Relig 350. Philosophy of Religion. (Same as Phil 350.) See *Philosophy.* Nonmajor graduate credit.

Relig 352. Religious Traditions of India. (3-0) Cr. 3. F. Examines the religious traditions of India, including HInduism, Jainism, and Skihism, through text, ritual, and contemporary practice. Nonmajor graduate credit.

Relig 353. Buddhism. (3-0) Cr. 3. S. The various Buddhist paths to realize enlightenment and freedom. Special attention to meditation and yoga and their relationship to altered states of consciousness and to social contexts. Nonmajor graduate credit.

Relig 354. Islamic Civilization. (3-0) Cr. 3. S. An introduction to Islamic religion, culture, and society from 700 to the present. Nonmajor graduate credit.

Relig 356. African Religions. (3-0) Cr. 3. An introduction to the teachings, practices, and history of the religions that originated in Africa and other religions which have gained substantial followings among African peoples. Nonmajor graduate credit.

Relig 367. Christianity in the Roman Empire. (Same as Cl St 367.) (3-0) Cr. 3. An historical introduction to the rise of Christianity in the Roman empire, with special attention to the impact of Greco-Roman culture on the thought and practice of Christians and the interaction of early Christians with their contemporaries. Nonmajor graduate credit.

Relig 370. Religion and Politics. (Same as Pol S 370.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 105 or 210 recommended.* The interaction of religion and politics in the U.S. from both an historical and contemporary perspective, as well as the role of religion in politics internationally. Nonmajor graduate credit.

Relig 376. The Archaeology of Greek and Roman Religions. (Same as Cl St 376.) See *Classical Studies.*

Relig 377. Social Dimensions of Religion. (Same as Soc 377.) (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 210, or Soc 130 or 134 recommended.* The influence of religion in society, both as a conservator of values and as a force for social change. Nonmajor graduate credit.

Relig 385. Theory and Method in Religious Studies. (3-0) Cr. 3. *Prereq: 105.* Examines the variety of theories and methods employed in the study of religion. Application of these methods to various religions of the world. Nonmajor graduate credit.

Relig 475. Seminar: Issues in the Study of Religion. (3-0) Cr. 3 each time taken, maximum of 6 credits. *Prereq: 6 credits in religious studies.* Topic changes each time offered. Closed to freshmen. Sophomores must have approval of instructor. Nonmajor graduate credit.

Relig 490. Independent Study. Cr. 1 to 3 each time taken. *Prereq: 6 credits in religious studies, and permission of instructor, approval of professor in charge of program.* No more than 9 credits of Relig 490 may be counted toward graduation. Guided reading and research on special topics selected to meet the needs of advanced students.
H. Honors

Relig 491. Senior Thesis. Cr. 3. Written under the supervision of a Religious Studies faculty advisor.

Relig 494. Special Studies in Religious Research Languages. Cr. 2 to 3 each time taken. *Prereq: 6 credits in Religious Studies and permission of instructor.*

Relig 499. Peace and Justice Internship. Cr. var., maximum of 6. *Prereq: 3 credits in religious studies, permission of faculty internship coordinator.* Supervised placement with a peace and justice agency; structured reflection on the relation of religion and practical social issues. Offered on a satisfactory-fail grading basis only.

Relig 590. Special Topics in Religious Studies. Cr. 1 to 3 each time taken. *Prereq: Permission of instructor, 9 credits in religious studies.*

Physics and Astronomy

www.physics.iastate.edu/

Alan I. Goldman, Chair of Department

Distinguished Professors: *Clem, Finnemore, Harmon, Ho, Johnston, Lynch*

University Professors: *Willson*

Professors: *Anderson, Borsa, Carter-Lewis, Crawley, Firestone, Goldman, Hauptman, Hill, Hodges, Kawaler, Kelly, Lassila, Leacock, Luban, Peterson, Rosenberg, Ross, Shinar, Soukoulis, Stassis, Struck, Tringides, Vary, Weber, Wolford, Young*

Professors (Adjunct): *Meyer*

Distinguished Professors (Emeritus): *Ruedenberg, Swenson, Zaffarano*

Professors (Emeritus): *Barnes, Bowen, Fuchs, Lamb, Pursey, Stanford, Williams, Wohn*

Associate Professors: *Appleton, Canfield, Qiu, Valencia, Whisnant*

Associate Professors (Adjunct): *Biswas, Kogan*

Assistant Professors: *Cochran, Krennrich, Lajoie, Lavery, Meltzer, Modler, Ogilvie, Rosati, Schmalian*

Assistant Professors (Adjunct): *Miller, Morris, Vaknin*

Undergraduate Study

For the undergraduate curriculum in liberal arts and sciences, major in physics, leading to the degree bachelor of science, see *Liberal Arts and Sciences, Curriculum.*

Physics and astronomy are basic natural sciences which attempt to describe and provide an understanding of both our world and our universe. Physics serves as the underpinning of many different disciplines including the other natural sciences and technological areas. Graduates are proficient in the methods of rigorous scientific analysis, relevant mathematical techniques, and modern computational and laboratory methods. They have a broad knowledge of physics, including mechanics, electricity and magnetism, thermodynamics, and modern physics. They are able to communicate clearly and effectively at general and technical levels. They are prepared to pursue a wide range of careers as a professional physicist, astronomer, or science educator. They are also prepared to pursue advanced studies and careers in areas as diverse as engineering, medicine, law, and business administration.

Many opportunities exist for students who terminate their studies with a bachelor's degree, especially when combined with technology studies in other areas. Students who meet the necessary scholastic standards often continue their studies in a graduate college, exploring and contributing to new developments in the field.

The department normally expects each student majoring in physics to complete at least the following courses: Phys 221, 222, 232, 321, 321L, 322, 322L, 304, 306, 361, 364, and three credits of laboratory work chosen from 310, 311, 311T, 470L, or Astro 344L. All students are required to earn at least 5 credits in laboratory work in physics in addition to the laboratory components of Phys 221 and 222. These 5 credits must be in courses numbered 300 or higher or in approved substitutions. All students must earn at least 20 credits in physics and astronomy courses numbered 304 or higher. The basic list of expected courses is not a rigid requirement and changes in this basic list will be approved by the department curriculum committee on recommendation of the student's advisor when such changes will better serve the student's needs. In particular, students planning a physics major and also seeking certification for high school teaching may, with the approval of their adviser, follow a significantly different program designed to meet their particular needs; these students should consult the department for further information. Further information concerning programs of study, including sample degree programs, is available from the department.

