293A. Seminar in Infectious Diseases (1)
Seminar—1 hour. Prerequisite: current enrollment in health science professional school or graduate standing in biological sciences. Discussion of current topics and cases of infectious diseases. May be repeated one time for credit. (S/U grading only)—I, II, III. (I, II, III.) Gershwin

293B. Seminar in Infectious Diseases (1)
Seminar—1 hour. Prerequisite: current enrollment in health science professional school or graduate standing in biological sciences. Discussion of current topics and cases of infectious diseases. May be repeated one time for credit if topic differs. (S/U grading only)—I, II, III. (I, II, III.) Byrne

298. Group Study (1-5)
Prerequisite: consent of instructor. (S/U grading only.)

299. Research (1-12)
Prerequisite: graduate standing and consent of instructor. (S/U grading only.)

Population Health and Reproduction (PHR)

192. Internship in Veterinary Science (1-4)
Discussion/laboratory—1-4 hours; clinic—3-36 hours; final report. Prerequisite: approval of project prior to period of internship by faculty sponsor. Supervised work experience in reproduction. (P/NP grading only)—I, II, III. (I, II, III.)

Upper Division

106. Human-Animal Interactions: Benefits and Issues (2)
Lecture—18 sessions; fieldwork—1 session. Prerequisite: upper division standing or consent of instructor. The contributions of animals to human society, including historic, anthropologic, developmental, human health and therapeutic perspectives, as well as effects of humans on animals. One field trip required.—(I, II.)

192. Internship in Veterinary Science (1-12)
Discussion/laboratory—1-12 hours; clinic—3-36 hours; final report. Prerequisite: upper division standing; approval of project prior to period of internship. Supervised work experience in Reproduction. May be repeated for credit. (P/NP grading only.)

243. Advanced Topics in Conservation Genetics (2)
Discussion—18 sessions; lecture—2 sessions. Prerequisite: graduate genetics and ecology or consent of instructor. Restricted to 16 students. In-depth study of topics related to the application of genetic tools to wildlife conservation. Topics will vary annually, but may include use of non-invasive methods of genetic assessment and monitoring of wildlife populations. Students will lead discussions on assigned readings. Limited enrollment. (Same course as Ecology 242.)—I. (I.)

251. Food and Water Borne Safety (2)
Lecture/discussion—2 hours. Prerequisite: MPVM or graduate student standing. Direct experience with food and water borne diseases. Topics will cover bacteria, protozoa, viruses, toxins from environmental and animal sources that impact food and water safety at the interface of livestock health and the food chain.—III. (III.)

266. Applied Analytic Epidemiology (3)
Lecture—2 hours; laboratory—2 hours. Prerequisite: Preventive Veterinary Medicine 404 or consent of instructor. Principles and applications in analysis of epidemiologic data. Methods of analyzing stratified and matched data; logistic regression for cohort and case-control studies; Poisson regression, survival-time methods. (Same course as Master of Public Health 266.)—III. (III.)

277. Mathematical Models in Epidemiology (3)
Lecture/discussion—2 hours; laboratory—2 hours. Prerequisite: Preventive Veterinary Medicine 403 and Epidemiology 405; consent of instructor; although not required, students are encouraged to refresh their knowledge of high school calculus and differential equations. Class size limited to 30 students. Theory of epidemics and mathematical modeling concepts for infectious diseases to include discrete and continuous time models, their use to explore disease dynamics and investigate prevention and control strategies for human and veterinary infectious diseases. (Same course as Epidemiology 277.)—III. (III.)

298. Group Study (1-5)
Prerequisite: consent of instructor. (S/U grading only.)

299. Research (1-12)
Prerequisite: consent of instructor. (S/U grading only.)

Graduate

202. Sampling in Health-Related Research (3)
Lecture—3 hours. Prerequisite: Preventive Veterinary Medicine 403 or the equivalent; consent of instructor. A very thorough coverage of simple random sampling, stratified sampling, cluster sampling, systematic sampling and other sampling methods applied extensively in epidemiology and other health-related disciplines. Emphasis on application of the sampling methods. Offered in alternate years.—II. (II.)

203. Multivariate Biostatistics (3)
Lecture—3 hours. Prerequisite: Preventive Veterinary Medicine 403 and 404, or the equivalent; consent of instructor. Multivariate procedures covered are principal component analysis, factor analysis, Two-group and k-group multivariate ANOVA, multivariate regression, Two-group and k-group discriminant analysis and repeated measures analysis, cluster analysis, and canonical analysis. Emphasis is on application of procedures. Offered in alternate years.—(II.)

