century to the present. Offered in alternate years. GE credit: ArtHum or SocSci. Div | ACGH, AH or SS, DD, WW, W—Kim

150E. Southeast Asian American Experience (4)
Lecture/discussion—4 hours. Upper division status. Historical survey of Southeast Asian experiences with special focus on United States involvement and post 1975 migrations. Defines international and transnational conditions that led up to the large exodus and resettlement of Southeast Asians. Offered in alternate years. GE credit: ArtHum or SocSci. Div | ACGH, AH or SS, DD, OL, WC, WE—S. Valverde

150F. South Asian American History, Culture, & Politics (4)
Lecture/discussion—4 hours. South Asian American experiences, focusing on the histories, cultures, and politics of Indian, Pakistani, Bangladeshi, and Sri Lankan communities in the U.S. Interdisciplinary approaches to migration, labor, gender, globalization, ethnicity, youth, community mobilization. Offered in alternate years. GE credit: ArtHum, SocSci, Div | ACGH, AH or SS, DD, OL, WE—W. Math

155. Asian American Legal History (4)
Lecture/discussion—4 hours. Legal history of Asian Americans, from the mid-19th century to present. Laws and administrative policies affecting Asian American communities, including those governing immigration, social and economic participation, WWII internment, and affirmative action. Offered irregularly. GE credit: SocSci | ACGH, DD, SS.

189A. Topics in Asian American Studies: History (4)
Lecture—4 hours. Intensive treatment of a topic in Asian American Studies; history. May be repeated for credit when topic differs. Offered irregularly. GE credit: SocSci | ACGH, DD, SS.

189B. Topics in Asian American Studies: Culture (4)
Lecture—4 hours. Intensive treatment of a topic in Asian American Studies; culture. May be repeated for credit when topic differs. Offered irregularly. GE credit: ArtHum or SocSci | AH or SS.

189C. Topics in Asian American Studies: Physical and Mental Health (4)
Lecture—4 hours. Intensive treatment of a topic in Asian American Studies; Health. May be repeated for credit when topic differs. Offered irregularly. GE credit: SocSci | SS.

189D. Topics in Asian American Studies: Policy and Community (4)
Lecture—4 hours. Intensive treatment of a topic in Asian American Studies; policy and community. May be repeated for credit when topic differs. Offered irregularly. GE credit: SocSci | ACGH, DD, SS.

189E. Topics in Asian American Studies: Comparative Racial Studies (4)
Lecture—4 hours. Intensive treatment of a topic in Asian American Studies; comparative race studies. May be repeated for credit when topic differs. Offered irregularly. GE credit: ArtHum or SocSci | ACGH, AH or SS, DD, OL, WE.

189F. Topics in Asian American Studies: Asian Studies and Asian American Studies (4)
Lecture—4 hours. Intensive treatment of a topic in Asian American Studies: asian and asian american studies. May be repeated for credit when topic differs. Offered irregularly. GE credit: SocSci | SS.

189G. Topics in Asian American Studies: Race, Class, Gender, and Sexuality (4)
Lecture—4 hours. Intensive treatment of a topic in Asian American Studies: race, class, gender, and sexuality. May be repeated for credit when topic differs. Offered irregularly. GE credit: SocSci | SS.

189H. Topics in Asian American Studies: Society and Institutions (4)
Lecture—4 hours. Intensive treatment of a topic in Asian American Studies: society and institutions. May be repeated for credit when topic differs. GE credit: ArtHum or SocSci | AH or SS.

189I. Topics in Asian American Studies: Politics and Social Movements (4)
Lecture—4 hours. Intensive treatment of a topic in Asian American Studies: politics and social movements. May be repeated for credit when topic differs. Offered irregularly. GE credit: ArtHum or SocSci | ACGH, AH or SS, DD, OL, WE.

192. Internship (1-5)
Internship—3-15 hours. Prerequisite: enrollment under 98F/198F. Offered irregularly. (P/W grading only.)—Arts and Humanities; Science and Engineering; Social Sciences; Div | Social Studies, Political Science, and Economics.