The department also offers a major in applied physics in cooperation with several other departments. This major consists of a physics core plus more specialized studies in a physics-related technology area, and is designed to prepare students to work in high-technology industry, or continue their studies in a graduate program in applied science or engineering. Normally students in this major will be expected to complete a physics core, consisting of the following courses: Phys 221, 222, 321, 321L, 361, 364, and six credits of laboratory work chosen from Phys 310, 311, and 470L. At least 3 credits of the laboratory must be in Phys 470L. In additions, a minimum of 12 credits in a specialized topic area must be obtained in a cooperating department. A minimum of 6 credits of additional physics courses are required at the 300 level or above. Specific requirements and recommendations for course selection depend on the area of specialization, and guidelines may be obtained from the Department of Physics and Astronomy. In summary, the major usually requires a minimum of 32 credits of physics and 12 credits in a specialized topic area.

Students majoring in physics who wish an emphasis in astronomy or astrophysics should consider a minor in astronomy (see below). Those planning graduate work in physics, astronomy, or astrophysics should add to the basic list the courses Phys 362, 365, 480, 481, and 496. One or more of Astro 405, Phys 511, 524, or 537 may also be added according to interest.

The department offers a minor in physics which may be earned by completing 20 credits in physics courses chosen as follows: Phys 221, 222; either 321 or 324; at least one credit of laboratory chosen from 321L, 322L, 310, 311, and 311T. Other acceptable courses are 304, 306, 322, 361, 362, 364, 365, 480, 481, and 496.

The department offers a minor in astronomy which may be earned by completing 15 credits chosen as follows: a total of 12 or more credits in Astro courses (must include Astro 344L and may include one of the courses Astro 120, Astro 150 or Astro 250), with the remaining 3 credits (if applicable) chosen from among Physics 304, 321, 324, 361, 362, 364, 365, 480, 481, or 496; 12 or more credits must be at the 300 level or higher. Note that the same course may not be used to satisfy both the requirements of a physics major and an astronomy minor.

English proficiency requirement: The department requires a grade of C or better in each of Engl 104 and 105 (or 105H), and a C– or better in Engl 305 or 314. Students are also encouraged to study at least one foreign language.

Graduate Study

The department offers studies for the degrees master of science and doctor of philosophy with majors at both levels in applied physics, astrophysics, condensed matter physics, high energy physics, nuclear physics, and physics; and minor credit courses for students majoring in other departments.

Facilities of various research groups of the department, the Ames Laboratory, and the Applied Science Center, including the Microelectronics Research Center, are available for research.

Students with bachelor's degrees in physics or astronomy from other institutions ordinarily will qualify for graduate study at Iowa State provided they have satisfactorily completed course work similar to that suggested for undergraduate majors here intending to go on to graduate school. In some cases additional instruction at the intermediate level may be required.

Graduates have a broad understanding of physical science, as well as mastery of state-of-the-art methods in their area of specialization. They are able to communicate effectively to a wide range of audiences, from the general public to research colleagues. Their skills in rigorous scientific thinking prepare them for leadership in the broader community. They are skilled in carrying out research, communicating research results, and soliciting research support. They have considerable teaching experience. They have developed problem solving skills that prepare them for careers in either industry or academia.

All candidates for an advanced degree in physics are expected to complete Phys 571, 572, 591, and either 531 or 564. Candidates for an advanced degree in applied physics are expected to complete Phys 571, 591, 470L (6 cr.), 699 (3 cr.), and either 572 or 531.

Except for the applied physics major where a thesis is always required, the degree master of science is offered both with and without thesis.

For all areas of study except applied physics the basic requirements for the M.S. are the same: At least 30 credits of acceptable graduate work must be completed, not less than 21 of which must be in physics or astronomy. Students must complete not less than 6 credits from outside their major area, with 3 credits being required from outside the department, and 3 credits from a 500 or 600 level course in another area of specialization.

Students choosing a degree with thesis may apply up to 8 credits of 699 but no credits of 599 toward the minimum 30 credits. Students choosing a degree without thesis should apply 2 credits of 599, but may not apply any credits of 699 toward the minimum 30 credits.

Students whose major area is applied physics must complete at least 30 credits of acceptable graduate work and not less than 19 credits of these must be in the required courses listed above; the remaining 11 credits of the 30 credit minimum may be chosen freely either from within the students major area or from without and either from the department or outside, but it should be noted that not more than 3 credits of Phys 699 may be applied toward the 30 credit minimum.

In addition to the list of basic courses above, all candidates for the doctor of philosophy degree, except those in astrophysics, must also complete Phys 592. Individual areas may impose additional requirements. In addition to course work in the major area of study a candidate must complete 12 credits from outside this area. Of these 6 must be taken from other departments and 6 must be taken from the department with the additional constraint that this latter 6 must include at least one 500 or 600 level introductory course in another area of specialization. Each candidate for the doctor of philosophy degree is required to teach one year of elementary physics or astronomy.

Graduate students interested in a physics minor should contact the department for requirements.

Courses open for nonmajor graduate credit: Phys 304, 310, 311, 324, 321, 322, 361, 362, 364, 365, 480, 481, 496, and Astro 342, 344L, 346.

Astronomy and Astrophysics (Astro)

Courses Primarily for Undergraduate Students

Astro 120. The Sky and the Solar System. (3-0) Cr. 3. F.S.SS. For the nonscientist. The sky: constellations; motions of the sun, moon, and planets; seasons and the calendar; eclipses. The solar system: origin and evolution; characteristics of the sun, planets, satellites, comets, meteorites, and asteroids. Extensive use of the planetarium is included.

Astro 125L. The Sky and the Solar System Laboratory. (0-2) Cr. 1. F.S. *Prereq: Concurrent or previous enrollment in Astro 120.* Laboratory course to accompany Astro 120. Students carry out practical exercises involving naked eye and telescopic observing to explore and reinforce ideas covered in Astro 120. Activities based on a sky-simulation computer program and other computer-based exercises are also included.