210. Epidemiological Approaches to Waterborne Zoonotic Pathogens (1)
Lecture—2 hours. Waterborne zoonotic diseases remain a significant cause of human illness. Review key waterborne pathogens; their biology, fate and transport in aquatic systems; on-farm management practices for reducing microbial contamination of California’s fresh and marine aquatic resources from livestock production systems. (S/U grading only.)—II. (II.) Atwill

212. Epidemiology of the Zoonoses (4)
Lecture—25 sessions, discussion—5 sessions. Prerequisite: graduate standing or third-year standing in the School of Veterinary Medicine or consent of instructor. Epidemiological, biological and ecological features of some major infections shared by humans and other animals. Wildlife and domestic animals zoonoses of major health and economic significance are presented to illustrate how knowledge of zoonoses epidemiology is essential for implementing control measures.—II. (II.)

241. Advanced Topics in Canine Genetics and Genomics (2)
Discussion—2 hours. Prerequisite: Genetics 201A, 201C (or equivalents, with consent of instructor). In-depth study of topics in canine genomics and genetics. Topics will vary annually, but can include positional cloning, whole genome association, complex traits and linkage disequilibrium. Students will lead discussions on assigned readings. May be repeated for credit when topic differs. Limited enrollment. Offered in alternate years.—III. (III.) Bannasch

Lecture—2 hours; discussion—0.5 hours; laboratory—0.5 hours. Prerequisite: undergraduate genetics and ecology/conservation biology courses recommended. Introduction to the field of applied ecological genetics to include applications in conservation ecology, population genetics, population biology, wildlife health and disease ecology. Limited enrollment. (Same course as Ecology 242.)—I. (I.)

267. Applied Analytic Epidemiology (3)
Lecture—2 hours; laboratory—2 hours. Prerequisite: Preventive Veterinary Medicine 403 or consent of instructor. Principles and applications in analysis of epidemiologic data. Methods of analyzing stratified and matched data; logistic regression for cohort and case-control studies; Poisson regression, survival-time methods. (Same course as Master of Public Health 267.)—III. (III.)

277. Mathematical Models in Epidemiology (3)
Lecture/discussion—2 hours; laboratory—2 hours. Prerequisite: Preventive Veterinary Medicine 403 and Epidemiology 405; consent of instructor; although not required, students are encouraged to refresh their knowledge of high school calculus and differential equations. Class size limited to 30 students. Theory of epidemics and mathematical modeling concepts for infectious diseases to include discrete and continuous time models, their use to explore disease dynamics and investigate prevention and control strategies for human and veterinary infectious diseases. (Same course as Epidemiology 277.)—III. (III.)

Viticulture and Enology

(Graduate and Undergraduate Courses)

299. Special Study for Undergraduates (1-5)
(P/NP grading only.)

Upper Division

299. Research (1-12)
Prerequisite: consent of instructor. (S/U grading only.)

Graduate

299. Research (1-12)
Prerequisite: consent of instructor. (S/U grading only.)

Viticulture and Enology

(College of Agricultural and Environmental Sciences)
David E. Block, Ph.D., Chairperson of the Department
Department Office. 1162 RMI North Building 530-752-0380; http://wineserver.ucdavis.edu

Faculty

Douglas O. Adams, Ph.D., Professor
Linda F. Bisson, Ph.D., Professor
David E. Block, Ph.D., Professor
(Viticulture and Enology, Chemical Engineering)
Academic Senate Distinguished Teaching Award
Roger B. Boulton, Ph.D., Professor
(Viticulture and Enology, Chemical Engineering)
Daria Cantu, Ph.D., Assistant Professor
Susan E. Ebeler, Ph.D., Professor
Hildigarde Heymann, Ph.D., Professor
Mark A. Matthews, Ph.D., Professor
David A. Mills, Ph.D., Professor
David R. Smart, Ph.D., Associate Professor
M. Andrew Walker, Ph.D., Professor
Andrew L. Waterhouse, Ph.D., Professor
Larry E. Williams, Ph.D., Professor

Emeriti Faculty

L. Peter Christensen, Specialist in Cooperative Extension, Emeritus
W. Mark Kleewer, Ph.D., Professor Emeritus
Lloyd A. Lider, Ph.D., Professor Emeritus
Carole P. Meredith, Ph.D., Professor Emerita
Ann C. Noble, Ph.D., Professor Emerita
Cornelius S. Ough, D.Sc., Professor Emeritus
Vernon L. Singleton, Ph.D., Professor Emeritus
Academic Senate Distinguished Teaching Award
James A. Wolfpert, Ph.D., Specialist in Cooperative Extension, Emeritus

Affiliated Faculty

Matthew W. Fidalibus, Ph.D., Associate Specialist in Cooperative Extension
James T. Lapsley, Ph.D., Research Associate Andrew J. McKernon, Ph.D., Assistant Adjunct Professor
Barbara Olechowski, Ph.D., Assistant Specialist in Cooperative Extension
Keri L. Steenworth, Ph.D., Assistant Adjunct Professor

Quarter Offered: I—Fall, II—Winter, III—Spring, IV—Summer; 2015-2016 offering in parentheses.

