Plant Physiology

See Plant Biology, on page 509; and Plant Biology (A Graduate Group), on page 511.

Plant Sciences

[College of Agricultural and Environmental Sciences]

Plant Physiology

Maciei Zwieneriek, Ph.D., Associate Professor
Emeriti Faculty

Steffen Abel, Ph.D., Professor Emeritus
Husein Ajwo, Ph.D., Specialist in Cooperative Extension, Emeritus
Michael G. Badger, Ph.D., Professor Emeritus
Academic Senate Distinguished Teaching Award
Frederick A. Bliss, Ph.D., Professor Emeritus
R. William Breidenbach, Ph.D., Lecturer Emeritus
Ivan V. Buddenhagen, Ph.D., Professor Emeritus
David W. Burger, Ph.D., Professor Emeritus
William J. Clawson, M.S., Specialist in Cooperative Extension, Emeritus
Montague W. DesGroseillers, Ph.D., Professor Emeritus
Theodore M. Dejong, Ph.D., Professor Emeritus
R. Ford Denison, Ph.D., Professor Emeritus
Don J. Durzan, Ph.D., Professor Emeritus
Clyde L. Elmore, Ph.D., Specialist in Cooperative Extension, Emeritus
Theodore C. Foin, Jr., Ph.D., Professor Emeritus
Shu Geng, Ph.D., Professor Emeritus
Melvin George, Ph.D., Specialist in Cooperative Extension, Emeritus
William H. Griggs, Ph.D., Professor Emeritus
James A. Harding, Ph.D., Professor Emeritus
Charles E. Hess, Ph.D., Professor Emeritus
James E. Hill, Ph.D., Specialist in Cooperative Extension, Emeritus
Ray C. Hultaker, Ph.D., Professor Emeritus
Les Jackson, Ph.D., Specialist in Cooperative Extension, Emeritus
Subodi K. Jain, Ph.D., Professor Emeritus
R. Scott Johnson, Ph.D., Specialist in Cooperative Extension, Emeritus
Milton B. Jones, Ph.D., Lecturer Emeritus
John M. Labavitch, Ph.D., Professor Emeritus
W. Thomas Lainini, Ph.D., Lecturer Emeritus
William C. Liebhardt, Ph.D., Specialist in Cooperative Extension, Emeritus
Muhammad Marrush, Ph.D., Lecturer Emeritus
George C. Martin, Ph.D., Professor Emeritus
Gale H. McGregor, Ph.D., Specialist in Cooperative Extension, Emeritus
Warren C. Micke, M.S., Specialist in Cooperative Extension, Emeritus
Donald J. Nawins, Ph.D., Professor Emeritus
Robert F. Norris, Ph.D., Professor Emeritus
Jack L. Paul, Ph.D., Professor Emeritus
Donald A. Phillips, Ph.D., Professor Emeritus
Richard F. Plant, Ph.D., Professor Emeritus
Vito S. Politio, Ph.D., Professor Emeritus
Calvin O. Quailset, Ph.D., Professor Emeritus
Carlos F. Quiros, Ph.D., Professor Emeritus
Charles A. Ragsdale, Ph.D., Professor Emeritus
D. William Rains, Ph.D., Professor Emeritus
David E. Ramos, Ph.D., Specialist in Cooperative Extension, Emeritus
Lawrence R. Raison, Ph.D., Ph.D., Professor Emeritus
Michael S. Reid, Ph.D., Professor Emeritus
Kevin J. Rice, Ph.D., Professor Emeritus
Roger J. Romani, Ph.D., Professor Emeritus
Vincent Kubatzycki, Ph.D., Specialist in Cooperative Extension, Emeritus
Kay Kyugo, Ph.D., Professor Emeritus
Mikal E. Salter, Ph.D., Professor Emeritus
Charles W. Schaller, Ph.D., Professor Emeritus
Douglas V. Shaw, Ph.D., Professor Emeritus
Steven Temple, Ph.D., Specialist in Cooperative Extension, Emeritus
Robert L. Travis, Ph.D., Professor Emeritus
Raymond C. Valentine, Ph.D., Professor Emeritus
Ronald E. Voss, Ph.D., Specialist in Cooperative Extension, Emeritus
Don J. Wulff, Ph.D., Professor Emeritus
Ilana I. Wurtzel, Ph.D., Professor Emeritus
Masatoshi Yamaguchi, Ph.D., Professor Emeritus
Affiliated Faculty
Marita Cantwell, Ph.D., Lecturer and Specialist in Cooperative Extension