Astro 150. Stars, Galaxies, and Cosmology. (3-0) Cr. 3. F.S. For the nonscientist. Observational aspects of stellar astronomy: motions, distances, sizes, spectra; types of stars; variability; binary systems. Stellar evolution: the birth, life, and death of stars, including supernovae, neutron stars, and black holes. The Milky Way Galaxy: clouds of matter in space, the structure and evolution of our galaxy. Other galaxies, clusters of galaxies, quasars. Theories of the origin of the universe.

Astro 250. Astronomy Bizzare. (3-0) Cr. 3. S. *Prereq: 120 or 150.* For the nonscientist. New and exciting topics in modern astronomy. Galaxy and star formation. Black holes and pulsars. Colliding galaxies. Quasars. Cosmology, the Big Bang and the future of the universe. Prospects and searches for extraterrestrial life.

Astro 290. Independent Study. Cr. 1 to 4 each time taken. *Prereq: Permission of instructor.*

Astro 342. Introduction to Solar System Astronomy. (3-0) Cr. 3. F. *Prereq: Phys 222.* Analytical and comparative studies of solar system objects—planets, satellites, rings, asteroids, comets, meteoroids, and interplanetary dust—with emphasis on the physical processes affecting them, their interactions, and their evolution. Orbital mechanics, including perturbations, stability, and resonances. Tidal forces and effects. Radiation laws and thermal physics with applications. Brief study of the sun as a star, and of stellar evolution. Origin and evolution of the solar system. Detection of other planetary systems. Nonmajor graduate credit.

Astro 344L. Astronomy Laboratory. (1-6) Cr. 3. F. *Prereq: Phys 222.* Experiments in optical astronomy. Observational techniques, ranging from stellar photometry to astrophotography. Available instruments include 8" Meade, 14" Celestron and Schmidt cameras. Class meets at Fick Observatory south of Boone. Nonmajor graduate credit.

Astro 346. Introduction to Astrophysics. (3-0) Cr. 3. S. *Prereq: Phys 222.* Basic radiation theory; spectra. Observational determination of stellar properties; spectral classification. Binary systems. Stellar structure and evolution. White dwarfs, neutron stars, black holes. The Galaxy: structure and composition; the interstellar medium. Other galaxies; active galaxies; cosmology. Nonmajor graduate credit.

Astro 405. Astrophysics. (Dual-listed with 505.) (3-0) Cr. 3. F. *Prereq: 342 or 346; Math 266.* Survey of astrophysics at an advanced level. Physics of stars, galaxies, and the universe. Stellar spectra, structure and evolution. Origin of the elements. Black holes, neutron stars and white dwarfs. Large scale structure of the universe, dark matter, Big Bang Cosmology.

Astro 450. Undergraduate Research. Cr. 1 to 6 each time taken. F.S.SS. *Prereq: Permission of instructor.* Research under supervision of astronomy faculty.

Astro 450L. Undergraduate Research. Cr. 1 to 6 each time taken. F.S.SS. *Prereq: 344L and permission of instructor.* Laboratory or observational project under supervision of astronomy faculty.

Astro 490. Independent Study. Cr. 1 to 4. *Prereq: 6 credits in astronomy, permission of instructor.* No more than 9 credits of Astro 490 may be counted toward graduation.
H. Honors

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

Astro 505. Astrophysics. (Dual-listed with 405.) (3-0) Cr. 3. F. *Prereq: 342 or 346; Math 266, permission of instructor.* Survey of astrophysics at an advanced level. Physics of stars, galaxies, and the universe. Stellar spectra, structure and evolution. Origin of the elements. Black holes, neutron stars and white dwarfs. Large scale structure of the universe, dark matter, Big Bang Cosmology.

Astro 510. Observational Astrophysics. (2-3) Cr. 3. Alt. F., offered 2002. *Prereq: 405 or 505.* Techniques in optical and near-IR astronomy, including spectroscopy and photometry with both single channel and 2-dimensional array detectors. Emphasis on projects involving proficiency in the use of research telescopes and modern instrumentation. Project topics range from spectroscopic and photometric studies of pulsating and binary star systems to deep photographic and CCD imaging of faint nebulae and galaxies.

Astro 518. Radio Astronomy and Astrophysics (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: Phys 365 or E E 313.* Radio astronomy fundamentals; wave polarization and measurement; radio telescope receivers and antennas; wave propagation in plasmas; synchrotron emission; continuum and line spectra; physical conditions in radio sources.

Astro 575. Radiative Transfer, Stellar Atmospheres, and Spectroscopy. (3-0) Cr. 3. Alt. F, offered 2001. *Prereq: 405 or 505.* Radiative transfer with applications to stellar interiors, atmospheres, and the interstellar medium. Interaction of radiation and matter; line and continuum processes. Statistical equilibrium. Line profiles. Interpretation of stellar spectra: temperature, pressure, and abundance determinations. Dynamic and extended atmospheres, chromospheres, coronae, and stellar winds.

Astro 580. Stellar Structure and Evolution. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 405 or 505.* Stellar structure equations and constitutive relations: energy generation, energy transport by radiation and convection; equation of state. Solutions to the equations: general theorems, analytic approximations, numerical techniques and results. Stellar evolution from formation to final phases. Nucleosynthesis; recycling of material to the interstellar medium. Evolution in interacting binaries. Variable stars.

Astro 590. Special topics. Cr. var.

Astro 599. Creative Component. Cr. var. *Prereq: Permission of instructor.* Individually directed study of research-level problems for students electing the nonthesis M.S. option in astronomy.

Courses for Graduate Students

Astro 615. Galactic and Extragalactic Astronomy. (3-0) Cr. 3. Alt. F, offered 2001. *Prereq: 405 or 505.* Galactic structure, dynamics of external galaxies, evolution and classification of galaxies, extragalactic radio sources, quasars, cosmological models.

Astro 650. Advanced Seminar. (1-0) Cr. 1 each time taken. F.S. Topics of current interest in astronomy and astrophysics. Offered on a satisfactory-fail grading basis only.

Astro 660. Advanced Topics in Astronomy and Astrophysics. Cr. 1 to 3 each time taken. F.S. Topics in stellar, galactic, and extragalactic astronomy, including stellar evolution, solar physics, variable stars, compact objects, the interstellar medium, active galaxies and quasars, formation and evolution of galaxies, cosmology, high energy astrophysics, advanced observational techniques, and astrophysical applications of hydrodynamics.

Astro 699. Research.

