

Michael L. Johnson, Ph.D., Associate Research Scientist (*Director, Aquatic Ecosystems Analysis Laboratory*); Adjunct Research Professor (*Department of Medicine and Epidemiology; School of Veterinary Medicine*)

Kirk C. Klasing, Ph.D., Professor (*Animal Science*)

Dietmar Kueltz, Ph.D., Associate Professor (*Animal Science*)

Bill Lasley, Ph.D., Professor (*Population Health and Reproduction; and Obstetrics and Gynecology, Associate Director at The Institute for Toxicology and Environmental Health*)

Y.B. Lee, Ph.D., Professor (*Animal Science*)

Leslie A. Lyons, Ph.D., Associate Professor (*Population Health and Reproduction; School of Veterinary Medicine*)

Elizabeth Maga, Ph.D., Assistant Research Biologist (*Animal Science*)

Bernie May, Ph.D., Adjunct Professor (*Animal Science*)

Juan F. Medrano, Ph.D., Professor (*Animal Science*)

Joy A. Mench, Ph.D., Professor (*Animal Science*)

Stuart Meyers, Ph.D., Associate Professor (*Anatomy, Physiology and Cell Biology; School of Veterinary Medicine*)

Deanne Meyer, Ph.D., Associate Extension Specialist: Livestock Waste Management (*Animal Science*)

Brenda J. McCowan, Ph.D., Associate Professional Researcher and Research Behaviorist (*Veterinary Medicine Teaching and Research Center and California National Primate Research Center*)

James R. Millam, Ph.D., Professor (*Animal Science*)

Frank M. Mitloehner, Ph.D., Associate Air Quality Extension Specialist (*Animal Science*)

James D. Murray, Ph.D., Professor (*Animal Science*)

Anita M. Oberbauer, Ph.D., Associate Professor (*Animal Science*)

James W. Oltjen, Ph.D., Extension Specialist: Animal Management Systems (*Animal Science*)

M. Cecilia Torres-Penedo, Ph.D., Associate Research Geneticist (*Veterinary Genetics Laboratory*)

Wolfgang Pittroff, Ph.D., Assistant Professor (*Animal Science*)

Kathryn Radke, Ph.D., Associate Professor (*Animal Science*)

Peter H. Robinson, Ph.D., Extension Specialist: Dairy Cattle Nutritional Management (*Animal Science*)

Jan F. Roser, Ph.D., Professor (*Animal Science*)

Roberto D. Sainz, Ph.D., Associate Professor (*Animal Science*)

Jose Eduardo Santos, D.V.M., Ph.D., Associate Professor (*Veterinary Medicine Teaching and Research Center and Population Health and Reproduction; School of Veterinary Medicine*)

Alison L. Van Eenennaam, Ph.D., Associate Animal Biotechnology and Genomics Extension Specialist (*Animal Science*)

Catherine A. VandeVoort, Ph.D., Associate Adjunct Professor (*California National Primate Research Center; and Reproductive Biology, Obstetrics and Gynecology; School of Medicine*)

Barry W. Wilson, Ph.D., Professor (*Animal Science*)

Richard A. Zinn, Ph.D., Professor (*Animal Science; located at Desert Research and Extension Center*)

**Graduate Study.** The Graduate Group in Animal Biology offers programs of study and research leading to the M.S. and the Ph.D. degrees. The Animal Biology Graduate Group focuses on integrated animal biology. Each student individually tailors his/her program of study to meet individual needs. The Animal Biology Graduate Group is unique in encouraging a multidisciplinary or interdisciplinary approach involving physiology, nutrition, genetics, ecology and/or behavior within the context of organismal animal biology.