Roger T. Chetelat, Ph.D., Lecturer and Agronomist
Carlos H. Crisosto, Ph.D., Lecturer and Specialist in Cooperative Extension
Richard Y. Evans, Ph.D., Lecturer and Specialist in Cooperative Extension
Steven A. Fennimore, Ph.D., Lecturer and Specialist in Cooperative Extension
Louise Ferguson, Ph.D., Lecturer and Specialist in Cooperative Extension
Bradley Hanson, Ph.D., Specialist in Cooperative Extension
Timothy K. Hartz, Ph.D., Lecturer, Agronomist and Specialist in Cooperative Extension
Robert B. Hutmaker, Ph.D., Agronomist and Specialist in Cooperative Extension
Stephen R. Kafk, Ph.D., Lecturer and Specialist in Cooperative Extension
Gurdev Khush, Ph.D., Adjunct Professor
Bruce Lampinen, Ph.D., Lecturer and Specialist in Cooperative Extension
Bruce A. Lingquist, Ph.D., Lecturer and Associate Specialist in Cooperative Extension
Mark E. Lundy, Ph.D., Lecturer and Assistant Specialist in Cooperative Extension
David J. Marsil, Ph.D., Adjunct Professor
Elizabeth J. Mitcham, Ph.D., Lecturer, Pomologist and Specialist in Cooperative Extension
Jeffrey P. Mitchell, Ph.D., Lecturer, Horticulturist and Specialist in Cooperative Extension
Lorence R. Oki, Ph.D., Lecturer and Associate Specialist in Cooperative Extension (Plant Sciences, Human Ecology)
Don E. Farlh, Ph.D., Lecturer, Agronomist and Pomologist
Daniel H. Putnam, Ph.D., Lecturer, Agronomist and Specialist in Cooperative Extension
Leslie M. Roche, Ph.D., Lecturer and Assistant Specialist in Cooperative Extension
Johann W. Six, Ph.D., Adjunct Professor
Trevor V. Suslow, Ph.D., Lecturer, Postharvest Horticulturist and Specialist in Cooperative Extension
Allen Van Deynze, Ph.D., Lecturer and Researcher

Major Programs. See Biotechnology, on page 196, Ecological Management and Restoration, on page 250, Environmental Horticulture and Urban Forestry, on page 324.

Related Courses. See the Biotechnology, Environmental Horticulture, Horticulture and Agronomy, and Plant Biology course listings.

Graduate Study. For related graduate study, see the M.S. degree program in International Agricultural Development, and the Ph.D. degree programs in the graduate groups of Horticulture and Agronomy, Plant Biology, Ecology, Genetics, Geology, and Soils and Biochemistry. See also Graduate Studies, on page 120.

The Major Program

The Plant Sciences major is designed for students who are interested in a scientific understanding of how plants grow and develop in managed agricultural ecosystems and how plant products are utilized for food, fiber and environmental enhancement. Advances in science and technology have provided new insights and options for using plants to address the issues associated with providing renewable food, fiber and energy resources for a growing global population while minimizing adverse impacts on the natural environment. Graduates in Plant Sciences are able to apply their skills and knowledge to a diverse range of agricultural and environmental goals or pursue advanced degrees in plant sciences.

The Program. The curriculum provides depth in the biological and physical sciences and a sound understanding of how plants obtain and utilize resources from their environment to sustain their growth and development. The influences of genetics, management systems and environmental inputs on crop development and productivity are emphasized along with the postharvest preservation and marketing of plant products. Study will develop an area of specialization with options in Crop Production,
B.S. Major Requirements:

Preparatory Subject Matter

UNITs

Biological Sciences 2A, 2B .................................. 10
Plant Sciences 2 ........................................... 4
Chemistry 2A, 2B, 2C ..................................... 15
Chemistry 2A, 11B, 118 ............................. 118C ............... 6-12
Physics 1A, 1B, 7A, 7B, 7C .......................... 6-12
Mathematics 16A, 16B, or 17A, 17B ....... 6-8
Plant Sciences 110 ..................................... 4
Applied Biological Systems Technology 49 or Plant Sciences 49 (recommended) .... 2-3

Depth Subject Matter

UNITs

Plant Sciences 100A, 100B, 100C ................. 9
Plant Sciences 100AL, 100BL, 100CL ....... 6
Plant Sciences 152 ....................................... 4
Evolution and Ecology 100 or Plant Biology 102 or 108 or 143 ........................................... 3-5
Plant Biology 100B or Plant Sciences 147 and 147L or Plant Sciences 150 or Environmental Horticulture 160 and 160L ......................................................... 4
Plant Pathology 120 or Entomology 110 or Nematology 100 or Plant Sciences 105 or Plant Sciences 172 ......................................................... 1-3
Plant Sciences 101 ...................................... 3
Internship or research, must be approved by master adviser ........................................... 3

Areas of Specialization (choose one)

Crop Production Option

UNITs

Complete two courses in pest management not completed for the depth subject matter: Plant Pathology 120, Entomology 110, Nematology 100 or Plant Sciences 105 or 116, Viticulture and Enology 118 ............................. 6-9
Soil Science 100 ......................................... 5
Plant Sciences 171 .................................... 4
Agricultural and Resource Economics 15 or Economics 1A ......................................................... 6

Plant Breeding and Genetics Options

UNITs

Biological Sciences 101 ................................ 4
Plant Sciences 154 .................................... 4
Biotechnology 161 ................................... 3
Biotechnology 162 ................................... 3
Plant Sciences 171 .................................... 4
Restricted Electives ...................................... 4

Postharvest Biology and Technology

UNITs

Plant Sciences 172 .................................... 4
Plant Sciences 173 .................................... 4

Plants 174 .................................................. 3
Plant Sciences 196 .................................... 3
Restricted Electives ...................................... 9
Select from: Agricultural and Resource Economics 100A, 130, Food Science and Technology 107, 109, 131, Plant Sciences 212

Individual Option ........................................ 23
Select a minimum of 25 upper division units, with approval from a faculty adviser, to form a coherent program of study resulting in expertise and competence in a sub-discipline of plant sciences.