Physics (Phys)

Courses Primarily for Undergraduate Students

Phys 101. Physics for the Nonscientist. (3-0) Cr. 3. F.S. Survey of the principal areas of both classical and modern physics. Emphasis on the nature of the physical universe and the application of physical principles to life in the modern world.

Phys 106. The Physics of Common Experience. (4-2) Cr. 4. F.S. Elementary topics from mechanics, heat, electricity, sound, and light, emphasizing the use of basic principles to understand everyday experience. Includes practical problem exercises and a coordinated laboratory.

Phys 111. General Physics. (4-2) Cr. 4. F.S.SS. *Prereq: 1½ years of high school algebra, 1 year of geometry, 1 semester of trigonometry.* General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering. Mechanics, fluids, heat and thermodynamics, vibrations, waves, sound.

Phys 112. General Physics. (4-2) Cr. 4. F.S.SS. *Prereq: 111.* General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering. Electricity and magnetism, ray and wave optics, topics in modern physics.

Phys 198. Physics of Music. (2-2) Cr. 3. F. Introductory level course on sound for nonphysics majors. Properties of pure tones and harmonics; human perception of sound; room acoustics; scales; production, and analysis of musical by voice, string, woodwind, brass, and percussion instruments.

Phys 199. Introductory Seminar. (1-1) Cr. R. F. Survey of recent scientific breakthroughs and current research of physics and astronomy faculty. Discussion of careers based on a major in physics. Offered on a satisfactory-fail grading basis only.

Phys 221. Introduction to Classical Physics I. (4.5-1) Cr. 5. F.S.SS. *Prereq: Credit or enrollment in Math 166.* For engineering and science majors. 3 hours of lecture each week plus 3 recitations and 1 laboratory every 2 weeks. Elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. Electric forces and fields. Electrical currents; DC circuits.
H. Honors. F.S.

Phys 222. Introduction to Classical Physics II. (4-2) Cr. 5. F.S.SS. *Prereq: 221, Math 166.* 3 hours of lecture each week plus 1 recitation and 1 laboratory each week. Magnetic forces and fields: LR, LC, LCR circuits; Maxwell's equations; waves and sound; ray optics and image formation; wave optics: heat, thermodynamics, kinetic theory of gases; topics in modern physics.
H. Honors. F.S.

Phys 232. Computational Skills of Physics. (0-2) Cr. 1. S. *Prereq: 222.* Development of skills in the use of software and computational equipment essential to physicists and other scientists. Students work at their own pace. Programming experience is helpful but not necessary.

Phys 290. Independent Study. Cr. 1 to 4 each time taken. *Prereq: Permission of instructor.*

Phys 298. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; sophomore classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Phys 302. The Challenge of Contemporary Physics. (3-0) Cr. 3. S. *Prereq: Sophomore classification.* A largely nonmathematical but intellectually challenging exploration of physics which assumes no previous work in the field. Selected material from classical and modern physics establishes the conceptual framework for the study of a major area of contemporary physics, culminating in the discussion of topics at the frontier of present knowledge. Research topics may vary from year to year and may include new particles, quarks, superconductivity, lasers, nuclear fusion, liquid crystals, solid state devices, gravitational waves.

Phys 304. Thermal Physics. (3-0) Cr. 3. F. *Prereq: 222, Math 266.* Concepts of temperature, entropy, and other characteristic thermodynamic functions, with application to macroscopic properties of matter. The laws of thermodynamics. Introduction to statistical mechanics, including quantum statistics. Application to black body radiation, crystalline vibrations, magnetic ions in solids, electronic heat capacity of metals. Phase transformations and chemical reactions. Nonmajor graduate credit.

Phys 306. Physics of Wave Motion. (3-0) Cr. 3. S. *Prereq: 222, credit or enrollment in Math 267.* Oscillating systems including damped and forced oscillations; fluids, geometric optics, water waves, the wave equation, Fourier and Laplace transforms, non-uniform media, cylindrical and spherical waves, polarization, interference and diffraction, transmission lines, non-linear waves.

Phys 310. Electronic Instrumentation for Experimental Physics. (2-4) Cr. 4. F. *Prereq: 222; Math 166.* Common electrical instruments; power supplies; transducers; passive and active devices, analog integrated circuits, including filters and amplifiers; digital integrated circuits; signal transmission and enhancement. Nonmajor graduate credit.

Phys 311. Intermediate Laboratory. (0-3) Cr. 1 or (0-6) Cr. 2 each time taken. S. *Prereq: 322 or 324.* Experiments in classical and modern physics performed independently by each student. Nonmajor graduate credit.

Phys 311T. Intermediate Laboratory. (0-6) Cr. 3 each time taken. S. *Prereq: 112 or 222.* Experiments in classical and modern physics performed independently by each student. For students preparing for a career in high school teaching.

Phys 321. Introduction to Modern Physics I. (3-0) Cr. 3. S. *Prereq: 222, credit or enrollment in Math 266.* Quantum nature of matter: photons, Bohr model of hydrogen, deBroglie wavelength of matter. Schrödinger wave equation in one dimension: energy quantization; detailed solutions for potential steps, barriers and wells. One-electron atoms, spin, and transition rates; x-ray and optical excitations of multielectron atoms. Nonmajor graduate credit.

Phys 321L. Introductory Laboratory in Modern Physics. (0-2) Cr. 1. S. *Prereq: Credit or enrollment in 321 and credit or enrollment in 232 or equivalent experience.* Experiments related to the foundations of modern physics. The dual wave and particle character of electrons and photons, statistics, interferometry and x-ray spectroscopy.

Phys 322. Introduction to Modern Physics II. (3-0) Cr. 3. F. *Prereq: 321.* Quantum statistics; lasers; physics of molecules. Properties of solids, including electron band structure, superconductivity and magnetism. Nuclear physics, including nuclear sizes and masses, stability, decay modes, reactions, fission and fusion. Elementary particles, including strangeness, charm, and quarks. Fundamental forces of nature. Nonmajor graduate credit.

Phys 322L. Introductory Laboratory in Modern Physics II. (0-2) Cr. 1. F. *Prereq: Credit or enrollment in 322.* Experiments related to the foundations of modern physics. Radioactive decay, elementary particles, Hall effect, spectroscopy and instrumentation.