Astronomy
See Physics, on page 503.

Atmospheric Science
(College of Agricultural and Environmental Sciences)
Faculty: See under Department of Land, Air and Water Resources, on page 391.

The Major Program
Atmospheric science is the study of the air that surrounds the planet. It includes the study of all weather phenomena and climate including global and regional climate change, the chemistry of trace constituents and cloud and particle formation, interactions between ecosystems and the atmosphere, as well as quantitative studies of climate extremes and severe weather, including droughts, floods, hurricanes and tornadoes. The study of the impacts of human and other biogeochemical activity on the quality of the air we breathe are important topics in this major.

The Program. Modern atmospheric science is a quantitative science that is reflected in the major’s curriculum. In addition to the study of daily weather events, the program deals with fundamental dynamical and physical processes that involve the general circulation of the atmosphere; turbulent mass and energy transfer at the planetary surface as well as within the free atmosphere; the processes of solar and terrestrial radiation throughout the atmosphere; atmospheric interaction with the biosphere; climate variations; and developments in remote sensing using satellites with remote meteorological instrumentation. In addition, the program has significant expertise in the areas of air quality and its related atmospheric chemistry. As well as providing a broad background in meteorology, the major includes an informal minor area to be chosen from mathematics, computer science, environmental studies, resource management or a physical or biological science.

Internships and Career Opportunities. Atmospheric science students have participated in internships with the California Air Resources Board, various county Air Pollution Control Districts, the National Weather Service, and performing research. Job opportunities include: national weather services, weather forecasting for broadcast media or private forecasting firms, environmental consulting firms (such as environmental impact reports, wind farm siting, government agencies at all levels from local (air quality districts, planning departments, etc.) to state (Air Resources Board) to national (NOAA), and companies whose operations are impacted by weather (such as airlines, insurance companies). About half of our graduates continue their education by seeking the M.S. or Ph.D. degree in atmospheric science or related areas.

B.S. Major Requirements:

- Written Expression, Also counts toward College English Composition Requirement ................................................................. 3-4
- University Writing Program 101 or one course from 102 or 104 sequences or course selected with adviser’s approval
- Preparatory Subject Matter ..................... 59-60
  - Plant Sciences 2 ........................................ 4
  - Chemistry 2A, 2B ........................................ 10
  - Computer Science Engineering 3 or course selected with adviser’s approval ......................................................... 4
  - Atmospheric Science 60 ......................................... 4
  - Physics 9A, 9B, 9C ........................................ 12
  - Statistics 13 ........................................ 3

- Depth Subject Matter ......................... 41
  - Atmospheric Science 110, 111, 111L, 112A, 112B, 128, 128L ........................................ 26
6. Fundamentals of Atmospheric Pollution (3)
   Lecture—3 hours. Effects of human emissions on the atmosphere: smog, ozone pollution, and ozone depletion; indoor air pollution; global warming; acid rain. Impacts of these problems on the earth, ecosystems, and human society. Strategies to reduce atmospheric pollution. GE credit: SciEng | SE, SL, VL—F (F) Anastasio

10. Severe and Unusual Weather (3)
    Lecture—2 hours; discussion—1 hour. Prerequisite: high school physics. Introduction to physical principles of severe weather: thunderstorms, tornados, blizzards, thunderstorms, lightning, tornadoes, and hurricanes. Emphasis on scientific perspective and human context. Not open to students who have received credit for course 100. (Former course 100.) GE credit: SciEng, Wrt | QL, SE, SL, VL—F, W, W (F) Chen, Grotjahn, Paw U

60. Introduction to Atmospheric Science (4)
    Lecture—3 hours; discussion—1 hour. Prerequisite: Mathematics 16A or 21A or Physics 5A, 7A or 9A. Fundamental principles of the physics, chemistry, and fluid dynamics underlying weather and climate. Solar radiation, energy balance, and the thermal budget of the Earth. Clouds and their role in radiative forcing, convection, precipitation, mid-latitude storm systems. GE credit: SciEng | OL, SL, VL—F (F) Faloona