Total Units for the Major .................................. 110-135

Major Adviser, Daniel Potter

Advising Center for the major is located in 1200 Plant and Environmental Sciences 330752-1715.

Courses in Plant Sciences (PLS)

(Formerly courses in Agricultural Management and Rangeland Resources, Agronomy, Crop Science and Management, Plant Biology, Pomology, Range Science and Vegetable Crops.)

Lower Division

1. Agriculture, Nature and Society (3)
   Lecture—2 hours; discussion/laboratory—1 hour. Multiple perspectives and connections between natural sciences, social sciences, and agriculture. Emphasizes agriculture’s central position between nature and society and its key role in our search for a productive and sustainable environment. Several full-period field trips provide hands-on learning. Not open for credit to students who have completed Agricultural Management and Rangeland Resources.

2. Botany and Physiology of Cultivated Plants (4)
   Lecture—3 hours; discussion/laboratory—3 hours. Prerequisite: high school biology and chemistry recommended. A holistic introduction to the biological and physiological principles of cultivation and their relationship to the environment. Includes concepts behind plant selection, cultivation, and utilization. Laboratories include discussion and interactive demonstrations. Not open for credit to students who have completed Agricultural Management and Rangeland Resources.

3. Principles of Organic Crop Production (4)
   Lecture—1 hour; discussion—1 hour; laboratory—3 hours. Principles and practices of organic production of annual crops. Emphasizes organic crops, soil, and pest management, crop covering, composting, seeding, transplanting, irrigation, harvesting and marketing. Not open for credit to students who have completed Agricultural Management and Rangeland Resources.

4. Soil Science (3)
   Lecture—2 hours; laboratory—3 hours. Prerequisite: high school algebra. Concepts of computing and applications using personal computers, spreadsheets, database management, word processing and communications. Not open for credit to students who have completed Agricultural Management and Rangeland Resources.

5. Plants for Garden, Orchard and Landscape (2)
   Lecture—1 hour; discussion—1 hour; laboratory—3 hours. Prerequisite: for non-majors. Hands-on experience with plants culivated for landscaping, recreational, or personal satisfaction. Topics include establishing a vegetable garden, pruning and propagation activities, growing flowers and ornamental plants, and the role of plants in human health and well-being. Not open for credit to students who have completed Plant Biology 1 or Plant Sciences 2. (Former course Plant Biology 1.)

6. Food Production—Art and Science of Fruits and Vegetables (2)
   Lecture/discussion—2 hours. Prerequisite: high school biology. Introduction to the art and science of using and growing flowers to harness the power that is representative of the human metabolism and the environment. Students are introduced to the principles of food production, raw materials, bioenergy, and environmental conservation. Global population growth and future food supplies. Not open for credit to students who have completed Plant Biology 12. (Former course Plant Biology 12.)

14. Introduction to Current Topics in Plant Biology (4)
   Discussion—3 hours; term paper. Introduction to scientific methods and current understanding of genetic, metabolic, and cellular structures in plants, with special emphasis on topics related to societal issues, such as herbal medicines and genetically modified organisms. Designed for students not specializing in biology. Not open for credit to students who have completed Plant Biology 11. GE credit: SciEng, Wrt|SE, VL, SL, VL

15. Introduction to Sustainable Agriculture (4)
   Lecture—3 hours; laboratory—3 hours. Multidisciplinary introduction to agricultural sustainability with a focus on local, regional, and global perspectives. Emphasizes concepts and perspectives. Agricultural evaluation, history, resources and functions. Diverse agricultural systems and practices and their relative sustainability. Laboratories provide direct experience with selected agricultural practices and systems. GE credit: SciEng | SE.—S. (S.) Van Horn, Williams

21. Application of Computers in Technology (3)
   Lecture—2 hours; laboratory/discussion—2 hours. Prerequisite: high school algebra. Concepts of computing and applications using personal computers, spreadsheets, database management, word processing and communications. Not open for credit to students who have completed Agricultural Management and Rangeland Resources.

49. Organic Crop Production Practices (3)
   Lecture—1 hour; discussion—1 hour; laboratory—3 hours. Principles and practices of organic production of annual crops. Emphasizes organic crops, soil, and pest management, crop covering, composting, seeding, transplanting, irrigation, harvesting and marketing. Not open for credit to students who have completed Agricultural Management and Rangeland Resources.

92. Internship (1-12)
   Internship—3.36-39. Prerequisite: consent of instructor. Work experience on or off campus in subject areas pertaining to plant and environmental sciences. Internship supervised by faculty member. May be repeated for credit. (P/NP grading only.)

98. Directed Group Study (1-5)
   Lecture—F, W, S. Prerequisite: approval of instructor. Work experience on or off campus in subject areas pertaining to plant and environmental sciences. Internship supervised by faculty member. May be repeated for credit. (P/NP grading only.)