**Graduate Advisers.** Consult the Animal Biology Graduate Group Office.

## Courses in Animal Biology (ABI)

### Graduate Courses

#### 200A. Integrated Animal Biology I (3)

Lecture/discussion—3 hours. Prerequisite: graduate standing; Biological Sciences 101 or the equivalent or the consent of the instructor. Natural history, man-

agement, historical and current uses, and specialized disciplinary features of model and novel animal systems used in research. Development of conceptual approaches in organismal biology to improve experimental design and interpretation of interdisciplinary research studies. Limited enrollment; first pass restricted to Animal Biology Graduate Group students.—I. (I.) Delany

#### 200B. Integrated Animal Biology II (3)

Lecture/discussion—3 hours. Prerequisite: course 200A. Natural history, management, historical and current uses, and specialized disciplinary features of model and novel animal systems used in research. Development of conceptual approaches in organismal biology to improve experimental design and interpretation of interdisciplinary research studies. Limited enrollment; first pass restricted to Animal Biology Graduate Group students.—II. (II.) Delany

#### 290. Seminar in Animal Biology (1)

Seminar—1 hour. Prerequisite: graduate standing. Seminar on advanced topics in animal biology. Presentations by members of the Animal Biology Graduate Group and guest speakers. May be repeated for credit. (S/U grading only.)—I, II, III. (I, II, III.)

#### 290C. Research Conference (1)

Discussion—1 hour. Prerequisite: graduate standing and consent of instructor. Student presentations of research in Animal Biology and discussions among participating students and Animal Biology faculty. May be repeated for credit. (S/U grading only.)—I, II, III, IV. (I, II, III, IV.)

#### 299. Research (1-11)

Prerequisite: graduate standing and consent of instructor. Research with a faculty member in Animal Biology Graduate Group. May be repeated for credit. (S/U grading only.)—I, II, III, IV. (I, II, III, IV.)

## Professional Courses

### 300. Methods in Teaching Animal Biology (2)

Lecture/discussion—2 hours. Prerequisite: graduate standing and consent of instructor. Practical experience in the methods and problems of teaching animal biology. Includes analysis of laboratory exercises, discussion of teaching techniques, grading scientific essays, preparing for and conducting discussion or laboratory sections, formulating quiz and exam questions under supervision of instructor. May be repeated up to three times for credit. (S/U grading only.)—I, II. (I, II.) Famula, Oberbauer

### 396. Teaching Assistant Training Practicum (1-4)

Variable—3-12 hours. Prerequisite: graduate standing and consent of instructor. May be repeated for credit. (S/U grading only.)—I, II, III. (I, II, III.)

### 401. Ethics and Professionalism in Animal Biology (2)

Discussion—2 hours. Prerequisite: graduate standing; first pass Animal Biology graduate group students. Case studies and discussion of ethical and professional issues for animal biologists, including the use of animals in research and teaching, patenting and intellectual property, consulting and conflict of interest, scientific integrity, dealing with the media, and mentoring relationships.—III. (III.) Mench

## Animal Genetics

(College of Agricultural and Environmental Sciences)

**Faculty.** See under Department of Animal Science, on page 134.

**Major Program.** See the major in Animal Science, on page 134.

**Related Courses.** See Agronomy 221; Biological Sciences 101, 101D; Evolution and Ecology 102, 175; Genetics Graduate Group courses; Microbiology 150, 170, 215, 260, 274, 292; Molecular and Cellular Biology 121, 141, 160L, 161, 162, 163, 164, 178, 182, 221C, 257, 262, 263; Neurobiology, Physiology, and Behavior 131; Plant Biol-

ogy 151, 152, 154, 161A, 161B; Plant Pathology 215X, 217; Vegetable Crops 220.

## Courses in Animal Genetics (ANG)

Questions pertaining to the following courses should be directed to the instructor or to the Animal Science Advising Center in 1202 Meyer Hall (530) 754-7915).

## Upper Division Courses

### 101. Animal Cytogenetics (3)

Laboratory/discussion—1 hour; laboratory—6 hours. Prerequisite: Biological Sciences 101, 102 or the equivalent. Principles and techniques of cytogenetics applied to animal systems; chromosome harvest techniques, analysis of mitosis and meiosis, karyotyping, chromosome banding, cytogenetic mapping, chromosome structure and function, comparative cytogenetics.—III. Delany

### 105. Horse Genetics (2)

Lecture—2 hours. Prerequisite: course 15 and Biological Sciences 101. Coat color, parentage testing, medical genetics, pedigrees, breeds, the gene map and genus *Equus*. Emphasis on understanding horse genetics based on the unity of mammalian genetics and making breeding decisions based on fundamental genetic concepts.—(III.)