Phys 324. Elementary Modern Physics. (3-0) Cr. 3. F.S. *Prereq: 222, credit or enrollment in Math 266.* For students desiring a one-semester introduction to modern physics following Phys 222; students desiring a more comprehensive treatment should consider Phys 321-322. Quantization of light and energy, Schrödinger equation, atomic physics, molecular structure and spectra, properties of solids, the nuclear atom, nuclear fission and fusion. Nonmajor graduate credit.

Phys 361. Classical Mechanics. (3-0) Cr. 3. F. *Prereq: 222, Math 265, 266.* Newtonian mechanics including forced oscillations, central forces and orbital motion, collisions, moving frames of reference, Lagrange's equations. Nonmajor graduate credit.

Phys 362. Intermediate Mechanics. (3-0) Cr. 3. S. *Prereq: 361.* Rigid body motion; small oscillations, normal modes. Special relativity including length contraction, time dilation, simultaneity, Lorentz transformation, 4-vector covariant formalism, relativistic mechanics. Nonmajor graduate credit.

Phys 364. Electricity and Magnetism I. (3-0) Cr. 3. S. *Prereq: 222, Math 385 or Math 395.* Static electric and magnetic fields, potential theory; electromagnetism, Maxwell's equations. Nonmajor graduate credit.

Phys 365. Electricity and Magnetism II. (2-0) Cr. 2. F. *Prereq: 364.* Relativistic electromagnetic theory; radiation and propagation of electromagnetic waves; interaction with matter. Nonmajor graduate credit.

Phys 389. Seminar (1-0) Cr. R. S. Required of all junior physics majors. Career opportunities: graduate school programs and application, job placement, alternative careers, basic skills needed for the job market competition. Offered on a satisfactory-fail grading basis only.

Phys 398. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; junior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Phys 399. Seminar on Secondary School Physics. Cr. 1 to 2; maximum of 2. F.S. *Prereq: Permission of instructor.* Review of materials and curricula for secondary school physics presented and discussed by members of the class. Required for approval to teach physics in secondary schools.

Phys 450. Undergraduate Research. Cr. 1 to 6 each time taken. F.S.SS. *Prereq: Permission of instructor.* Theoretical research under supervision of physics faculty.

Phys 450L. Undergraduate Research. Cr. 1 to 6 each time taken. F.S.SS. *Prereq: 311, permission of instructor.* Laboratory project under supervision of physics faculty.

Phys 470L. Applied Physics Laboratory. Cr. 2-5 each time taken. F.S.SS. *Prereq: 322 or 324 and permission of instructor.* Studies in modern experimental techniques via experimentation and simulation in various areas of applied physics, e.g. superconductivity, optical spectroscopy, nuclear magnetic resonance, electron spin resonance, x-ray diffraction, and computation of electronic and structural properties of matter.

Phys 480. Quantum Mechanics I. (3-0) Cr. 3. F. *Prereq: 322, Math 385.* First semester of a full-year course. A systematic development of the formalism and applications of quantum mechanics. Solutions to the time independent Schrodinger equation for various one-dimensional potentials including the harmonice oscillator; operator methods; Heisenberg picture; angular momentum; the hydrogen atom; spin; symmetry properties. Nonmajor graduate credit.

Phys 481. Quantum Mechanics II. (3-0) Cr. 3. S. *Prereq: 480.* Continuation of 480. Addition of angular momentum; charged particles in electromagnetic fields; time-independent perturbation theory; variational principles; WKB approximation; interaction picture; time-dependent perturbation theory; adiabatic approximation; scattering; selected topics in radiation theory; quantum paradoxes. Nonmajor graduate credit.

Phys 489. Tutorial Seminar. (1-0) Cr. 1 each time taken. F.S. *Prereq: Permission of instructor.* For junior and senior physics majors. Topics of interest in physics discussed in small groups. Offered on a satisfactory-fail grading basis only.

Phys 490. Independent Study. Cr. 1 to 4. *Prereq: 6 credits in physics, permission of instructor.* No more than 9 credits of Phys 490 may be counted toward graduation.
H. Honors

Phys 496. Modern Optics. (3-0) Cr. 3. S. *Prereq: Credit or enrollment in 321 and 365.* Review of wave and electromagnetic theory; topics selected from: reflection/refraction, interference, geometrical optics, Fourier analysis, dispersion, coherence, Fraunhofer and Fresnel diffraction, holography, quantum optics, nonlinear optics. Nonmajor graduate credit.

Phys 498. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; senior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

Phys 500. Introductory Research Seminar. (1-1) Cr. R. F. Discussion by research staff of their research areas, expected thesis research work, and opportunities in the field. For graduate physics majors only. Offered on a satisfactory-fail grading basis only.

Phys 501. Oral Communication of Physics Seminar. (2-0) Cr. 1 each time taken. F. *Prereq: Graduate classification.* Practice in communication of physics and astronomy in typical college classroom settings and professional meetings. Skills emphasized include selection of physical examples and analogies, presentation styles of topics, scientific dialogue, organization of physics topics, and classroom technique. The teaching proficiency of each student is evaluated in detail. For graduate physics majors only. Offered on a satisfactory-fail grading basis only.

Phys 511. Solid State Physics. (3-0) Cr. 3. S. *Prereq: 304, 322.* First semester of a full-year course. Free electron model; crystal symmetry; band theory of solids; transport properties; Fermi surface; phonons; semiconductors; crystal surfaces; magnetism; superconductivity.

Phys 512. Solid State Physics. (3-0) Cr. 3. F. *Prereq: 511.* Continuation of 511. Free electron model; crystal symmetry; band theory of solids; transport properties; Fermi surface; phonons; semiconductors; crystal surfaces; magnetism; superconductivity.

Phys 515. Physical Processes in Plasma. (Same as E E 515.) See *Electrical Engineering.*

Phys 524. Nuclear Physics. (3-0) Cr. 3. S. *Prereq: 480.* Basic properties and structure of atomic nuclei, introduction to nuclear models, nuclear reactions, decay and stability; accelerators; nuclear astrophysics and relativistic heavy-ion collisions.

Phys 528. Atmospheric Physics. (Same as Mteor 528.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 304, 322, 361, and 364.* Physics of fluids as applied to the atmosphere: equations of motion, conservation laws; atmospheric waves, small to planetary scale; remote sensing by satellites.