99. Special Study for Undergraduates (1-5)
   Lecture—F, W, S. Prerequisite: approval of instructor. Work experience on or off campus in subject areas pertaining to plant and environmental sciences. Internship supervised by faculty member. May be repeated for credit. (P/NP grading only.)

100. Labor Study (1-5)
   Lecture—Fall, Winter, Spring, Summer. Prerequisite: approval of instructor. Work experience on or off campus in subject areas pertaining to plant and environmental sciences. Internship supervised by faculty member. May be repeated for credit. (P/NP grading only.)

100A. Metabolic Processes of Cultivated Plants (3)
   Lecture—3 hours. Prerequisite: course 2 or Biological Sciences 1C or consent of instructor. Principles of energy capture and photosynthesis, water use, and nutrient cycling. Conversion of these resources into products (carbohydrates, proteins, lipids, and other chemicals) by plants. Emphasis on the relationships between environmental productivity, plant metabolism and plant growth. GE credit: SciEng | SE.—F. (F.) Gilbert

100AL. Metabolic Processes of Cultivated Plants Laboratory (2)
   Lecture—discussion—3 hours. Prerequisite: course 100A or the equivalent (may be taken concurrently). Techniques and instruments used to study plant metabolic processes, including water relations,
respiration, photosynthesis, enzyme kinetics, micros- copy, immunochrometry, and nitrogen fixation. Quantitative reasoning, scientific thinking, and practical applications are emphasized. GE credit: SciEng | SE | VL - W (W) Bradford, Melillo

100B. Growth and Yield of Cultivated Plants Laboratory (25) Laboratory/discussion — 3 hours. Prerequisite: course 100B or equivalent (may be taken concurrently). Laboratory exercises in plant growth and development; seed germination; plant anatomy and physiology; growth, development, and reproduction. GE credit: SciEng | SE | W (W) Bradford

100C. Environmental Interactions of Cultivated Plants (3) Lecture — 3 hours. Prerequisite: course 100A or consent of instructor. Principles of the cellular mechanisms and hormonal regulation underlying plant growth, development, and reproduction. Emphasis on how these processes are used to increase the harvestable yield of cultivated plants and can be managed to increase crop productivity and quality. GE credit: SciEng | SE | W (W) Bradford

100CL. Environmental Interactions of Cultivated Plants Laboratory (2) Laboratory/discussion — 3 hours. Prerequisite: course 100C or equivalent (may be taken concurrently). Techniques and instruments used to study plant interactions with their physical and biological environments and their acquisition of the resources needed for growth and reproduction. Emphasis on how management practices affect these processes and on the factors that affect crop productivity. GE credit: SciEng | SE | S (S) Brown

101. Agriculture and the Environment (3) Lecture — 3 hours; laboratory — 8 hours. Prerequisite: course 2, Biological Sciences 1C, 2C, or equivalent course in Plant Science. Survey of the flora of California, emphasizing recognition of important vascular plant families and genera and use of taxonomic keys for identification. Current understanding of relationships among families. Principles of plant taxonomy and phylogenetic systematics. One Saturday field trip. (Same course as Plant Biology 102.) GE credit: SciEng | SE | VL - W (W) Van Kessel

102. California Floristics (5) Lecture — 3 hours; laboratory — 8 hours. Prerequisite: course 2, Biological Sciences 1C, 2C, or equivalent course in Plant Science. Survey of the flora of California, emphasizing recognition of important vascular plant families and genera and use of taxonomic keys for identification. Current understanding of relationships among families. Principles of plant taxonomy and phylogenetic systematics. One Saturday field trip. (Same course as Plant Biology 102.) GE credit: SciEng | SE | VL - S (S) Potter

105. Concepts in Pest Management (3) Lecture — 2 hours; laboratory/discussion — 3 hours. Prerequisite: Biological Sciences 1C or course 2, Chemistry 88. Introduction to the ecological principles of pest management, biology of different classes of pests and the types of losses they cause, population assessment, evaluation of advantages and disadvantages of different techniques used for pest control. Principles of IPM programs. Not open for credit to students who have completed Agricultural Management and Rangeland Resources 105. (Former course Agricultural Management and Rangeland Resources 105.) GE credit: SciEng | SE - F (F) AlKhali

110A. Principles of Agronomic Crop Production in Temperate and Tropical Systems (3) Lecture — 3 hours. Prerequisite: course in general botany or course 2 recommended. Fundamentals of field crop production in temperate and tropical climates. Resource allocation, genetic, political, and social problems are considered in relation to technological problems and their influences on agricultural development. Not open for credit to students who have completed Agricultural Management and Rangeland Resources 110A. (Former course Agricultural Management and Rangeland Resources 110A.) GE credit: SciEng | SE | W (W) Mitchell

110C. Crop Management Systems for Vegetables and Fruit (3) Lecture — 2 hours; laboratory — 3 hours; discussion — 1 hour. Prerequisite: course 2; course 110A recommended. Horticultural principles applied to production and management systems for vegetable crops. Laboratory and discussion will illustrate efficient field management and resource use practices. Not open for credit to students who have completed Agricultural Management and Rangeland Resources 110C. (Former course Agricultural Management and Rangeland Resources 110C.) GE credit: SciEng | QL - F (F) Laca, Medrano