### 107. Genetics and Animal Breeding (5)

Lecture—4 hours; laboratory—3 hours. Prerequisite: Biological Sciences 101. Principles of quantitative genetics applied to improvement of livestock and poultry. Effects of mating systems and selection methods are emphasized with illustration from current breeding practices.—I. (I.) Medrano

### 111. Molecular Biology Laboratory Techniques (4)

Lecture—2 hours; laboratory—6 hours. Prerequisite: Biological Sciences 1C, 101, 102, 103. Introduction to the concepts and techniques used in molecular biology; the role of this technology in both basic and applied animal research, and participation in laboratories using some of the most common techniques in molecular biology.—II. (II.) Murray, Williamson, Kueltz

### 120. Introduction to Statistical Genomics (3)

Lecture—3 hours. Prerequisite: Biological Sciences 101, Agricultural Management and Rangeland Resources 120 or Statistics 100 or 102. Statistical concepts associated with genomics. Linkage analysis and grouping, theory and methods for identifying quantitative trait loci, and algorithms useful in genomics.—III. (III.) Famula

### 198. Directed Group Study (1-5)

Prerequisite: consent of instructor. Selected topics relating to animal genetics. (P/NP grading only.)

### 199. Special Study for Advanced Undergraduates (1-5)

Prerequisite: consent of instructor. (P/NP grading only.)

## Graduate Courses

### 204. Theory of Quantitative Genetics (3)

Lecture—3 hours. Prerequisite: course 107 or the equivalent. Theoretical basis of quantitative genetics and the consequences of Mendelian inheritance. Concepts used to estimate quantitative genetic differences and basis for partitioning the phenotypic variance. Offered in alternate years.—III.

### 206. Advanced Domestic Animal Breeding (3)

Lecture—3 hours. Prerequisite: course 107 and Animal Science 205; course 204 recommended. Procedures for the genetic evaluation of individuals to include selection indices and mixed model evaluation for single and multiple traits. Methods of estimating genetic trends. Offered in alternate years.—III. Famula

### 208. Estimation of Genetic Parameters (3)

Lecture—3 hours. Prerequisite: course 107 and Animal Science 205; courses 204 and 108 recommended. General methods for the estimation of components of variance and covariance and their application to the estimation of heritability, repeat-

Quarter Offered: I=Fall, II=Winter, III=Spring, IV=Summer; 2007-2008 offering in parentheses

General Education (GE) credit: ArtHum=Arts and Humanities; SciEng=Science and Engineering; SocSci=Social Sciences; Div=Social-Cultural Diversity; Wrt=Writing Experience

ability and genetic correlations are considered. Specific emphasis is given to procedures applicable to livestock populations under selection.

### 211. Genetic Engineering of Animals (2)

Lecture—1 hour; lecture/discussion—1 hour. Review of techniques for the genetic engineering of animals and their limitations and applications. Student-led discussions of recent papers in the field and possible future applications of genetically engineered animals in basic research and applied agricultural and medical research. Offered in alternate years. (S/U grading only.)—(III.) Murray

### 212. Sequence Analysis in Molecular Genetics (2)

Lecture/laboratory—2 hours. Prerequisite: Biological Sciences 101 or the equivalent, graduate standing or consent of instructor. The use of computer algorithms and online databases to analyze nucleic acid and protein sequences in molecular genetics research. Offered in alternate years.—II. Medrano

### 298. Group Study (1-5)

Prerequisite: consent of instructor. Lectures and discussions of advanced topics in animal genetics. (S/U grading only.)

### 299. Research in Animal Genetics (1-12)

(S/U grading only.)

## Animal Physiology

See **Animal Biology**, on page 132; **Animal Science**, on page 134; **Neurobiology, Physiology, and Behavior**, on page 392; **Philosophy, on page 403**; and **Molecular, Cellular, and Integrative Physiology (A Graduate Group)**, on page 382.