Phys 531. Statistical Mechanics. (3-0) Cr. 3. F. *Prereq: 304, Math 465, credit or enrollment in Math 365 or 426.* Thermodynamic properties of systems of many particles obeying Boltzmann, Fermi-Dirac, and Bose-Einstein statistics; microcanonical, canonical, and grand canonical ensembles and their application to physical problems; density matrices; introduction to phase transitions; renormalization group theory; kinetic theory and fluctuations.

Phys 535. Physics of Semiconductors. (Same as E E 535.) See *Electrical Engineering.*

Phys 536. Physics of Semiconductor Devices. (Same as E E 536.) See *Electrical Engineering.*

Phys 537. High Energy Physics. (3-0) Cr. 3. S. *Prereq: 480.* Survey of particle physics; covariant kinematics and Lagrangians; the Standard Model and the Higgs mechanism, $W^{\pm}$ and Z^0 production and decay; hadron spectroscopy, structure functions; running coupling constants; the CKM matrix; selected topics beyond the Standard Model such as supersymmetry and grand unification.

Phys 541. General Relativity. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 362 or Math 465.* Tensor analysis and differential geometry developed and used to formulate Einstein field equations. Schwarzschild and Kerr solutions. Other advanced topics may include gravitational radiation, particle production by gravitational fields, alternate gravitational theories, attempts at unified field theories, cosmology.

Phys 551. Computational Physics. (0-4) Cr. 2. S. *Prereq: 365, 480.* Use of modern computational techniques to analyze topics in classical and modern physics. Offered on a satisfactory-fail grading basis only.

Phys 564. Advanced Classical Mechanics. (3-0) Cr. 3. F. *Prereq: 361, Math 426, 465.* Variational principles, Lagrange's equations, Hamilton's canonical equations, canonical transformations, Hamilton-Jacobi theory, infinitesimal transformations, classical field theory.

Phys 571. Advanced Electricity and Magnetism. (3-0) Cr. 3. F. *Prereq: 365, Math 426.* Electrostatics, magnetostatics, boundary value problems, Maxwell's equations, wave phenomena in macroscopic media, wave guides.

Phys 572. Advanced Electricity and Magnetism. (3-0) Cr. 3. S. *Prereq: 571.* Special theory of relativity, least action and motion of charged particles in electromagnetic fields, radiation, collisions between charged particles, multipole fields, radiation damping.

Phys 590. Special Topics. Cr. var. *Prereq: Permission of instructor.* Topics of current interest.
A. Nuclear Physics
B. Condensed Matter Physics
C. High Energy Physics
D. Physics
E. Applied Physics

Phys 591. Quantum Physics I. (4-0) Cr. 4. F. *Prereq: 481.* First semester of a full-year course. Postulates of quantum mechanics; time-dependent and time-independent Schrödinger equations for one-,two-, and three-dimensional systems; theory of angular momentum; Rayleigh- Schrödinger time-independent perturbation theory.

Phys 592. Quantum Physics II. (4-0) Cr. 4. S. *Prereq: 591.* Continuation of 591. Variational theorem and WKB method; time-dependent perturbation theory; method of partial waves and Born approximation for scattering by central potentials; identical particles and symmetry; Dirac and Klein-Gordon equation for free particles; path integral formalism.

Phys 599. Creative Component. Cr. var. *Prereq: Permission of instructor.* Individually directed study of research-level problems for students electing the nonthesis M.S. degree option.

Courses for Graduate Students

Phys 611. Quantum Theory of Condensed Matter. (3-0) Cr. 3. S. *Prereq: 512, 681.* Quasiparticles in condensed matter: phonons, magnons, photons, electrons. Quantum theory of interacting many body systems: Green's functions and diagrammatic techniques.

Phys 624. Advanced Nuclear Physics. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 524 and 592.* Microscopic few-body and many-body theory; theory of effective Hamiltonians; relativistic nuclear physics; nuclear effects in hadron-nucleus, lepton-nucleus, and nucleus-nucleus reactions.

Phys 625. Physics of Strong Interactions. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 681.* Quark model; Quantum Chromodynamics IQCD); perturbation methods for QCD; effective field theories for pions and nucleons; finite temperature field theories; quark-gluon plasma; phase transitions in QCD.

Phys 632. Semiconductor Physics. (Same as E E 632.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 480, 481, 511.* Band structure; statistical mechanics of electrons and holes; galvano-magnetic effects, magnetoresistivity, cyclotron resonance; transport properties; principles of junctions and heterostructures; optical properties; amorphous semiconductors; quantum well structures.

Phys 637. Elementary Particle Physics. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 537.* First semester of a full year course. Properties of leptons, bosons, and quarks and their interactions; quantum chromodynamics, Glashow-Weinberg-Salam model, grand unification theories, supersymmetry; modern theoretical techniques and tests of the Standard Model.

Phys 638. Elementary Particle Physics. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 637.* Continuation of 637. Properties of leptons, bosons, and quarks and their interactions; quantum chromodynamics, Glashow-Weinberg-Salam model, grand unification theories, supersymmetry, and superstring theory; modern theoretical techniques.

Phys 650. Advanced Seminar. (1-0) Cr. 1 each time taken. F.S. Topics of current interest. Offered on a satisfactory-fail grading basis only.
A. Nuclear Physics
B. Condensed Matter Physics
C. High Energy Physics
D. Physics
E. Applied Physics

Phys 660. Advanced Topics in Physics. Cr. 1 to 3 each time taken. F.S. Courses on advanced topics and recent developments.
A. Nuclear Physics
B. Condensed Matter Physics
C. High Energy Physics
D. Physics
E. Applied Physics

Phys 674. Applications of Group Theory to Physics: Condensed Matter Physics. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 592.* Theory of groups and group representations; point, space, and rotation groups; applications to molecular and crystal structures, crystal field and spin-orbit interactions, energy bands and phonon dispersion relations. Applications to modern materials.

Phys 675. Applications of Group Theory to Physics: Nuclear and High Energy Physics. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 592.* Theory of Lie groups, Lie algebras, and their representations. Survey of the Lorentz group, Poincaré group, SU(N), and other Lie groups of physical importance. Applications to nuclear and elementary particle physics.

Phys 681. Quantum Field Theory I. (3-0) Cr. 3. F. *Prereq: 592.* Quantization of fields (canonical and path integral); Feynman rules; introduction to gauge theories; Quantum Electrodynamics; radiative corrections; renormalization and renormalization group.