110L. Principles of Agronomy Laboratory (1) Laboratory — 3 hours. Prerequisite: course 110B (may be taken concurrently). Field-oriented introductions to principles of agronomic crop production. Not open for credit to students who have completed Agricultural Management and Rangeland Resources 110L. (Former course Agricultural Management and Rangeland Resources 110L.) GE credit: SciEng | SE | W (W) Mitchell

112. Forage Crop Ecology (3) Lecture — 3 hours. Prerequisite: course 2, Biological Sciences 1C, 2C, or consent of instructor. Forages as a world resource in food production. Ecological principles governing the adaptation, establishment, growth and management of perennial and annual forages, including pastures, rangelands and hay, aspects of forage quality which affect feeding value to livestock. Not open for credit to students who have completed Agricultural Management and Rangeland Resources 112. (Former course Agricultural Management and Rangeland Resources 112.) GE credit: SciEng | SE | W (W) Brummer

113. Biological Applications in Fruit Tree Management (2) Lecture — 2 hours; laboratory — 3 hours. Prerequisite: course 2, Biological Sciences 1C, 2C or equivalent. Physiology, growth, development and environmental requirements of fruit trees and the cultural practices used to maintain these conditions. Not open for credit to students who have completed Biological Sciences 1C, 2C, or course 2. GE credit: SciEng | SE | W (W) Delong

114. Biological Applications in Fruit Production (2) Lecture — 1 hour; laboratory — 3 hours. Prerequisite: course 2, Biological Sciences 1C or 2C, course 113. Reproductive biology of tree crop species. Biological principles of fruit production, tree nutrition and orchard management for optimizing cropping. Laboratories emphasis will be on orchard tree systems that are done specifically to produce the crop. Not open for credit to students who have completed Plant Biology 174. (Former course Plant Biology 174.) GE credit: SciEng | SE | S (S) Delong

116. Plant Morphology and Evolution (5) Lecture — 3 hours; laboratory — 4 hours. Prerequisite: introductory plant biology [e.g., Biological Sciences 2C, Plant Sciences 2]. Introduction to the form, development, and diversity of plants. Emphasis given to the form and development of reproductive structures in ferns and seed-producing plants as a basis for determining evolutionary relationships. Not open for credit to students who have completed Plant Biology 116. (Same course as Plant Biology 116.) GE credit: SciEng | SE | VL - W (W) Jerome

120. Applied Statistics in Agricultural Science (4) Lecture — 3 hours; discussion/laboratory — 3 hours. Prerequisite: upper division standing. Application of statistical methods and analysis to agricultural research trials for plants, animals, behavioral, nutritional, and consumer sciences. Concepts and statistical methods are presented in lectures, laboratory and activities. GE credit: SciEng | QL - F (F) Laca, Medrano

130. Rangelands: Ecology, Conservation and Restoration (3) Lecture — 3 hours. Prerequisite: Biological Sciences 1C, introductory ecology course and junior standing recommended. Introduction to the ecological principles and processes important for an understanding of the dynamics of range ecosystems. Emphasis on ecological and evolutionary concepts underlying management strategies for conserving biological diversity and environmental quality in rangelands. Not open for credit to students who have completed Agricultural Management and Rangeland Resources 130. (Former course Agricultural Management and Rangeland Resources 130.) GE credit: SciEng | SE | W (W) Potter

131. Identification and Ecology of Grasses (2) Lecture — 7.5 hours; laboratory — 20 hours; discussion — 5 hours. Prerequisite: Biological Sciences 1C or course 2, Plant Biology 102 and junior standing recommended. Taxonomy and identification of western grasses. Development of skills in using plant identification keys. Ecology and evolution of grasses in grazing ecosystems. Given the week following spring quarter. Not open for credit to students who have completed Agricultural Management and Rangeland Resources 131. (Former course Agricultural Management and Rangeland Resources 131.) Offered in alternate years. GE credit: SciEng | SE | VL - S (S) DiTomaso

135. Ecology and Community Structure of Grassland and Savannah Herbivores (3) Lecture — 3 hours; prerequisites: courses 1A or 1B and course 2, or Biological Sciences 1C, general ecology course [Environmental Science and Policy 100] recommended. Feeding ecology of grazing and browsing herbivores and the importance of the interplay of herdboke communities and social systems. Optimal foraging, interspecific interactions, and primary productivity are considered as factors structuring natural and managed grassland and savannah systems. Not open for credit to students who have completed Agricultural Management and Rangeland Resources 135. (Former course Agricultural Management and Rangeland Resources 135.)