## Animal Science

(College of Agricultural and Environmental Sciences  
Mary E. Delany, Ph.D., Chairperson of the Department

Thomas R. Famula, Ph.D., Vice Chairperson of the Department

Anita M. Oberbauer, Ph.D., Vice Chairperson of the Department

**Department Office.** 2223 Meyer Hall  
(530) 752-1250; <http://animalscience.ucdavis.edu>

**Undergraduate Advising.** 1202 Meyer Hall  
(530) 754-7915

**Graduate Advising.** 1202 Meyer Hall  
(530) 752-2382; <http://asac.ucdavis.edu>

Bodega Marine Laboratory  
P.O. Box 247, Bodega Bay, CA; (707) 875-2211  
<http://www.bml.ucdavis.edu/index.html>

### Faculty

Thomas E. Adams, Ph.D., Professor,  
*Academic Senate Distinguished Teaching Award*  
Gary B. Anderson, Ph.D., Professor, *Academic Senate Distinguished Teaching Award, UC Davis Prize for Teaching and Scholarly Achievement*  
Patricia J. Berger, Ph.D., Professor  
C. Christopher Calvert, Ph.D., Professor,  
*Academic Senate Distinguished Teaching Award*  
Ernest S. Chang, Ph.D., Professor  
(*Biological Sciences, Bodega Marine Laboratory*)  
Douglas E. Conklin, Ph.D., Professor  
Mary E. Delany, Ph.D., Professor  
Edward J. DePeters, Ph.D., Professor,  
*Academic Senate Distinguished Teaching Award*  
Serge I. Doroshov, Ph.D., Professor  
John M. Eadie, Ph.D., Professor  
James G. Fadel, Ph.D., Professor

Thomas R. Famula, Ph.D., Professor,  
*Academic Senate Distinguished Teaching Award*  
Silas S. O. Hung, Ph.D., Professor  
Annie J. King, Ph.D., Professor  
Dietmar Kueltz, Ph.D., Associate Professor  
Kirk C. Klasing, Ph.D., Professor  
Yu-Bang Lee, Ph.D., Professor  
Juan F. Medrano, Ph.D., Professor  
Joy A. Mench, Ph.D., Professor  
James R. Millam, Ph.D., Professor  
James D. Murray, Ph.D., Professor  
Anita M. Oberbauer, Ph.D., Professor,  
*Academic Senate Distinguished Teaching Award*  
Wolfgang Pittroff, Ph.D., Assistant Professor  
Kathryn Radke, Ph.D., Associate Professor  
Janet F. Roser, Ph.D., Professor  
Roberto D. Sainz, Ph.D., Associate Professor  
Wesley W. Weathers, Ph.D., Professor  
Barry W. Wilson, Ph.D., Professor  
Richard A. Zinn, Ph.D., Professor

### Emeriti Faculty

Ursula K. Abbott, Ph.D., Professor Emeritus  
Hans Abplanalp, Ph.D., Professor Emeritus  
C. Robert Ashmore, Ph.D., Professor Emeritus  
R. Leland Baldwin, Jr., Ph.D., Professor Emeritus  
G. Eric Bradford, Ph.D., Professor Emeritus  
Wallis H. Clark, Jr., Ph.D., Professor Emeritus  
Perry T. Cupps, Ph.D., Professor Emeritus  
Graham A. E. Gall, Ph.D., Professor Emeritus  
William N. Garrett, Ph.D., Professor Emeritus  
F. Howard Kratzer, Ph.D., Professor Emeritus  
Glen P. Lofgreen, Ph.D., Professor Emeritus  
Edward O. Price, Ph.D., Professor Emeritus  
Robert W. Touchberry, Ph.D., Professor Emeritus

### Affiliated Faculty

Steven L. Berry, D.V.M., Specialist in Cooperative Extension  
Francine A. Bradley, Ph.D., Lecturer and Specialist in Cooperative Extension  
Fred S. Conte, Ph.D., Lecturer and Specialist in Cooperative Extension  
Elizabeth A. Maga, Ph.D., Assistant Researcher and Lecturer  
Bernard P. May, Ph.D., Adjunct Professor  
Deanne Meyer, Ph.D., Specialist in Cooperative Extension  
Frank M. Mitloehner, Ph.D., Associate Specialist in Cooperative Extension  
James W. Oltjen, Ph.D., Lecturer and Specialist in Cooperative Extension  
Peter H. Robinson, Ph.D., Specialist in Cooperative Extension  
Alison L. Van Eenennaam, Ph.D., Associate Specialist in Cooperative Extension  
Dana B. Van Liew, M.Ed., Lecturer, Academic Federation Excellence in Teaching Award  
Gideon Zeidler, Ph.D., Specialist in Cooperative Extension