Phys 682. Quantum Field Theory II. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 681.* Continuation of 681. Systematics of renormalization; renormalization group methods; symmetries; spontaneous symmetry breaking; non-abelian gauge theories; the Standard Model and beyond; special topics.

Phys 699. Research.

Plant Health and Protection

www.plantpath.iastate.edu

Interdepartmental Undergraduate Program)

Advisory Committee: Ed Braun, Chair; Burras, Hart, Martinson, Taber, Wray

Undergraduate Study

For undergraduate major in plant health and protection leading to the degree bachelor of science, see *Agriculture, Curricula.*

Plant Health and Protection is an interdepartmental major administered by the departments of Plant Pathology, Entomology, Agronomy, Horticulture, and Forestry. The program emphasizes a holistic approach to plant health maintenance encompassing soil fertility and plant nutrition, genetics and plant breeding, cultural practices, and protection from pests such as insects, weeds, and the microorganisms that cause plant diseases. Graduates understand the principles of plant structure and function and the ways in which plants are affected by biotic and abiotic stress factors. They are skilled in diagnosing plant health problems and in developing and implementing plant health management strategies to reduce plant stress with minimal environmental impact. Graduates are able to communicate clearly and work effectively with others on complex plant health problems. They understand the ethical and environmental dimensions of problems and issues facing agricultural and natural resource professionals.

Plant Health and Protection is a broad-based curriculum in biological and agricultural sciences. Students take courses in the basic biological and physical sciences, plant fertility management, entomology, weed science, plant pathology, and plant production systems (agronomy, horticulture, and forestry). Cooperative practical work experience/internships with industry and governmental agencies are available to qualified students. Students also have a large number of free elective credits for courses that they can use to individualize their degree program.

Plant health professionals are employed by agribusiness firms such as seed companies, agricultural chemical companies, farm management and crop consulting businesses, producer cooperatives, food processors, greenhouses, nurseries, and landscape businesses. Graduates are also employed by governmental agencies like the EPA, USDA, Extension Service, and state departments of agriculture. The curriculum in plant health and protection provides an excellent preparation for graduate study in the crop protection disciplines and related fields such as agronomy, horticulture, plant breeding, genetics, microbiology, molecular biology, botany, and environmental science.

A minor in plant health and protection may be earned with 15 or more credits in 206, 391 and additional courses selected from an approved list available from the chair of the Plant Health and Protection advisory committee. At least 9 of the 15 credits may not be used to satisfy other department, college, or university requirements.

Courses open for nonmajor graduate credit: 301, 320, 354, 376, 407, 416.

Courses Primarily for Undergraduate Students

Pl HP 110. Orientation in Plant Health and Protection. (1-0) Cr. R. F. *Prereq: Required of students in the plant health and protection curriculum.* Requirements and career opportunities in the fields of plant health and protection.

Pl HP 206. Plant Health Biology. (3-0) Cr. 3. S. *Prereq: Biol 109 or 201.* Introduction to issues in plant health biology: plant productivity and food supply, soils and plant health, plant biotechnology, integrated pest management, plant health and sustainable agriculture.

Pl HP 283. Pesticide Application Certification. (Same as Ent 283.) See *Entomology.*

Pl HP 301. Forest Ecology and Soils. (Same as For 301.) See *Forestry.* Nonmajor graduate credit.

Pl HP 317. Principles of Weed Science. (Same as Agron 317.) See *Agronomy.*

Pl HP 320. Plant Nutrition. (Same as Hort 320.) See *Horticulture.* Nonmajor graduate credit.

Pl HP 354. Soils and Plant Growth. (Same as Agron 354.) See *Agronomy.* Nonmajor graduate credit.

Pl HP 354L. Soils and Plant Growth Laboratory. (Same as Agron 354L.) See *Agronomy.*

Pl HP 376. Fundamentals of Entomology and Pest Management. (Same as Ent 376.) See *Entomology.* Nonmajor graduate credit.

Pl HP 391. Practical Plant Health. (Same as Pl P 391.) (0-4) Cr. 2. F. *Prereq: 6 credits in biological sciences.* Diagnosis of all types of plant health problems caused by diseases, insects, weeds, nutrient deficiencies and toxicities, herbicide injury, and environmental stress. Emphasis is on acquiring practical skills. Students will gain experience in written and oral communications. Field trips.

Pl HP 392. Plant Health and Protection Work Experience. Cr. R. F.S.SS. *Prereq: 6 credits in plant health and protection, permission of advisor.* Practical work experience in a plant health discipline. For majors and advanced students.

Pl HP 407. Principles of Plant Pathology. (Same as Pl P 407.) See *Plant Pathology.* Nonmajor graduate credit.

Pl HP 416. Forest Pest Management. (Same as Pl P 416.) See *Plant Pathology.* Nonmajor graduate credit.

Pl HP 475. Community Tree Management. (Same as For 475.) See *Forestry.*

Pl HP 490. Independent Study. Cr. 1 to 3. F.S.SS. *Prereq: Junior or senior classification, 6 credits in plant health and protection, permission of instructor.* A maximum of 6 credits of 490 may be used toward the total of 128 credits required for graduation.
A. Plant Health and Protection
H. Honors

Pl HP 498. Plant Health Management. (2-3) Cr. 3. S. *Prereq: 391.* Exploration of issues in plant health management from multiple perspectives. Technical and socioeconomic dimensions of problems will be analyzed through case studies, guest speakers, field trips, and other resources. Problem-solving and communications skills will be emphasized.

Plant Pathology

www.plantpath.iastate.edu

Edward J. Braun, Chair of Department

Distinguished Professors: Tiffany

Professors: Braun, Bronson, Gleason, Harrington, Hill, McGee, Miller, Nutter, Tylka

Professors (Collaborators): Stuckey, Wise

University Professors (Emeritus): McNabb

Professors (Emeritus): Durand, Epstein, Everson, Hodges, Norton, Stewart

Associate Professors: Baum, Martinson, Munkvold, Yang

Assistant Professors: Beattie, Bogdanove, Whitham

Undergraduate Study

The department participates in the undergraduate major and minor in plant health and protection; see *Agriculture, Curricula.*

For a second major in pest management see *Agriculture, Curricula.*

Graduate Study

The department offers studies for the degrees master of science and doctor of philosophy with a major in plant pathology, and minor work for students majoring in other departments or programs. A master of science nonthesis option is available. The department also participates in the inter-departmental majors in toxicology; genetics; plant physiology; molecular, cellular, and developmental biology, ecology and evolutionary biology, and sustainable agriculture.