141. Ethnobotany (4) Lecture — 3 hours; laboratory/discussion — 2 hours. Prerequisite: course 2, Biological Sciences 1C or 2C. Relationships and interactions between plants and people, including human agriculture, and uses of plants, influences of plants on human cultures, and effects of human activity on plant ecology and evolution. Concepts, questions, methods, and ethical considerations in ethnobotanical research. Not open for credit to students who have completed Plant Biology 141. (Former course Plant Biology 141.) Offered in alternate years. GE credit: SciEng | QL or SciEng | Writing Experience

144. Trees and Forests (4) Lecture — 3 hours; discussion — 1 hour. Prerequisite: Plant Sciences 2 or Biological Sciences 1C or 2C. Biological structure and function of trees as organisms; understanding of forests as communities and as ecosystems; use of forests by humans; tree pheno- logy, photosynthesis, respiration, soil processes, life
147L. California Plant Communities Field Study

Discussion/laboratory—3 hours. Prerequisite: course 2 or Biological Sciences 2C, and concurrent or previous enrollment in course 147. Visits to many of northern California’s plant communities, from the north coast to the Central Valley to the Sierras. Discussion of community ecology and hands-on identification of species. Two Saturday and two three-day field trips required. Not open for credit to students who have completed Plant Biology 147. (Former course Plant Biology 147.) GE credit: SciEng | SE, VL—S. (S.) Young

150. Sustainability and Agroecosystem Management

Lecture—3 hours; laboratory—3 hours. Prerequisite: Soil Science 10, Chemistry 2A, and Plant Sciences 2, Biological Sciences 1C or 2C. Interdisciplinary application of agricultural production and food systems with primary emphasis on biophysical processes. General concepts governing the functioning of temperate and tropical agroecosystems in relation to resource availability, ecological sustainability, and socio-economic viability. Comparative ecological analyses of agroecosystems. Not open for credit to students who have completed Agricultural Management and Rangeland Resources 150. GE credit: SciEng | OL, SE, SL—S. (S.) Gaudin

152. Plant Genetics (4)

Lecture—3 hours; discussion/laboratory—1 hour. Prerequisite: Biological Sciences 1A or 2A or consent of instructor. Basic principles of transmission genetics, cytogenetics, population and quantitative genetics, and molecular genetics. Practical aspects of genetic crosses and analysis of segregating populations. Not open to students who have completed Plant Biology 152. (Former course Plant Biology 152.) GE credit: SciEng | SE, VL—F. (F.) Beck

153. Plant, Cell, Tissue and Organ Culture (4)

Lecture—2 hours; discussion—1 hour; laboratory—3 hours. Prerequisite: course 2 or Biological Sciences 1C or 2C. Basic and applied aspects of plant tissue culture including media preparation, micropropagation, organogenesis, embryogenesis, anther culture, protoplast culture and transformation. Not open for credit to students who have completed Plant Biology 153. (Former course Plant Biology 153.) GE credit: SciEng | SE.

154. Introduction to Plant Breeding (4)

Lecture—3 hours; laboratory—3 hours. Prerequisite: course 152, Biological Sciences 101 or consent of instructor. Principles, methods and applications of plant breeding and genetics to the improvement of crop plants. Illustration of how plant breeding is a dynamic, multidisciplinary, constantly evolving science. Laboratory emphasizes hands-on experience in the basics of breeding through experiments. Not open for credit to students who have completed Plant Biology 144 or 145. GE credit: SciEng | SE, VL—W. (W.) St. Clair

157. Physiology of Environmental Stresses in Plants (4)

Lecture—3 hours; discussion—2 hours. Prerequisite: course 100C or Plant Biology 111 or 112 or Environmental Horticulture 102 or Viticulture and Enology 110. Stress concepts and principles; molecular, physiological, and morphological characteristics enabling plants to avoid or tolerate environmental stresses; stress acclimation and adaptation processes; responses of wild and cultivated species to drought, salinity, and nutrient deficiencies, salt tolerance, extremes of temperature, etc. Not open for credit to students who have completed Plant Biology 157. (Former course Plant Biology 157.) GE credit: SciEng | SE.

158. Minimal Nutrition of Plants (4)

Lecture—3 hours; laboratory—3 hours. Prerequisite: course 100A or Plant Biology 111 or Environmental Horticulture 102 or Viticulture and Enology 110. Evolution and scope of plant nutrition: essential elements; mechanisms of absorption and membrane transporters; translocation and allocation processes; mineral metabolism; deficiencies and toxicities; genetic variation in plant nutrition; applications to management and understanding ecological effects of nutrient availability or deficiency. Not open for credit to students who have completed Plant Biology 158. (Former course Plant Biology 158.) Offered in alternate years. GE credit: SciEng | SE—S. Brown

160. Agroforestry: Global and Local Perspectives (3)

Lecture/discussion—3 hours. Prerequisite: course 2 or Biological Sciences 1C or 2C; course 142 or 150 or Biological Sciences 1B or 2B. An introduction to agroecology, traditional and evolving uses of trees in agricultural ecosystems; their multiple roles in environmental stabilization of food, fuel, and fiber; and socioeconomic barriers to the adoption and implementation of agroforestry practices. Not open for credit to students who have previously taken Agricultural Management and Rangeland Resources 160. (Former course Agricultural Management and Rangeland Resources 160.) Offered in alternate years. GE credit: SciEng | SE—F. Gradziel

