular Biology
Timothy J. Close, Ph.D. Genetics
Darleen A. DeMason, Ph.D. Botany
Norman C. Elfrstrand, Ph.D. Genetics
Ezequiel Ezcurre, Ph.D. Ecology
Jodie S. Holt, Ph.D. Plant Physiology
Anthony H. C. Huang, Ph.D. Plant Cell and Molecular Biology

Bai-Lian “Larry” Li, Ph.D. Ecology
Carol J. Lovatt, Ph.D. Plant Physiology
Adam J. Lukaszewski, Ph.D. Genetics
Eugene A. Nothnagel, Ph.D. Plant Physiology
Natasha Rainkehl, Ph.D. Ernst and Helen Leibacher Chair; Plant Cell Biology
Mikel L. Roose, Ph.D. Genetics
J. Giles Waines, Ph.D. Genetics
Linda L. Walling, Ph.D. Genetics
Susan Wessler, Ph.D. Distinguished Professor of Genetics
Shizhong Xu, Ph.D. Plant Biology

Professors Emeriti
Charles W. Coggins, Jr., Ph.D.
Arturo Gómez-Pompa, Ph.D.
Anthony E. Hall, Ph.D.
Robert L. Heath, Ph.D. Plant Physiology and Biophysics
Lowell S. Jordan, Ph.D.
Charles K. Labanauskas, Ph.D.
Elizabeth M. Lord, Ph.D. Botany/Developmental Biology
Rainer W. Scora, Ph.D.
William W. Thomson, Ph.D.
Irwin P. Ting, Ph.D.

Associate Professor
Sean Cutler, Ph.D. Plant Cell Biology
Thomas A. Eulgem, Ph.D. Plant Cell Biology
Thomas Girke, Ph.D. Bioinformatics
Patricia S. Springer, Ph.D. Genetics

Assistant Professors
Venugopala R. Gorelah, Ph.D. Plant Cell Biology
Damel Jenettette, Ph.D. Landscape Ecology
Renyi Liu, Ph.D. Evolutionary Genomics
Louis Santiago, Ph.D. Physiological Ecosystems
Matthew S.H. “Harley” Smith, Ph.D. Plant Cell Biology

Lecturers
Mary Lu Arpaia, Ph.D. Subtropical Horticulture
James Baird, Ph.D. Turfgrass Horticulture
David A. Grantz, Ph.D. Agronomy and Plant Physiology
Milton E. McGiffen, Jr., Ph.D.
Vegetable Crops/Plant Physiology
Alan McHughen, Ph.D. Plant Biotechnology
Donald J. Merhaut, Ph.D.
Horticulture and Floriculture

Affiliated Emeriti
Junji Kumatomo, Ph.D. (Chemist Emeritus)

Cooperating Faculty
Michael Allen, Ph.D., (Plant Pathology and Microbiology)
Hailing Jin, Ph.D. (Plant Pathology and Microbiology)
Iagoshi Kaloshian, Ph.D. (Nematology)
David R. Parker, Ph.D. (Environmental Sciences)
Joel Sachs, Ph.D. (Biology)

Major
The mission of the interdepartmental Undergraduate Program in Plant Biology is to provide students with a solid background in modern principles and research practices of basic Plant Biology and in their area of specialization.

Courses prerequisite to the major, courses used to satisfy major requirements, and the GPA (for B.S. degree) related to the major must be taken for letter grades. Students may elect to take other courses on a Satisfactory (S)/No Credit (NC) basis. Refer to the Academic Regulations section of this catalog for additional information on “S/NC” grading.

Information about this program is available from the CNAS Academic Advising Center (1223 Pierce Hall, Monday through Friday, 9 a.m. to noon and 1 to 4 p.m., [951] 827-7294).

Transfer Students
Students planning to transfer to UCR with a major in Plant Biology must have a minimum GPA of 2.7 in transferable college courses and “C” or higher grades in a year sequence of general chemistry and in courses equivalent to our BIOL 005A, BIOL 005B. We also recommend that transfer students complete a year of college calculus before admission. Exceptions may be granted by the faculty advisor.

University Requirements
See Undergraduate Studies section.

College Requirements
See College of Natural and Agricultural Sciences, Colleges and Programs section.

Some of the following requirements for the major may also fulfill some of the college’s breadth requirements. Consult with a department advisor for course planning.