Pre-Fall 2011 General Education (GE): AH=Arts and Humanities; SE=Science and Engineering; SS=Social Sciences; ACH—American Cultures; DD—Domestic Diversity; WRT=Writing Experience

Fall 2011 and on Revised General Education (GE): AH—Arts and Humanities; SE=Science and Engineering; SS=Social Sciences; ACH—American Cultures; DD—Domestic Diversity; OL=Oral Skills; QL=Quantitative; SL=Scientific; VL=Visual; WC=World Cultures; WRT=Writing Experience

http://wineserver.ucdavis.edu
The Major Program
The Viticulture and Enology major provides an interdisciplinary education in the biological and physical principles underlying grape and wine production as well as practical knowledge of grape growing (viticulture) and wine making (enology). This program provides the knowledge base for problem-solving and decision-making in commercial grape and wine production.

Preparatory Requirements. Before transferring into the Viticulture and Enology major, students must complete the following courses with a grade of C or better and with a combined grade point average of at least 2.000 at the University of California (at least 3.000 for similar courses taken at community college) for these and all other preparatory courses. In addition, students’ overall UC GPA must be 2.250 or higher. All courses must be taken for a letter grade.

UNITS

Biological Sciences 1A or 2A ............................................ 4-5
Chemistry 2A, 2B, 2C, 8A ............................................ 17
Mathematics 16A ................................................... 3
Physics 1A ............................................................. 4-6

Recommendations. Completion of UC Davis equivalents of the following preparatory courses for the major are not required for entry but are highly recommended. Failure to complete these will delay entry into required upper division courses and may thus delay graduation. Some courses may be available at UC Davis during Summer Session:

UNITS

Chemistry 8B ........................................................... 4
Mathematics 16B ................................................... 3
Biological Sciences 1C or Plant Sciences 2 .................. 1.5-4-5
Biological Sciences 102 .......................... 5

The Program. The curriculum builds upon a foundation of biology, chemistry, biochemistry and mathematics with specialized courses related to grape and wine production. To complete the program, students may choose to place particular emphasis on viticulture, enology or economics. Credit may also be earned for foreign language study and internships.

Career Alternatives. Graduates are qualified for a variety of vineyard and winery positions, including production manager, quality control, and wine sales. They may also pursue graduate study in agriculture and related disciplines. Additionally they may work in related fields such as pest management, nursery production and analytical services.

B.S. Major Requirements:

UNITS

Preparatory Subject Matter .......................... 44-51
Biological Sciences 1A or 2A and 1C or Plant Sciences 2 .......................... 8-10
Chemistry 2A-2B-2C ........................................... 15
Chemistry 8A, 8B ............................................. 6
Plant Sciences 21 or equivalent and adviser approval .......... 3
Mathematics 16A-16B ...................................... 5-6
Physics 1A, 1B or 7A ...................................... 4-6
Viticulture and Enology 2 .................................. 3

Depth Subject Matter ................................ 48-54
Biological Sciences 102, 103 or 105 .......................... 3-6
Microbiology 102 or 112 ...................................... 3-5
Plant Sciences 120 or Statistics 106 ......................... 4-6
Viticulture and Enology 101A, 101B, 101C, 110, 118, 123, 124, 125, 126, 128, 135 ........................................... 15
Viticulture and Enology 123, 124, 125, 126, 128, 135 and in consultation with the adviser, choose 3 of the following courses: 122L, 124L, 125L, 126L, 128L. If more than 3 are taken, the extra courses will count as restricted electives in Area B ........................................... 1-22

Restricted Electives ............................................ 28

In consultation with adviser, choose 28 units from the following five areas. At least 12 units must be from one of the following areas: (A) Plant Science, (B) Food Science and Microbiology, or (C) Economics and Business.


(B) Food Science and Microbiology area: Biological Sciences 101, Food Science and Technology 102A, 102B, 1028, 1041, 108, 109, 110A, 1108, 127, Microbiology 140, 150, 155L, Viticulture and Enology 140.