### The Major Program

The Animal Science major is devoted to the sciences central to understanding biological function of domestic and captive animals including birds, their care, management, and utilization by people for food, fiber, companionship and recreation. Advances in science and technology, and an ever growing human population, have increased the complexity of issues surrounding the care and management of animals. Specializations within the major allow students to develop a scientific appreciation of animals and their relationship to their environment. Graduates in Animal Science are able to advance the science and technology of animal care in an objective and effective manner for the betterment of animals and society.

**The Program.** The curriculum provides depth in the biological and physiological sciences and allows students to specialize within the broad field of applied animal science. Study begins with introductory courses in animal science, biology, chemistry, mathematics, and statistics. Students undertake advanced courses in animal behavior, biochemistry, genetics, nutrition, and physiology and the integration of these sciences to animal function, growth,

reproduction, and lactation. Students complete the curriculum by choosing a specialization in either an animal science discipline (behavior, biochemistry, genetics, nutrition, or physiology) or in the sciences particular to a class of animals (aquatic, avian, companion, captive, equine, laboratory, livestock, dairy, or poultry).

**Career Alternatives.** A wide range of career opportunities are available to graduates. The primary goal of the major is to prepare students for graduate study leading to the M.S. and Ph.D. degree; for continued study in a professional school such as veterinary medicine, human medicine or dentistry; for careers in research, agricultural production, farm and ranch management, or positions in business, sales, financial services, health care, agricultural extension, consulting services, teaching, journalism, or laboratory technology.

### B.S. Major Requirements:

UNITS

**Written and Oral Expression**..... 0-8  
See College requirement.

**Preparatory Subject Matter**..... 56- 61

Animal Science 1, 2, 41, 41L ..... 12  
Biological Sciences 1A, 1B, 1C..... 15  
Chemistry 2A, 2B and 8A, 8B or 118A, 118B..... 16-18  
Agricultural Management and Rangeland Resources 21 or Computer Science Engineering 15..... 3-4  
Mathematics 16A, 16B or 17A, 17B or 21A, 21B..... 6-8  
Agricultural Management and Rangeland Resources 120 or Statistics 100..... 4

Note: Some professional and graduate schools may require additional preparatory subject matter. Please consult the advising center.

**Breadth/General Education**..... 24

See General Education requirement.

**Depth Subject Matter** ..... 38-42

*Biology* (Biological Sciences 101; Animal Genetics 107; Animal Biology 102, 103; Neurobiology, Physiology, and Behavior 101) ..... 24  
*Integrative Animal Biology* (Animal Science 123, 124, and Neurobiology, Physiology, and Behavior 121 and 121U) ..... 12  
*Laboratory* (Select one from the following: Animal Genetics 111; Animal Science 106 or 136 and 137; Microbiology 102L; Molecular and Cellular Biology 120L or 160L; Neurobiology, Physiology, and Behavior 101L or 104L; Pathology, Microbiology, and Immunology 126L ..... 2-6

**Area of Specialization**..... 20-23

Choose one area of specialization below; the program of study must be approved in advance by your faculty adviser.

### Animal Science with a Disciplinary Focus

**Focus**..... 20

Select 20 upper division units, with approval from your faculty adviser, to form a coherent series of courses in one of the following disciplines: animal behavior, biochemistry, genetics, nutrition, or physiology.

**Aquatic Animals** ..... 20

Animal Science 18 and 131; Nutrition 124; and Animal Science 118 or 119.

Select additional units from any Animal Genetics or Animal Science course, or other courses approved by your faculty adviser. Students in this specialization must take Animal Science 136 and 137 to meet their Laboratory Depth Subject Matter requirement. Students in this specialization may elect to substitute any of Biological Sciences 104, Evolution and Ecology 112, or Wildlife, Fish, and Conservation Biology 120 and 121 for the 12-unit requirement under Integrative