Major Requirements
The major requirements for the B.S. and B.A. degrees in Plant Biology are as follows:

1. Life Sciences core requirements (68-72 units)
   Students must complete all required courses with a grade of “C-” or better and add a cumulative GPA in the core courses of at least 2.0. Grades of “D” or “F” in two core courses, either separate courses or repetitions of the same course, are grounds for discontinuation from the major.
   a) BIOL 005A, BIOL 005LA, BIOL 005B, BIOL 005C
   b) CHEM 001A, CHEM 001B, CHEM 001C, CHEM 01LA, CHEM 01LB, CHEM 01LC, CHEM 112A, CHEM 112B, CHEM 112C
   c) MATH 008B or MATH 009A, MATH 009B (MATH 009C recommended)
   d) PHYS 002A, PHYS 002B, PHYS 002C, PHYS 02LA, PHYS 02LB, PHYS 02LC
   e) STAT 100A
   f) BCH 100 or BCH 110A (BCH 110A is strongly recommended)

Note for the B.S. degree, courses in Statistics and Biochemistry taken as part of the core may count toward the 16 units from an area of specialization. For the B.A. degree, courses in Statistics and Biochemistry taken as part of the core may not count toward the 12 units required from an area of specialization.

2. Upper-division requirements (40-52 units)
   A GPA of at least 2.0 in upper-division courses taken in the field of the major is a graduation requirement. A student is subject to discontinuation from the major whenever
Areas of Specialization

Individual student career goals may be achieved by selecting an area of specialization within the diverse disciplines of botany and plant sciences. Adjustments within these programs can be made to accommodate students’ interests. Students must consult with a faculty advisor to clarify educational goals and to plan a program of study.

1. Plant Cellular, Molecular, and Developmental Biology
   a) BPSC 135
   b) Additional units from the following to meet either the B.S. or B.A. requirement: BCH 102, BCH 110B, BCH 110C or BIOL 107A, BIOL 107B, BIOL 108, BIOL 112/MCLB 121, BIOL 121/MCLB 121, BIOL 123/MCLB 121, BIOL 123/MCLB 123, BPSC 120, BPSC 148, BPSC 155, BPSC 156, BPSC 159, BPSC 180, CBNS 101, CBNS 108

2. Plant Genetics, Breeding, and Biotechnology
   a) BPSC 150
   b) Additional units from the following to meet either the B.S. or B.A. requirement: BCH 153, BCH 158, BPSC 153, BIOL 105, BIOL 107A, BIOL 107B, BIOL 108, BIOL 119, BIOL 148/BPSC 148, BIOL 155/BPSC 155, BPSC 135, BPSC 158, BPSC 185, CBNS 108

3. Ecology, Evolution, and Systematics
   a) BPSC 146
   b) Additional units from the following to meet either the B.S. or B.A. requirement: ANTH 170/BPSC 170, BIOL 105, BIOL 108, BIOL 112/BPSC 112/ENTS 112, BIOL 116, BIOL 116L, BIOL 117, BIOL 138/BPSC 138, BIOL 165/BPSC 165, BPSC 134/ENTS 134/SWSC 134, BPSC 158, BPSC 166, BPSC 185, ENSC 100/SWSC 100, GEO 151, GEO 153, GEO 169

4. Plant Pathology, Nematology, and Pest Management
   a) BIOL 120/MCLB 120/PLPA 120
   b) Additional units from the following to meet either the B.S. or B.A. requirement: BCH 183/BPSC 183, BIOL 121/MCLB 121, BIOL 121/MCLB 121L, BIOL 124/MCLB 124, BIOL 124/MCLB 124L, BIOL 134/PLPA 134, BIOL 134L/PLPA 134L, BIOL 159/NEM 159, BPSC 135, BIOL 132/BPSC 132, BIOL 138/BPSC 138, BIOL 143/BPSC 143, BPSC 133, BPSC 158, BPSC 166, ENSC 134/SWSC 134/BPSC 134, ENST 100/BIOL 100, ENTS 109, ENTS 124/ENTS 124L, BPSC 138, BIOL 143/BPSC 143, BPSC 133

Minor

The minor in Plant Biology allows students majoring in other departments to obtain in-depth training in Plant Biology.