(C) Economics and Business area: Agricultural and Resource Economics 100A, 112, 113, 118, 130, 140, 150, Economics 1A, 1B, Management 11A, 118, Viticulture and Enology 111, 130

(D) Language area: Maximum 12 units, not counting course 1, of one of the following languages: French, German, Italian, Portuguese or Spanish. At least one course must be Intermediate or Conversational; qualifying Intermediate or Conversational courses are listed below:

French 8, 21, 22, 23, 38, German 6, 11, 20, 21, 22, Italian 5, Spanish 8, 21, 22, 28, 31, 32, 33.

Courses taught in English will not count as restricted electives in this major.

(E) Internship area: A maximum of eight units of Viticulture and Enology 190X, 192, 198, 199, 299 or 298 may be counted as restricted electives by prior arrangement with adviser. May be increased to 12 units in exceptional circumstances.

Total Units for the Major .................................. 120-133

Major Adviser. M. Matthews

Related Major Programs. Food Science and Technology, and Plant Sciences.

Graduate Study. Several graduate groups offer programs of study leading to advanced degrees in the fields of viticulture and enology. For the M.S. or Ph.D. degree, see Agricultural and Environmental Chemistry (A Graduate Group), on page 141, Engineering: Chemical Engineering and Materials Science, on page 255, Ecology (A Graduate Group), on page 229, Food Science (A Graduate Group), on page 313, Genetics and Genomics (A Graduate Group), on page 352, Horticulture and Agronomy (A Graduate Group), on page 342, Microbiology (A Graduate Group), on page 423, Plant Biology (A Graduate Group), on page 473, Plant Pathology, on page 474, Soils and Biogeochemistry (A Graduate Group), on page 510, and Viticulture and Enology (A Graduate Group), on page 544.

Courses in Viticulture and Enology (VEN)

Lower Division

2. Introduction to Viticulture (2)

Lecture—2 hours. Fundamental principles of biology and culture of the grape, including anatomy, morphology, physiology, distribution, domestication, utilization, propagation, production systems, harvesting, and storage and processing of grapes. Successful completion of the course will prepare students for upper division courses in viticulture. GE credit: CE.—I (II) Cantu

3. Introduction to Winemaking (3)

Lecture—3 hours. Overview of the history of wine, viticulture, fermentation, wine processing operations, the phychology of wine consumption, wines produced in California and other major wine-producing regions and the sensory evaluation of wine. GE credit: SE.—III (III) Hymann, Admission, Adams

90X. Lower Division Seminar (2)

Seminar—1 hour; term paper (required)/discussion. Prerequisite: lower division standing and consent of instructor. Introduction to current issues surrounding wine and health as they relate to diet, nutrition, and toxicology. May not be repeated for credit. GE credit: Wrt.

99. Special Study for Undergraduates (1-5)

(P/NF grading only.)

Upper Division

101A. Viticultural Practices (3)

Lecture—1.5 hours; discussion/laboratory—3.5 hours. Prerequisite: course 2. Identification, cultivation, and use of the major wine, table, raisin, and rootstock cultivars. Includes practices specific to the fall such as fruit contracts, maturity sampling, harvesting, cover crops, and soil-pests. One field trip required. GE credit: SE.—II (II) Walker

101B. Viticultural Practices (3)

Lecture—1.5 hours; discussion/laboratory—3.5 hours. Prerequisite: course 2. Theory, principles, and practices of pruning and grapevine propagation. Plant materials and the certification procedures and control and weed identification, wood diseases, and frost protection. One field trip required. GE credit: SE.—III (III) Smart

110. Grapevine Growth and Physiology (3)

Lecture—3 hours. Prerequisite: course 2. Botanical aspects including morphology and domestication will precede lectures covering flower development and energy budget concepts. Impact of physiological variables such as photosynthesis translocation, mineral nutrition, and water relations on fruit ripening and composition will be covered. GE credit: SciEng | SE.—II (II) Walker

111. World Viticulture (3)

Lecture—3 hours. Prerequisite: upper division standing. Study of the diversity of viticulture, both geographical and historical. History of grape growing and spread throughout history will be covered, along with discussions of current viticultural practices in different parts of the world, including California. GE credit: SciEng | OL, SE, WE

112. Technical Evaluation of Wines of the World (1)

Laboratory/discussion—3 hours. Prerequisite: course 111 (must be taken concurrently), course 125 with a grade of C or better. Critical analysis of wines produced in different parts of the world with emphasis on the relationship between sensory properties of the wines and factors associated with their place of origin. GE credit: SE.—II (II) Matthews

115. Raisin and Table Grape Production (3)

Lecture—2 hours. Prerequisite: course 112. Overview of the raisin and table grape industries in California and other production areas of the world. Cultural practices associated with raisin and table grape production will also be discussed. GE credit: SciEng | SE