92. Atmospheric Science Internship (1-12)
    Internship—3-36 hours. Prerequisite: lower division standing and consent of instructor. Internship off and on campus in atmospheric science. Internship supervised by a member of the faculty. (P/NP grading only.)—F, W, F (F, S)

98A. Directed Group Study (1-5)
    Prerequisite: consent of instructor. (P/NP grading only.)—F, W, F (F, S, W)

99. Special Study for Undergraduates (1-5)
    (P/NP grading only.)—F, W, F (F, W, S)

Upper Division

110. Weather Observation and Analysis (4)
    Lecture—3 hours; laboratory—3 hours. Prerequisite: course 60. Acquisition, distribution and analysis of meteorological data, including ground-based analysis, stability indices, probability of local severe weather, weather map analysis. Use of National Weather Service analyses and forecast products. Laboratory makes use of computer-generated analyses. Offered in alternate years. GE credit: SciEng | OL, QL, SE, SL—S. Chen

111. Weather Analysis and Prediction (3)
    Lecture—3 hours. Prerequisite: courses 110, 121B, 111L (concurrent or immediate past). Emphasis on the modification of solar and infrared radiation by the atmosphere. Estimation from satellite remote sensing of cloud cover and the use of these data in weather forecasting. GE credit: SciEng | OL, QL, SL, VL—W. Grotjahn

111L. Weather Analysis and Prediction Laboratory (2)
    Laboratory—2 hours: virtual lectures. GE credit: SciEng | OL, QL, SL, VL—W. Grotjahn

112. Weather Forecasting Practice (2)
    Discussion—2 hours; laboratory—1 hour. Prerequisite: course 110. Formal practice in preparing local weather forecasts. Analysis of current weather conditions and recent model performance. Verification of forecast accuracy. Interpretation of current forecast model guidance. Posting of forecast. May be repeated for credit up to three times. (P/NP grading only.)—F (F) Grotjahn

115. Hydroclimatology (4)
    Lecture—3 hours. Prerequisite: course 60. Examination of climate as the forcing function for the hydrologic system. Emphasis on fundamental and applied aspects of the relationship between precipitation and evapotranspiration for meso-scale areas. Watershed modeling of floods and droughts and evaluation of the effects of climate fluctuations. Offered irregularly. GE credit: SciEng | OL, QL, SL, WE—S (S)

116. Climate Change (4)
    Lecture—3 hours; extensive writing. Prerequisite: University Writing Program 1; consent of instructor. Climate trends and patterns spanning past, present and future. Emphasis on natural processes that produce climate variations and human influence on these processes. Evidence of climate change and the role of global climate models in understanding climate variability. Offered in alternate years. GE credit: SciEng | OL, SL, WE—S (S)

120. Atmospheric Thermodynamics and C. (4)
    Lecture—3 hours, extensive problem solving. Prerequisite: Mathematics 21C, Physics 9B, course 60 (may be taken concurrently). Atmospheric composition and structure, thermodynamics of atmospheric gases, thermal properties of dry and moist air, atmospheric stability; cloud nucleation, cloud growth by condensation and collision, cloud models. GE credit: SciEng | QL, SE, VL—F, W (F, W) Ulrich

121A. Atmospheric Dynamics (4)
    Lecture—3 hours; extensive problem solving. Prerequisite: course 120, Mathematics 21D, Physics 9B, Fundamental forces of atmospheric flow; noninertial reference frames; development of the equations of motion for rotating spherical atmosphere. Two-dimensional and natural coordinate systems; geostrophic flow; thermal wind; circulation and vorticity. GE credit: SciEng | QL, SE, VL—W, W (F)