162. Urban Ecology (3)


163. Ecosystem and Landscape Ecology (4)

Lecture—4 hours. Prerequisite: course in general, plant, or soil ecology; Evolution and Ecology 117, Plant Biology 117, Environmental Science and Policy 100, Evolution and Ecology 101. Soil Science 108. Integration of concepts to understand and manage ecosystems in a complex and changing world. Focus on interactions among biotic, abiotic and human factors and changes over space/time. Local to global controls over water, carbon and nutrients across landscapes. Not open for credit to students who have completed Ecology 201—W. (W.) Cadnesso, Enver

164. Practicum in Ecological Restoration (1)

Fieldwork—3 hours. Prerequisite: Environmental Horticulture 100 and field course that exposes students to various aspects of ecological restoration throughout the seasonal restoration cycle with real-world practitioners. Emphasis on grassland/rangeland and oak woodland communities. May be repeated three times for credit.—F. W. S. (F. W. S.) Young

170A. Fruit and Nut Cropping Systems (2)

Lecture—1 hour; laboratory—3 hours. Prerequisite: course 2, Biological Sciences 1C or 2C, Chemistry 8B or 118B; course 100C, Plant Biology 111, Environmental Horticulture 102, or Hydrologic Science 122 recom
188. Undergraduate Research Proposal (3)
Lecture—3 hours. Prerequisite: upper division standing. Preparation and review of a scientific proposal. Problem definition, identification of objectives, literature survey, hypothesis generation, design of experiments, data analysis planning, proposal outline and preparation. (Same course as Bio-technology 188.) GE credit: SciEng, Wrt|OL, SE, WE. — S. (S.) Kliebenstein

189L. Laboratory Research in Plant Sciences (2-5)
Laboratory—3-12 hours; discussion—1 hour. Prereq: course 188 and consent of instructor. Formulating experimental approaches to current questions in Plant Sciences; performance of proposed experiments. May be repeated up to 12 units for credit. (P/NP grading only)—F, W, S, Su. (F, W, S, Su.)

190. Seminar on Alternatives in Agriculture (2)
Seminar—1 hour; discussion—1 hour. Prerequisite: upper division standing or consent of instructor. Seminar on topics related to alternative theories, practices and systems of agriculture and the relationship of agriculture to economic development and social issues. Scientific, technological, social, political and economic perspectives. May be repeated for two times for credit for a total of three times. GE credit: SciEng, Wrt|OL, SE, WE. — F, W, S. (F, W, S.)

190C. Research Group Conference (1)
Discussion—1 hour. Prerequisite: advanced standing; consent of instructor. Weekly conference on research problems, progress and techniques in the plant sciences. May be repeated for credit. (P/NP grading only)—F, W, S, F. (F, W, S.)

192. Internship (1-12)
Internship—1-12 hours. Prerequisite: completion of 84 units and consent of instructor. Work experience on or off campus in subject areas pertaining to plant and environmental sciences. Internship supervised by a faculty member. (P/NP grading only)—F, W, S, Su. (F, W, S, Su.)

193. Garden and Farm-Based Experiential Education Methods (5)
Lecture—1 hour; laboratory—3 hours. Prerequisite: upper division standing or consent of instructor. Methods of teaching children and youth about fruit and vegetable production and consumption. Lecture and activity planning for garden and farm field trips. Basic biology, ecology, plant science, and crop management practices. Mentorship in experiential learning. Preparation of garden site. (P/NP grading only)—GE credit: SciEng, Wrt|OL, SE, WE. — S. (S.) Van Horn

194H. Senior Honors Thesis (1-2)
Independent study—1-2 hours. Prerequisite: senior standing, GPA of 3.250 or higher and consent of master adviser. Independent study of selected topics under the direction of a member or members of the staff. Completion will involve the writing of a senior thesis. GE credit: SciEng, Wrt|OL, SE, WE. — F, W, S, Su. (F, W, S, Su.)

196. Postharvest Technology of Horticultural Crops (3)
Lecture/discussion—45 hours; fieldwork—45 hours. Prerequisite: upper division standing or graduate student standing. Intensive study of postharvest considerations and current procedures and challenges in postharvest handling for fruits, nuts, vegetables, and ornamentals. Scheduled for two weeks immediately following last day of spring quarter. Not open for credit to students who have completed Plant Biology 196L. (Former course Plant Biology 196.) (P/NP grading only)—GE credit: SciEng, SE. — S. (S.) Mitcham

1977. Tutoring in Plant Sciences (1-5)
Tutoring—1-5 hours. Prerequisite: upper division standing, completion of course being tutored or the equivalent, consent of instructor. Leading small voluntary discussion or lab groups affiliated with one of the department's regular courses. May be repeated for up to eight units of credit. (P/NP grading only)—F, W, S, Su. (F, W, S, Su.)

198. Directed Group Study (1-5)
Prerequisites: consent of instructor. (P/NP grading only)—F, W, S, Su. (F, W, S, Su.)

199. Special Study for Undergraduates (1-5)
Prerequisites: consent of instructor. (P/NP grading only)—F, W, S, Su. (F, W, S, Su.)