118. Grapevine Pests, Diseases, and Disorders (3)

Lecture—3 hours. Prerequisite: course 2. Various pests and diseases of vineyards throughout California. Pest/disease identification and control methods (to include sampling techniques) also will be discussed. Integrated management approach to pest control methods will be emphasized. GE credit: SciEng | SE.—II (II) Cantu
123. Analysis of Musts and Wines (2)
Lecture—2 hours. Prerequisite: Chemistry 2C and 88 or equivalent; Agricultural Management and Range- land Science 212. Students enrolled in the lecture portion of the course will be required to enroll in 1 unit of course 199/299. Fundamental principles of analytical chemistry as they relate to specific methods used in winemaking. GE credit: SciEng | QL.-I. (I.) Waterhouse

123L. Analysis of Musts & Wines Laboratory (2)
Lab—3 hours; independent study—2 hours. Prerequisites: Chemistry 2C and 88, or equivalent, Agricultural Management and Rangeland Resources 212, and course 123 (course 123 may be taken concurrently). Fundamental principles of analytical chemistry as they relate to specific methods used in winemaking. Laboratory exercises demonstrating various chemical, physical and biochemical methods. Data will be analyzed and results interpreted in weekly lab reports; includes student-designed independent project and written report. Enrollment restricted to upper division and graduate students in Viticulture & Enology. Others by approval of instructor. GE credit: SciEng, Wrt | QL, SE, Vl, WE.-I. (I.) Waterhouse

124. Wine Production (2)
Lecture—2 hours. Prerequisite: course 3, 123 (may be taken concurrently). Principles and practices of making standard types of wines, with special reference to grape varieties used and methods of vinification. SciEng | QL, SE.-I. (I.) Bisset

124L. Wine Production Laboratory (3) Laboratory—3 hours; independent study—3 hours; term paper. Prerequisite: course 124 (may be taken concurrently). Restricted to undergraduate students in fermentation science, enology and viticulture, bio- technology, microbiology, food science and applied plant biology or graduate students in food science, agricultural and environmental chemistry and horticulture. Current technologies used in production of California table wines; analysis and monitoring of impact of fermentation variables on microbial performance and product quality; student-designed independent research project. GE credit: SciEng | QT, SE.-I. (I.) Bisset

125. Wine Types and Sensory Evaluation (2)
Lecture—2 hours. Prerequisite: course 124; Plant Sciences 120 or Statistics 106. Open to upper division and graduate students in Viticulture & Enology; others by approval of instructor. Principles of sensory evaluation and application to wines. Factors influencing wine flavor, data from sensory analysis of model solutions. GE credit: SciEng | QT, SE.-III. (III.) Heymann

125L. Sensory Evaluation of Wine Laboratory (2)
Laboratory—2 hours; term paper. Prerequisite: course 125 (may be taken concurrently). Restricted to upper division majors in fermentation science or viticulture and enology or graduate students in food science. Sensory evaluation of wines and model systems; discrimination tests, ranking, descriptive analysis and time-intensity analysis. Data analyzed by appropriate statistical tests and results interpreted in extended weekly reports. GE credit: SciEng | QT, SE, Vl, WE.-III. (III.) Heymann

126. Wine Stability (3)
Lecture—2 hours; discussion—1 hour. Prerequisite: course 124. Restricted to students in viticulture and enology, fermentation science, applied plant biology majors, or graduate students in food science, microbiology, horticulture, and horticulture and agronomy. Principles of equilibria and rates of physical and chemical reactions in wines; treatment of unstable components in wines by absorption, ion exchange, refrigeration, filtration, and membrane processes; and protein, polysaccharide, tartrate, oxidative, and color stabilities. GE credit: SciEng | QT, SE.-II. (II.) Boulton

126L. Wine Stability Laboratory (2)
Laboratory—3 hours; independent study—3 hours. Prerequisite: course 126 (may be taken concurrently). Restricted to upper division fermentation science, viticulture and enology majors, or graduate students in food science, agricultural and environmental chemistry, microbiology or by consent of instructor. Proceedings involved with examples of equilibria and rates of physical and chemical reactions to wine stability. GE credit: SciEng | SE, WE.-II. (II.) Boulton

128. Wine Microbiology (2)
Lecture—2 hours. Prerequisite: courses 123 and 124; Microbiology 102 and 102L, or Food Science and Technology 104 and 104L; courses 125 and 126 recommended. Nature, development, physiology, biochemistry and control of yeasts and bacteria involved in the making, aging and spoilage of wine. GE credit: SciEng | SE.-II. (II.) Mills