121B. Atmospheric Dynamics (4)
    Lecture—3 hours; extensive problem solving. Prerequisite: course 121A. Dynamics of fluid motion in geophysical systems; quasi-geostrophic theory; fundamental forces of wave propagation in fluids; Rossby waves; gravity waves; fundamental forces of hydrodynamic instability; two-level model; baroclinic instability and cyclogenesis. GE credit: SciEng | OL, QL, SE—S (S)

124. Meteorological Instruments and Observations (3)
    Lecture—2 hours; laboratory—3 hours. Prerequisite: course 60, Physics 5C. Modern meteorological instruments and their use in meteorological observations and measurements. Brief introduction to some meteorological instruments are included. Offered in alternate years. GE credit: SciEng | QL, SL, VL—W (W) Nathan

128. Radiation and Satellite Meteorology (4)
    Laboratory/discussion—3 hours; extensive problem solving—1 hour. Prerequisite: course 60, Physics 9B, Mathematics 22B, 21D. Concepts of atmospheric radiation and the use of satellites in remote sensing. Emphasis on the modification of solar and infrared radiation by the atmosphere. Estimation from satellite data of atmospheric variables such as temperature and cloudiness. GE credit: SciEng | OL, QL, SL, VL—W (W) Nathan

133. Biomegameometry (4)
    Lecture—3 hours; discussion—1 hour. Prerequisite: one course in a biological discipline and Meteorology 168 or consent of instructor. Atmospheric and biological interactions. Physical and biological basis for water vapor, carbon dioxide and energy exchanges with the atmosphere associated with plants and animals, including photosynthesis of plant canopies and microclimate modification such as frost protection and windbreaks. GE credit: SciEng | OL, QL, SL, VL—W (W) Paw U

149. Air Pollution (4)
    Lecture—3 hours; discussion—1 hour. Prerequisite: Mathematics 21D, 22B; C or better in Chemistry 2B, Atmospheric Science 121A or C or better in Engineering 103. Physical and technical aspects of
air pollution. Emphasis on geophysical processes and air pollution meteorology as well as physical and chemical properties of pollutants. (Same course as Civil and Environmental Engineering 149.) GE credit: SciEng | QL, SE, SL.—F. (F.) Capra

150. Introduction to Computer Methods in Physical Sciences (4)
Lecture—3 hours; lecture/discussion—2 hours. Prerequisite: Mathematics 228, Physics 98, and a computer programming course such as Engineering Computer Science 30. Additional courses in fluid dynamics (course 121A or equivalent); course 103D and in Fourier transforms (Mathematics 118C or Physics 104A) are helpful, but not required. Computational techniques used in physical sciences. Integral and differential equation numerical solution: mainly finite differencing and spectral (Fourier transform) methods. Time series applications (time-permitting). Specific applications drawn from meteorology. Accelerated introduction to FORTRAN including programing assignments. Enrollment limited to 25, preference to Atmospheric Science majors. (P/NP grading only.) Offered irregularly. GE credit: SE.—F. (F.) Grotch

158. Boundary-Layer Meteorology (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 121A. Dynamics of the atmosphere nearest the Earth's surface. Friction and heat transfer. Properties of turbulent flow. Statistical and spectral techniques; use and interpretation of differential equations. Emphasis on the importance to weather, air pollution, and the world's oceans. Offered in alternate years. GE credit: SciEng | QL, SE, VL.—(S.) Faloona

160. Introduction to Atmospheric Chemistry (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Chemistry 98. Qualitative examination of current local, regional and global problems in atmospheric chemistry (including photochemical smog, acid deposition, climate change, and stratospheric ozone depletion) using fundamental concepts from chemistry. Basic chemical modeling of atmospheric reaction systems. Offered in alternate years. GE credit: SciEng | QL, SE, VL.—W. Anastasio

192. Atmospheric Science Internship (1-12)
Internship—1-12 hours. Prerequisite: completion of 24 units and consent of instructor. Internship off and on campus in atmospheric science. Internship supervised by a member of the faculty. (P/NP grading only.)—F, W, S. (F, W, S.)