Requirements for the minor in Plant Biology are as follows:

1. BIOL 104/BPSC 104 (4 units)
2. One course (4–5 units) from the following: BIOL 132/BPSC 132, BIOL 138/BPSC 138, BIOL 143/BPSC 143, BPSC 133
3. Twelve (12) to 20 units from the following: ANTH 170/BPSC 170, BCH 183, BIOL 153/BIOI 153/BPSC 153, BIOL 132/BPSC 132, BIOL 138/BPSC 138, BIOL 143/BPSC 143, BIOL 148/BPSC 148, BPSC 148, BIOL 155/BPSC 155, BIOL 165/BPSC 165, BPSC 133, BPSC 134/SWSC 134, BPSC 135, BPSC 146, BPSC 150, BPSC 158, BPSC 166, BPSC 190, BPSC 195H, BPSC 197, BPSC 198-I, BPSC 199, PLPA 120/BIOI 120/MCLB 120

Note: No more than 4 units of BPSC 190–199 may be used to fulfill this requirement. The course used to fulfill the requirement in 2. cannot also be used to fulfill the requirement in 3. See Minors under the College of Natural and Agricultural Sciences in the Colleges and Programs section of this catalog for additional information on minors.

Graduate Program

The Department of Botany and Plant Sciences offers programs leading to the M.S. degree in Plant Biology with two tracks, Botany or Plant Science, and a program leading to Ph.D. degrees in Plant Biology or Plant Biology (Plant Genetics)*. Research in these programs can focus on basic and/or applied questions.

Admission Applicants who have a baccalaureate degree and who satisfy the general requirements of the university listed in the Graduate Studies section of this catalog are considered for admission to graduate status. Students applying to the Ph.D. program and domestic applicants to the M.S. program must submit GRE General Test scores (verbal, quantitative, and analytical).

Regardless of the area of their major for the baccalaureate degree, students must have had, or complete soon after entering graduate school the following:

1. A year of course work in general biology and general chemistry
2. A course in genetics, biochemistry, and calculus
3. Two courses in physics and/or statistics.

Credit from these courses does not count toward the graduate degree.

Immediately after being admitted, each student should identify a faculty advisor and consult with that advisor or the graduate advisor regarding educational goals; scheduling initial course work and possible lab rotations; and forming a guidance committee. Further guidance on these matters is provided in the Botany and Plant Sciences Graduate Student Handbook.

Master's Degree

The Department of Botany and Plant Sciences offers programs leading to the M.S. degree in Plant Biology with tracks in Botany or Plant Science.

The master’s degree may be earned under Plan I (Thesis) or Plan II (Comprehensive Examination). Students must meet all general requirements of the Graduate Division. The detailed course program is determined by the guidance committee after considering the specific interests of the student. Department requirements are as follows:

Requirements for the minor in Plant Biology are as follows:

1. BIOL 104/BPSC 104 (4 units)
2. One course (4–5 units) from the following: BIOL 132/BPSC 132, BIOL 138/BPSC 138, BIOL 143/BPSC 143, BPSC 133
3. Twelve (12) to 20 units from the following: ANTH 170/BPSC 170, BCH 183, BIOL 153/BIOI 153/BPSC 153, BIOL 132/BPSC 132, BIOL 138/BPSC 138, BIOL 143/BPSC 143, BIOL 148/BPSC 148, BPSC 148, BIOL 155/BPSC 155, BIOL 165/BPSC 165, BPSC 133, BPSC 134/SWSC 134, BPSC 135, BPSC 146, BPSC 150, BPSC 158, BPSC 166, BPSC 190, BPSC 195H, BPSC 197, BPSC 198-I, BPSC 199, PLPA 120/BIOI 120/MCLB 120

Note: No more than 4 units of BPSC 190–199 may be used to fulfill this requirement. The course used to fulfill the requirement in 2. cannot also be used to fulfill the requirement in 3. See Minors under the College of Natural and Agricultural Sciences in the Colleges and Programs section of this catalog for additional information on minors.
Plan I (Thesis)
1. Three courses from Section I of either the Botany track or the Plant Science track M.S. list
2. Two courses from Section II. In fulfilling the Section II requirement, students may use no more than one course cross-listed by Botany and Plant Sciences and another program. If such a cross-listed course is used toward fulfilling the Section II requirement, the same course may not be used toward fulfilling the Section I or III requirements.
3. At least 6 units from Section III of either the Botany track or Plant Science track M.S. list
4. Preparation of a thesis (not more than 12 units from Section V may apply toward the degree)

If the student takes research courses from Section IV, no more than 6 units may be applied toward the degree. Students who have taken courses comparable to those in Section I during their baccalaureate training may have a portion or all of this section waived. In such instances, however, it is expected that their programs include increased units in courses from Sections II, III, and/or IV. Recommendations for waivers should specify alternative courses and should be sent to the department educational advisory committee for approval.