128L. Wine Microbiology Laboratory (2) Laboratory—6 hours. Prerequisite: course 123, 124, and 128 (may be taken concurrently). Microbiology 102L or Food Science and Technology 104 and 104L; course 125 and 126 recommended. Restricted to upper division students in fermentation science, viticulture and enology and graduate students in food science. Nature, development, physiology, biochemistry and control of yeasts and bacteria involved in the making, aging and spoilage of wine. GE credit: SciEng | SE, Vl, WE.-II. (II.) Mills

135. Wine Technology and Winery Systems (5)
Lecture—3 hours; discussion/laboratory—2 hours. Prerequisite: course 124. Process technologies and process systems used in modern commercial wineries. Lectures, demonstrations, problem solving sessions, and possible field trips. Includes grape preparation and fermentation equipment; post-fermentation processing equipment; winery utilities, cleaning systems, and waste treatment. GE credit: SciEng | QT, SE.-III. (III.) Block

140. Distilled Beverage Technology (3)
Lecture—3 hours. Prerequisite: Chemistry 88; Food Science and Technology 110A. Distillation principles and practices, production technology of brandy, whiskey, rum, vodka, gin, and other distilled beverages; characteristics of raw materials, fermentation, distillation, and aging. Offered in alternate years. GE credit: SciEng | QT, SE.-III. (III.) Boulton

181. Readings in Enology (1)
Discussion—1 hour. Prerequisite: course 3. Critical evaluation of selected monographs in enology. Discussion leader rotates among the students. May be repeated three times for credit. (P/NP grading only) GE credit: SE.-III. (III.) Matthews

190X. Winemaking Seminar (1)
Seminar—1 hour; discussion—1 hour. Prerequisite: course 3. Open to Viticulture and Enology majors and graduate students. Outside speakers on a specific winemaking topic chosen for the quarter. Discussion with the speaker hosted by the faculty member(s) in charge. May be repeated for credit up to 3 times. (P/NP grading only) GE credit: SE.-III. (III.)

192. Internship (1-12)
Internship—3-36 hours. Prerequisite: completion of 94 units. Work experience related to Fermentation Science (Enology) or Plant Science (Viticulture) majors. Internships must be approved and supervised by a member of the department or major facility, but are arranged by the student. (P/NP grading only) GE credit: SE.

199. Special Study for Advanced Undergraduates (1-5)
(P/NP grading only) GE credit: SE.

200. Introduction to Scientific Methods (2)
Lecture/discussion—1 hour; term paper. Prerequisite: graduate standing or consent of instructor. Courses in scientific research. Topics include conducting literature review, formulating hypotheses, and analyzing and reporting results. Annotated bibliography and written and oral research proposals.

210. Grape Development and Composition (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Biological Sciences 102 and 103, or 105. Anatomy, physiology and biochemistry of grape development, with emphasis on the development of grape composition relevant to winemaking. Offered in alternate years. —III. Adams, Polito

213. Flavor Chemistry of Foods and Beverages (3)
Lecture/discussion—3 hours. Prerequisite: Chemistry 88, course 123, course 123L or Food Science and Technology 103 or consent of instructors. Students will become familiar with basic principles of flavor chemistry, analysis, and formation in fresh and processed foods. Students will be required to read and critically evaluate flavor chemistry literature. (Same course as Food Science and Technology 213).—III. (III.) Ebeler, Heymann

215. Sensometrics (3)
Lecture—3 hours. Prerequisite: Food Science and Technology 117 or the equivalent, course 125 and 125L or Food Science and Technology 107 or 107B. Experimental design and statistical analysis, including multivariate analysis, for both sensory and instrumental data in enology and food-related studies. —III. (III.) Heideman

216. Sustainable Vineyard Development (5)
Lecture/discussion—3 hours; fieldwork—3 hours; term paper. Prerequisite: course 101A, 101B, 101C, and one of courses 115 and 118 or consent of instructor; course 110, Soil Science 100, Atmospheric Science 133 and Agricultural and Resource Economics 140 recommended. Application of plant, meteorological, soil, water, GIS, and economic sciences to sustainable vineyard development. Preparation of a comprehensive study to determine the viticultural and economic feasibility of a given site for raisin, table, or wine grape production. —I. (I.) Smart

217. Field and GIS Evaluation of Soils (3)
Lecture/laboratory—4 hours; fieldwork—3 hours. Prerequisite: Plant Sciences 120, 205 or 206; Soil Science 100, 105, or 107; course 101C; Applied Biotechnology 180 are recommended; consent of Instructor. Principles and practices used to evaluate agricultural soils in the field, including soil pits, soil cores, electrical conductivity and ground penetrating radar, geomorphology and surface terrain analysis. Use of geographic information sciences, soil databases, digital elevation models and geostatistics. Offered in alternate years. —II. (II.) Smart