198. Directed Group Study (1-5)
Prerequisite: three upper division units in Atmospheric Science. (P/NP grading only.)—F, W, S. (F, W, S.)

199. Special Study for Advanced Undergraduates (4)
Prerequisite: three upper division units in Atmospheric Science and at least an overall B average. (P/NP grading only.)—F, W, S. (F, W, S.)

Graduate

215. Advanced Hydroclimatology (3)
Lecture—3 hours. Prerequisite: course 115. Theoretical and applied aspects of energy and mass fluxes linking the earth's surface, atmosphere, and hydrologic system. Emphasis on regional scale analysis and modeling, spatial data representation, and climate change influences on precipitation and its hydroclimatic expression. Offered irregularly.—S. (S.)

221. Advanced Atmospheric Dynamics (3)
Lecture—3 hours. Prerequisite: course 121B. Conditions for instability in stratified atmospheres, baroclinic instability, forced topographic Rossby Waves; wave-mean flow interaction theory; tropical dynamics; stratospheric dynamics. Offered in alternate years.—(W.) Nathan

223. Advanced Boundary-Layer Meteorology (3)
Lecture—2 hours. Prerequisite: course 230. Characteristics of the atmospheric boundary layer under convective and nocturnal conditions. Heat budget at the surface and boundary layer forcing. Similarity theory and scaling of the boundary layer. Measurement and simulation techniques. Offered in alternate years.—(S.) Faloona

230. Atmospheric Turbulence (3)
Lecture—3 hours. Prerequisite: course 121B or 158. Dynamics and energetics of turbulence in the atmosphere in the context of air pollution. Statistics. Description of turbulence: Eulerian and Lagrangian scales, spectral analysis, conditional sampling techniques. Turbulence processes, the closure problem, gradient-diffusion and secondary flow methods. Offered in alternate years.—W. Pow U

231. Advanced Air Pollution Meteorology (3)
Lecture—2 hours. Prerequisite: Course 149A, 160 and one course in fluid dynamics. Processes determining transport and diffusion of primary and secondary pollutants. Models of chemical transformation, of the atmospheric boundary layer and of mesoscale wind fields, as applicable to pollutant dispersion problems. Offered irregularly.—F. (F.)

233. Advanced Biometeorology (3)
Lecture/discussion—3 hours. Prerequisite: course 153 or consent of instructor. Current topics in biometeorology. Physical and biological basis for water vapor, other gases, and energy exchange with the atmosphere. Topics include modeling and measuring turbulent transport processes, surface temperature and energy budgets, bio-aerosol physics and aerobiology. Offered in alternate years.—(W.) Pow U

240. General Circulation of the Atmosphere (4)
Lecture/discussion—4 hours. Prerequisite: course 121B. Large-scale, observed atmospheric properties. Radiation, momentum, and energy balances derived and compared with observations. Lectures and homework synthesize observations and theories, then apply them to understand the large-scale circulation in 3-4 alternate years.—F. (F.) Grotch

241. Climate Dynamics (3)
Lecture/discussion—3 hours. Prerequisite: course 121B. Dynamics of large-scale climatic variations over time periods from weeks to centuries. Description of the appropriate methods of analysis of atmospheric and oceanic observations. Conservation of mass, energy and momentum. Introduction to the range of climate simulations. Offered in alternate years.—F, W, S. (F, W, S.)