Plan II (Comprehensive Examination)
1. Three courses from Section I of either the Botany track or Plant Science track M.S. list
2. Two courses from Section II. In fulfilling the Section II requirement, students may use no more than one course cross-listed by Botany and Plant Sciences and another program. If such a cross-listed course is used toward fulfilling the Section II requirement, the same course may not be used toward fulfilling the Section I or III requirements.
3. At least 12 units from Section III of either the Botany track or Plant Science track M.S. list
4. At least 6 units from Section IV for a research project or literature review, which should be described in a report to be submitted for evaluation by the comprehensive examination committee
5. Comprehensive written and oral examinations

Students who have taken courses comparable to those in Section I during their baccalaureate training may have a portion or all of this section waived. In such instances, however, it is expected that their programs include increased units in courses from Section II and/or III. Recommendations for waivers should specify alternative courses and should be sent to the educational advisory committee for approval.

Seminar Requirement
All full-time students must enroll in the BPSC 250 seminar during each quarter in which it is offered. Part-time students must take one BPSC 250 seminar for every 12 units of courses. One quarter per year, students may enroll in an equivalent seminar course as a replacement for the BPSC 250 seminar course. All students must present at least one BPSC 250 seminar and complete at least two quarters of BPSC 240 (or equivalent).

Courses available for fulfilling the requirement for the M.S. degree:

Section I — Upper-division undergraduate courses:


Section II — Graduate and upper-division undergraduate courses in related departments or programs: applicable courses are determined by the educational advisory committee and require approval of the graduate advisor.

Section III —

Botany track: BCH 205/BPSC 205/CMDB 205/GEN 205/MCBL 205/PLPA 205, BCH 231/BPSC 231, BPSC 201 (E-Z) (for a maximum of 2 units), BPSC 210, BPSC 230, BPSC 232, BPSC 234, BPSC 237, BPSC 239, BPSC 240 (only if taken in addition to the required seminar units; see seminar requirement), BPSC 243, BPSC 245, BPSC 247

Plant Science track: BCH 205/BPSC 205/CMDB 205/GEN 205/MCBL 205/PLPA 205, BCH 231/BPSC 231, BPSC 201 (E-Z) (for a maximum of 2 units), BPSC 221, BPSC 222, BPSC 232, BPSC 234, BPSC 237, BPSC 239, BPSC 240 (only if taken in addition to the required seminar units; see seminar requirement), BPSC 243, BPSC 245, BPSC 247

Section IV — Research courses: BPSC 290 and BPSC 297

Section V — Thesis research: BPSC 299, Thesis for Plan I

Normative Time to Degree
7 quarters

Doctoral Degree
The Department of Botany and Plant Sciences offers programs leading to Ph.D. degrees in Plant Biology or Plant Biology (Plant Genetics)*.

The student must meet the general requirements of the Graduate Division.

* The Plant Biology (Plant Genetics) program is in the process of being phased out and replaced by a concentration in Plant Genetics within the Plant Biology program.

Admission
Either prior to entering the graduate program or before advancement to candidacy, students must have completed the equivalent of BPSC 104 and one other course from the core plant biology courses (BIOL 107A, BPSC 132, BPSC 135, BPSC 138, BPSC 143, BPSC 146). Course requirements for each student are determined by individual guidance committees and by the educational advisory committee. No later than the second quarter in residence, students must meet with a guidance committee to (1) determine a course program to be submitted to the educational advisory committee, and (2) choose a major area of specialization and two minor areas.

Course Work
Guidance committees and students should design individual course programs that meet the specific needs of the student and the requirements of the Ph.D. program. Course programs should prepare students for the qualifying examination and dissertation research. All first-year students must enroll in BPSC 200A and BPSC 200B during their first Fall and Winter quarters. Students must take a minimum of 12 additional graduate-level units relevant to the specialization. Graduate courses taken previously may be considered towards fulfilling this requirement. Students’ course programs must be approved by the educational advisory committee. At the time of submission of course programs to the educational advisory committee, the area of specialization and two minor areas to be covered on the qualifying examination should be specified. Students may petition to change the course program, area of specialization, or minor areas at any time.

Students entering the Plant Biology Ph.D. program have four choices, as listed below. Students with a general interest in plant biology and/or evolution are encouraged to choose the first.

Ph.D. in Plant Biology
Students who choose to obtain a Ph.D. in Plant Biology without one of the following concentrations are encouraged to —

Ph.D. in Plant Biology (Concentration in Plant Cell, Molecular, and Developmental Biology) To earn the concentration in Plant Cell, Molecular, and Developmental Biology (appears on the transcript only), students must complete BPSC 231, BPSC 232, and BPSC 237. In addition, the required BPSC 240 course must be on a topic related to the concentration.