219. Natural Products of Wine (3)
Lecture—3 hours. Prerequisite: courses 123 and 124, or natural products background and consent of instructor. Structure, occurrence, and changes due to production to the natural products found in wine. Chemicals with a sensory impact will be emphasized, including flavonoids and other pheno- lipids, terpenes and norisoprenoids, pyrazines, oak volatiles and other wine constituents. —I. (I.) Waterhouse

233. Instrumental Analysis of Must and Wine (4)
Lecture—2 hours; laboratory—3 hours; discussion—1 hour. Prerequisite: courses 123 or 123L and Food Science and Technology 103 required. Biological Sciences 102 and 103 or Biological Sciences 105, Chemistry 107/108 or Chemistry 115 recommended. Open to upper division students in Viticulture & Enology, Food Science and Technology; students in Food Science, Ag & Environmental Chemistry and Viticulture & Enology graduate groups. Theory and practice of instrumental analysis of food and wine, with emphasis on the principles of analytical techniques (e.g., CE, GC, HPLC, Mass Spectrometry) and factors determining correct choice of instrumental method.—III. (III.) Ebeler
224. Advances in the Science of Winemaking (3)
Lecture—3 hours. Prerequisite: course 125, 126 and graduate standing or consent of instructor. Selected topics in the science and technology of winemaking. Topics drawn from current research of participating faculty. Critical analysis of the technical content of published material.—II, III.

225. Advanced Sensory Analysis of Wines (3)
Lecture/discussion—2 hours; laboratory—4 hours. Prerequisite: courses 124 and 125 (or Food Science and Technology 107) and Agricultural Management and Rangeland Resources 120 or the equivalent. Sensory descriptive analysis experiments will be designed and conducted using standard sensory science methods. Data will be analyzed by analyses of variance, principal component analyses and generalized Procrustes analysis to evaluate the judge's performance and interpret the significance of the results.—II. Heymann.

235. Winery Design (4)
Lecture—2 hours; discussion—1 hour; independent study. Prerequisite: course 124, 135 or consent of instructor. Design of wineries. Includes process calculations, equipment selection, process layout and building choice and siting. Project scheduling, capital costs, and ten-year cash flow analysis for the winery. One field trip required. Offered in alternate years.—II. Boulton.

270. Critical Evaluation of Scientific Literature (2)
Discussion—2 hours. Prerequisite: consent of instructor. Contemporary research topics in biological sciences. Discussion of recent research articles in a special topic area. Intended to develop skills in critical evaluation of scientific publications. May be repeated for credit. (S/U grading only.)—II, III, (I, II, III) Bisson.

290. Seminar (1)
Seminar—1 hour. Prerequisite: consent of instructor. (S/U grading only.)—II, III. (II, III.) Bisson.

290C. Advanced Research Conference (1)
Discussion—1 hour. Prerequisite: graduate standing and consent of instructor. Planning and results of research programs, proposals, and experiments. Discussion and critical evaluation of original research being conducted by the group. Discussion led by an individual research instructors for research group. May be repeated for credit. (S/U grading only.)—I, II, III, (I, II, III.)

291. Advanced Viticulture (2)
Lecture/discussion—2 hours. Prerequisite: course 110, 112, 114, 122, 125, course 210 recommended. Critical evaluation of scientific and popular literature on selected topics of current interest that relate viticulture to fruit or wine sensory attributes or quality. May be repeated one time for credit. Offered in alternate years.—II. Matthews.

292. Advanced Internship (1-15)
Internship—3-45 hours. Prerequisite: courses 123, 123A, 123B, 124, 124A, 125, 125A, 126, 126A, 128, 128B; consent of instructor. Restricted to Viticulture & Enology Graduate Group graduate students. Work experience related to Fermentation Science (Enology) or Plant Science (Viticulture) majors. Internships must be standing and supervised by a graduate group faculty member or students major professor, but are arranged by the student. May be repeated 12 units for credit. (S/U grading only.)—I, II, III, (I, II, III.)

297. Tutoring in Viticulture and Enology (1-5)
Prerequisite: graduate standing and consent of instructor. Designed for graduate students who desire teaching experience, but are not teaching assistants. Student contact primarily in laboratory or discussion sections, and under direction of a faculty member. (S/U grading only.)

298. Group Study (1-5)
(S/U grading only.)

299. Research (1-12)
(S/U grading only.)

396. Teaching Assistant Training Practicum (1-4)
Prerequisite: graduate standing. May be repeated for credit. (S/U grading only.)—I, II, III. (II, III.)