245. Climate Change, Water and Society (4)
Lecture—4 hours. Class size limited to 25 students. Integration of climate science and hydrology with policy to understand hydroclimatology and its impact upon natural and human systems. Assignments: readings, take-home examination on climate and hydrologic science, paper that integrates course concepts into a research prospectus or review article. (Same course as Hydrologic Sciences 245 and Ecology 245.)—(F) Faloona, (W) Tabbell, (S) Ulrich

250. Meso-Scale Meteorology (3)
Lecture—3 hours. Prerequisite: graduate standing, course 150, a course in partial differential equations; or consent of instructor. The study of weather phenomena with horizontal scales between 2.5 and 2500 kilometers. Methods of observational study and numerical modeling of the structure and temporal behavior of these weather systems. Offered in alternate years.—(W.) Chen

255. Numerical Modeling of the Atmosphere (4)
Lecture—2 hours; laboratory—6 hours. Prerequisite: course 121B and Engineering 5; course 150 recommended. Principles of numerical modeling of the dynamic, thermodynamic and physical processes of the atmosphere. Hands-on experiments on model development using the shallow water equations and the primitive equations. Operational forecast models. Offered in alternate years.—W. Chen

260. Atmospheric Chemistry (3)
Lecture—3 hours. Prerequisite: course 160. Chemistry and photochemistry in tropospheric condensed phases (fog, cloud, and rain drops and aerosol particles). Gas-gas and gas-particle partitioning of compounds and effects of reactions in condensed phases on the fates and transformations of tropospheric chemical species. Offered in alternate years.—S. Anastasio

265. The Art of Climate Modeling (3)
Lecture—2 hours; laboratory—1 hour. Prerequisite: course 121A. Over the past fifty years, global models have given us incredible insight into the Earth system. This course provides an introduction to these models, with a focus on their design and the science questions they have been built to address. Offered irregularly.—S. (S.) Ulrich

270A. Topics in Atmospheric Science: Meteorological Statistics (1-3)
Discussion—1-3 hours. Prerequisite: consent or instructor. Applications and concepts in meteorological statistics.—F, W, S. (F, W, S.)

270B. Topics in Atmospheric Science: Computer Modeling of the Atmosphere (1-3)
Discussion—1-3 hours. Prerequisite: consent or instructor. Applications and concepts in computer modeling of the atmosphere.—F, W, S. (F, W, S.)

270C. Topics in Atmospheric Science: Design of Experiments and Field Studies in Meteorology (1-3)
Discussion—1-3 hours. Prerequisite: consent or instructor. Applications and concepts in design of experiments and field studies in meteorology.—F, W, S. (F, W, S.)

270D. Topics in Atmospheric Science: Solar and Infrared Radiation in the Atmosphere (1-3)
Discussion—1-3 hours. Prerequisite: consent or instructor. Applications and concepts in solar and infrared radiation in the atmosphere.—F, W, S. (F, W, S.)

270E. Topics in Atmospheric Science: Aerosol and Cloud Physics (1-3)
Discussion—1-3 hours. Prerequisite: consent or instructor. Applications and concepts in aerosol and cloud physics.—F, W, S. (F, W, S.)

270F. Topics in Atmospheric Science: Atmospheric Chemistry (1-3)
Discussion—1-3 hours. Prerequisite: consent or instructor. Applications and concepts in atmospheric chemistry.—F, W, S. (F, W, S.)

270G. Topics in Atmospheric Science: General Meteorology (1-3)
Discussion—1-3 hours. Prerequisite: consent or instructor. Applications and concepts in general meteorology.—F, W, S. (F, W, S.)

280A. Air Quality Policy in the Real World (4)
Project. Prerequisite: consent of instructor; Atmospheric Science 149 or Engineering: Civil and Environmental 149, and Engineering 242 or equivalent. In-depth investigation of an air quality problem with a team and mentor from government or industry. Science, engineering and policy will be involved. Findings will be presented orally and in writing. (Deferred grading only, pending completion of sequence.) Offered irregularly.—F. (F.)

280B. Air Quality Policy in the Real World (4)
Project. Prerequisite: course 280A; consent of instructor. In-depth investigation of an air quality problem with a team and mentor from government or industry. Science, engineering and policy will be involved. Findings will be presented orally and in writing. (Deferred grading only, pending completion of sequence.) Offered irregularly.—F. (F.)