Graduate

205. Experimental Design and Analysis (5)
Lecture—3 hours; discussion/lab—2 hours. Prerequisite: course 120 or equivalent. Introduction to the research process and statistical methods to plan, conduct and interpret experiments. Not open for credit to students who have completed Agronomy 205. (Former course Agronomy 200.)—W. (W.) Dubcovsky, Runcate

206. Applied Multivariate Modeling in Agricultural and Environmental Sciences (4)
Lecture—3 hours. Prerequisite: one of course 120, Statistics 106, 108, course 205 or equivalent. Multivariate linear and nonlinear models. Model selection and parameter estimation. Analysis of manipulative and observational agroecological experiments. Discriminant, principal component, and path analyses. Logistic and biased regression. Bootstrapping. Exercises based on actual research by UC Davis students. Not open for credit to students who have completed Agronomy 206. (Former course Agronomy 206.)—F. (F.) Laca

212. Postharvest Biology and Biotechnology of Fruits and Nuts (3)
Lecture—3 hours. Prerequisite: course 172. Review of postharvest biology of fruits and nuts and biotechnological approaches to address postharvest challenges. Morphology, biology and postharvest handling of fruits and nuts are presented along with current research, including biotechnology, and discussion of future research needs and approaches. Not open for credit to students who have completed Pomology 212. Offered in alternate years. —S. (S.) Crisosto, Mitcham, Zakharov

213. Postharvest Physiology of Vegetables (3)
Lecture—2 hours; discussion—1 hour. Prerequisite: course 172 or course 100B or Plant Biology 112. Comparative physiology of harvest vegetables; emphasis on maturation, senescence, compositional changes, physiological disorders and effects of environmental factors and research procedures. Not open for credit to students who have completed Vegetable Crops 212. (Former course Vegetable Crops 212.) Offered in alternate years. —S. (S.) Saltveit

220. Genomics and Biotechnology of Plant Improvement (3)
Lecture—3 hours. Prerequisite: Biological Sciences 101 or the equivalent. Integration of modern biotechnology and classical plant breeding including the impact of structural, comparative and functional genomics on gene discovery, characterization and exploitation. Also covers molecular markers, plant transformation, hybrid production, disease resistance, and novel output traits. Not open for credit to students who have completed Vegetable Crops 220. (Former course Vegetable Crops 220.) [Same course as Genetics 220]—F. (F.) Klee

221. Genomics and Breeding of Vegetable Crops (3)
Lecture—3 hours. Prerequisite: Biological Sciences 101 or equivalent. Preview of genome structure, mapping, gene tagging and observational genetic resources applied to improvement of major vegetables. For graduate students contemplating a career in modern vegetable breeding and biotechnology. Not open for credit to students who have completed Vegetable Crops 221. (Former course Vegetable Crops 221.)

222. Advanced Plant Breeding (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: courses 154 and 205; Genetics 201 or Animal Genetics 107 recommended. Philosophy, methods, and problems in developing improved plant species. Topics include: inbreeding, heterosis, progeny testing, breeding methodology, index selection, germplasm conservation, and breeding for stress resistance. Laboratories include tours of breeding facilities and calculation and interpretation of quantitative data. —S. (S.) Brummer

230. Forest Biology (4)
Lecture—3 hours; seminar—1 hour. Prerequisite: graduate standing or advanced undergraduate with consent of instructor. Cross-disciplinary review of forest biology, including physiology, genetics, pathology, ecology, and silviculture. —S. (S.) Neale, North, Rice, Rizzo, Schwartz

290. Seminar (1-2)
Seminar—1-2 hours. Topics of current interest related to Plant Sciences. (S/U grading only.)—F, W, S, F. (F, W, S.)

290C. Research Conference (1)
Discussion—1 hour. Prerequisite: consent of instructor. (S/U grading only.)—F, W, S, F. (F, W, S.)

297T. Tutoring in Plant Sciences (1-5)
Tutoring—1-5 hours. Prerequisite: graduate standing; consent of instructor; completion of course to be tutored or the equivalent. Designed for graduate students who desire teaching experience but are not teaching assistants. May be repeated for credit for a total of five units. Same course may not be tutored more than once. (S/U grading only.)

298. Group Study (1-5)

299. Research (1-12)
Prerequisite: consent of instructor. (S/U grading only.)—F, W, S, Su. (F, W, S, Su.)

Professional

386. Teaching Assistant Training Practicum (1-4)
Prerequisite: consent of instructor; graduate standing. (S/U grading only.)—F, W, S, Su. (F, W, S, Su.)

Graduate Student Matters.

Department Office.

Erik Engstrom, Ph.D., Associate Professor

Amber Boydstun, Ph.D., Associate Professor

Cheryl L. Boudreau, Ph.D, Associate Professor

Josephine T. Andrews, Ph.D., Associate Professor

Erik Engstrom, Ph.D., Professor

Ralph Brummer, Ph.D., Professor

Marie Krupa, Ph.D., Professor

Krista Anderson, Ph.D., Assistant Professor

Katie Crisosto, Ph.D., Assistant Professor

Gloria Van Horn, Ph.D., Assistant Professor

Research Offic