Viticulture and Enology (A Graduate Group)

David A. Mills, Ph.D., Chairperson of the Group

Group Office. 1204 EM South 530-752-1852; Fax 530-758-032; http://vengg.ucdavis.edu

Faculty

Douglas O. Adams, Ph.D., Professor (Viticulture and Enology)
Charles W. Bamforth, Ph.D., Professor (Food Science and Technology)
Linda F. Bisson, Ph.D., Professor (Viticulture and Enology)
David E. Black, Ph.D., Professor (Viticulture and Enology, Chemical Engineering)
Academic Senate Distinguished Teaching Award
Roger B. Boulton, Ph.D., Professor (Viticulture and Enology, Chemical Engineering)
Dario Cantu, Ph.D., Assistant Professor (Viticulture and Enology)
Susan E. Ebeler, Ph.D., Professor (Viticulture and Enology)
Jean Xavier Quinnard, Ph.D., Professor (Food Science and Technology)
Hildegard Heymann, Ph.D., Professor (Viticulture and Enology)
Maria Marco, Ph.D., Assistant Professor (Food Science and Technology)
Mark A. Matthews, Ph.D., Professor (Viticulture and Enology)
David A. Mills, Ph.D., Professor (Viticulture and Enology, Food Science and Technology)
Kenneth A. Shackel, Ph.D., Professor (Plant Sciences)
David R. Smart, Ph.D., Associate Professor (Viticulture and Enology)
Li, Tian, Ph.D., Assistant Professor (Plant Sciences)
M. Andrew Walker, Ph.D., Professor (Viticulture and Enology)
Andrew L. Waterhouse, Ph.D., Professor (Viticulture and Enology)
Larry E. Williams, Ph.D., Professor (Viticulture and Enology)

Affiliated Faculty

Matthew W. Fidelibus, Ph.D., Associate Specialist in Cooperative Extension, (Viticulture and Enology)
W. Douglas, Gubler, Ph.D., Specialist in Cooperative Extension (Plant Pathology)
Andrew J. McElrone, Ph.D., Assistant Adjunct Professor (Viticulture and Enology)
Anita Oberholser, Ph.D., Assistant Specialist in Cooperative Extension (Viticulture and Enology)
Keri L. Steenwerth, Ph.D., Assistant Adjunct Professor (Viticulture and Enology)

Graduate Study

The M.S. program offers advanced studies in viticulture and enology, ranging from the genetics, physiology and biochemistry of grapevines to the chemistry, microbiology and sensory science of wines and the chemical engineering of winemaking. Applications must be submitted online by January 15.

Ph.D. studies are not offered by the Graduate Program in Viticulture and Enology.

Preparation

Applicants to the program are required to have a level of competence equivalent to that of a strong science undergraduate program.

This includes coursework in biology, general chemistry, organic chemistry, calculus, statistics (analysis of variance), biochemistry, microbiology, and economics.

Specific requirements are outlined in detail and may be obtained by visiting http://vengg.ucdavis.edu.

Graduate Advisers. H. Heymann, A.J. McElrone

War–Peace Studies

[College of Letters and Science]

The interdisciplinary minor in War–Peace Studies examines the causes and dynamics of intra- and international wars and efforts to prevent and settle such conflicts. Students in the minor are encouraged to participate in the educational activities of the Davis Program of the UC Institute on Global Conflict and Cooperation (IGCC). The minor is sponsored by the International Relations Program.

Minor Program Requirements:

UNITS

War–Peace Studies------------------------- 19-20

One or two courses from each of the following areas:

- Approaches: Anthropology 123AN, 126B, Comparative Literature 157, Philosophy 115, 116, Political Science 121, 123, 124, 132, 176, Sociology 157, Women's Studies 102

Restriction. No more than two courses from a single department may be offered in satisfaction of the minor requirements.

Advising. International Relations Program 530-754-8098

Water Science

See Hydrologic Sciences (A Graduate Group), on page 347; Hydrology, on page 348; and Soil and Water Science, on page 511.

Wildlife, Fish, and Conservation Biology

[College of Agricultural and Environmental Sciences]

John M. Eadie, Ph.D., Chairperson of the Department

Department Office. 1088 Academic Surge 530-752-6586; http://wfcb.ucdavis.edu

Faculty

Louis W. Botsford, Ph.D., Professor
Tim Caro, Ph.D., Professor
John M. Eadie, Ph.D., Professor
Nann A. Fangue, Ph.D., Assistant Professor
Douglas A. Kelt, Ph.D., Professor
A. Peter Klimley, Ph.D., Adjunct Professor
Peter B. Mayle, Ph.D., Professor