Atmospheric Science 187
Atmospheric Science (A Graduate Group)

Christopher Cappa, Ph.D., Assistant Professor (Civil and Environmental Engineering)
Shu-Hua Chen, Ph.D., Assistant Professor
Ian Falona, Ph.D., Associate Professor
Richard Grassl, Ph.D., Professor
Michael J. Kleman, Ph.D., Professor (Civil and Environmental Engineering)
John Largier, Ph.D., Professor (Environmental Science and Policy)
Terrence K. Nathan, Ph.D., Professor
Kyaw Thaw Paw U, Ph.D., Professor
Paul Ullrich, Ph.D., Assistant Professor
Susan Ustin, Ph.D., Professor
Anthony Wexler, Ph.D, Professor (Mechanical and Aerospace Engineering; Civil and Environmental Engineering)
Bruce White, Ph.D., Professor (Mechanical and Aerospace Engineering)
Zhang, Qi, Assistant Professor (Environmental Toxicology)

Emeriti Faculty
Thomas A. Cahill, Ph.D., Professor Emeritus
Robert Flachioni, Ph.D., Professor Emeritus (Crocker Nuclear Laboratory)
Ruth Keck, Ph.D., Professor Emeritus
Bryan Weare, Ph.D., Professor Emeritus

Affiliated Faculty
Lowell Aushaugh, Ph.D., Associate Researcher Emeritus (Crocker Nuclear Laboratory)
Steven S. Cliff, Ph.D., Assistant Researcher (Applied Science)
Ann Dillner, Ph.D., Assistant Researcher (Crocker Nuclear Laboratory)
Richard L. Snyder, Ph.D., Biometeorology Specialist
Richard Anthony VanCuren, Ph.D., Professional Researcher (Air Pollution Research Center)

Graduate Study. The Graduate Group in Atmospheric Science offers both the M.S. and Ph.D. degree programs. A student may place emphasis on graduate work in one or more of the following fields: air quality meteorology, atmospheric chemistry, biometeorology, micrometeorology, numerical weather prediction, remote sensing, climate dynamics, large scale dynamics, and meso-scale meteorology. The diverse and extensive backgrounds of the faculty allow opportunities for interdisciplinary training and research.

Preparation. The Group encourages applications from all interested students with backgrounds in the physical or natural sciences. Basic qualifications for students entering Atmospheric Science graduate program include mathematics to the level of vector calculus and differential equations, and one year of college-level physics. Flexibility may be allowed for students with high academic potential, but it is expected that deficiencies in preparatory material and in key undergraduate atmospheric science courses be completed within the first year of graduate study.

Graduate Adviser. Terrence Nathan, Ph.D.
Graduate Admissions Officer. Christopher Cappa, Ph.D.

Avian Sciences

This major has been discontinued as of Fall 2011; see Animal Science, on page 162.

Internships and Career Alternatives. Independent study, undergraduate research, and internships are emphasized in the Avian Sciences program. Birds for laboratory or special study are housed within the main building as well as at the research farm and the experimental aviary.

Minor Program Requirements:

Avian Sciences

Choose one from: Avian Sciences 11, 13, 141, 151, 161
Choose remaining units from: Avian Sciences 100, 103, 115, 121, 149, 150, 160; Animal Science 143; Neurobiology, Physiology, and Behavior 117, Wildlife, Fish, and Conservation Biology 111, 136; 15-16

Graduate Study. The Avian Sciences Graduate Group offers a program of study and research leading to the M.S. and Ph.D. degrees. The M.S. degree is offered in Avian Sciences. For details, see Graduate Studies, on page 120.

Related Courses. See Agricultural and Resource Economics 130; Animal Science 143; Food Science and Technology 120, 121; Molecular and Cellular Biology 150, 1500; Nutrition 123, 123L.

Courses in Avian Sciences (AVS)

Lower Division

11. Introduction to Poultry Science (3)

Pre-requisite: consent of instructor. One weekly discussion and field trip to study practical captive management (housing, feeding, equipment, marketing, diseases). Visit facilities rearing birds such as commercial parrots, hobbyist exotics, ostrich, raptors, waterfowl, game birds, poultry and pigeons. GE credit: SciEng|Wrt|SE.

13. Birds, Humans and the Environment (3)

Pre-requisite: consent of instructor. One weekly discussion and field trip to study practical captive management (housing, feeding, equipment, marketing, diseases). Visit facilities rearing birds such as commercial parrots, hobbyist exotics, ostrich, raptors, waterfowl, game birds, poultry and pigeons. GE credit: SciEng|Wrt|SE.

15L. Captive Raptor Management (2)

Laboratory—3 hours; independent study—3 hours; one field trip. Hands-on experience handling birds of prey. Students are taught all of the skills required to handle and care for the various species, including banding, biology, habitat requirements, cage design, veterinary care, rehabilitation methods, research potential and long-term care requirements. GE credit: SciEng|SE.

16A. Raptor Migration and Population Fluctuations (2)

Fieldwork—3 hours; discussion—1 hour. Prerequisite: consent of instructor. One weekly discussion and field trip to study practical captive management (housing, feeding, equipment, marketing, diseases). Visit facilities rearing birds such as commercial parrots, hobbyist exotics, ostrich, raptors, waterfowl, game birds, poultry and pigeons. GE credit: SciEng|SE.

16B. Raptor Migration and Population Fluctuations (2)

Fieldwork—3 hours; discussion—1 hour. Prerequisite: consent of instructor. Identify raptors: study of effects of weather, crops, agricultural practices on fluctuations in raptor species and numbers. Familiarize with literature; design a project; survey study sites; collect, computerize, analyze data, compare with previous years. Speciation emphasis different each quarter. One Saturday field trip. GE credit: SciEng|SE.

16C. Raptor Migration and Population Fluctuations (2)

Fieldwork—3 hours; discussion—1 hour. Prerequisite: consent of instructor. Identify raptors: study of effects of weather, crops, agricultural practices on fluctuations in raptor species and numbers. Familiarize with literature; design a project; survey study sites; collect, computerize, analyze data, compare with previous years. Speciation emphasis different each quarter. One Saturday field trip. GE credit: SciEng|SE.

16D. Raptor Migration and Population Fluctuations (2)

Fieldwork—3 hours; discussion—1 hour. Prerequisite: consent of instructor. Identify raptors: study of effects of weather, crops, agricultural practices on fluctuations in raptor species and numbers. Familiarize with literature; design a project; survey study sites; collect, computerize, analyze data, compare with previous years. Speciation emphasis different each quarter. One Saturday field trip. GE credit: SciEng|SE.

16E. Raptor Migration and Population Fluctuations (2)

Fieldwork—3 hours; discussion—1 hour. Prerequisite: consent of instructor. Identify raptors: study of effects of weather, crops, agricultural practices on fluctuations in raptor species and numbers. Familiarize with literature; design a project; survey study sites; collect, computerize, analyze data, compare with previous years. Speciation emphasis different each quarter. One Saturday field trip. GE credit: SciEng|SE.

16F. Raptor Migration and Population Fluctuations (2)

Fieldwork—3 hours; discussion—1 hour. Prerequisite: consent of instructor. Identify raptors: study of effects of weather, crops, agricultural practices on fluctuations in raptor species and numbers. Familiarize with literature; design a project; survey study sites; collect, computerize, analyze data, compare with previous years. Speciation emphasis different each quarter. One Saturday field trip. GE credit: SciEng|SE.

16G. Raptor Migration and Population Fluctuations (2)

Fieldwork—3 hours; discussion—1 hour. Prerequisite: consent of instructor. Identify raptors: study of effects of weather, crops, agricultural practices on fluctuations in raptor species and numbers. Familiarize with literature; design a project; survey study sites; collect, computerize, analyze data, compare with previous years. Speciation emphasis different each quarter. One Saturday field trip. GE credit: SciEng|SE.