Students entering graduate programs in the department need a sound background in the physical, biological, and mathematical sciences as well as adequate preparation in English.

Graduates have a broad understanding of the biology and management of plant pathogenic microorganisms and the interactions of pathogens with their host plants. They understand the relationship between plant pathology and allied disciplines and are able to communicate effectively with scientific colleagues and the general public in both formal and informal settings. Graduates are able to address complex plant disease problems facing agricultural and bioscience professionals, taking into account the related ethical, social, legal, and environmental issues. They are skilled in research procedures, communicating research

results, and writing concise and persuasive grant proposals.

Courses open for nonmajor graduate credit: 407, 416, 483, 493.

Courses Primarily for Undergraduate Students

Pl P 391. Practical Plant Health. (Same as Pl HP 391.) See *Plant Health and Protection.*

Pl P 407. Principles of Plant Pathology. (Same as Pl HP 407, P M 407.) (2-3) Cr. 3. F.S. *Prereq: 8 credits in biological sciences, including Biol 202.* Braun. Principles underlying the nature, diagnosis, and management of plant diseases. Laboratory complements lecture topics and provides experience in plant disease diagnosis. Nonmajor graduate credit.

Pl P 416. Forest Pest Management. (Same as Ent 416, For 416, Pl HP 416, P M 416.) (3-3) Cr. 4. S. *Prereq: 8 credits in biological sciences, including Biol 201.* Harrington, Hart. Nature of forest, shade tree, and wood pests; physical agents of tree damage; concepts of forest health; integrated case studies in the evaluation and economic analysis of protection and pest management problems; weekend field trip. Nonmajor graduate credit.

Pl P 452. Integrated Management of Diseases and Insect Pests of Turfgrasses. (Dual-listed with 552; same as Ent 452, Hort 452.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: Hort 351.* Gleason, Lewis D. Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

Pl P 477. Bacterial-Plant Interactions. (Dual-listed with 577; same as Micro 477.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 3 credits in microbiology or plant pathology.* Focuses on plant-associated bacteria in terms of their ecology, diversity, and the physiological and molecular mechanisms involved in their interactions with plants.

Pl P 483. Wood Deterioration and Preservation. (Same as For 483.) See *Forestry.* Nonmajor graduate credit.

Pl P 490. Independent Study. Cr. 1 to 3. F.S.SS. *Prereq: Junior or senior classification, 7 credits in biological sciences, permission of instructor.* A maximum of 6 credits of 490 may be used toward the total of 128 credits required for graduation.

A. Plant Pathology

H. Honors

Pl P 493. Practical Plant Pathology. Cr. 1. (40-hour workshop.) *Prereq: 6 credits in biological sciences.* Team-taught. Introduction to the characteristics and ecology of plant diseases caused by fungi, bacteria, nematodes, and viruses. Emphasis is on practical knowledge and hands-on experiences geared to the interests of agribusiness, horticultural, and extension professionals. Offered on a satisfactory-fail grading basis only. Nonmajor graduate credit.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

Pl P 503. Biology of Plant Pathogens. (3-3) Cr. 4. F. *Prereq: Biol 202, Biol 301.* Bogdanove, Hill, Martinson, Tylka. Biology, ecology, and taxonomy of organisms that cause plant disease. Laboratory experience emphasizes techniques in working with fungi, bacteria, nematodes, and viruses. Field trips.

Pl P 506. Plant-Pathogen Interactions. (2-0) Cr. 2. S. *Prereq: 407 or 416 or 503, Biol 301.* Baum, Bronson. Genetics of disease resistance and pathogenicity. Introduction to mechanisms of plant-parasite interaction.

Pl P 507. Epidemiology and Disease Management. (2-0) Cr. 2. S. *Prereq: 407 or 416 or 503.* Martinson, Nutter. Principles of pathogen population dynamics as affected by environment and host/pathogen genetics; modeling biotic plant stress on crop productivity. Principles and practices employed for disease control and their utilization for management; applications of disease management and epidemiological principles to specific diseases through case studies.

Pl P 509. Plant Virology. (Same as Micro 509.) (2-6) Cr. 4. Alt. S., offered 2003. *Prereq: 407 or 503, Bot 404, BBMB 405, Chem 211.* Hill. Plant viruses and the diseases they cause. Emphasis on epidemiology and control. Structure, function, and biochemical-biophysical properties of plant viruses.

Pl P 511. Integrated Management of Tropical Crops. (2-0) Cr. 2. Alt. S., offered 2003. *Prereq: 407 or 416 or 503 or Ent 370 or 376 or Hort 221.* Gleason, Lewis, Delate. Applications of Integrated Crop Management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects. Tour expenses paid by students.

Pl P 530. Ecologically Based Pest Management Strategies. (Same as Agron 530, Ent 530, SusAg 530.) (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: SusAg 509.* Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

Pl P 543. Plant Disease Epidemiology. (2-4) Cr. 4. Alt. F., offered 2002. *Prereq: 407 or 416 or 503.* Nutter. Theory and practice relating to the quantification of biotic plant stress as affected by the temporal and spatial interaction of host and pathogen populations. Analysis of environmental, ecological, and host and pathogen genetic factors that alter the course of plant disease epidemics. Risk assessment theory and modeling the impact of biotic plant stresses on yield and quality.

Pl P 552. Integrated Management of Diseases and Insect Pests of Turfgrasses. (Dual-listed with 452; same as Ent 552, Hort 552.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: Hort 351.* Gleason, Lewis D. Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

Pl P 574. Plant Nematology. (2-3) Cr. 3. Alt. F., offered 2002. *Prereq: 407 or 416 or 503.* Baum. Morphology, anatomy, identification, control, and life cycles of common plant-parasitic nematodes; host-parasite interactions; Caenorhabditis elegans.

Pl P 577. Bacterial-Plant Interactions. (Dual-listed with 477; same as Micro 577.) (3-1) Cr. 3. Alt. S., offered 2002. *Prereq: 3 credits in microbiology or plant pathology.* Focuses on plant-associated bacteria in terms of their ecology, diversity, and the physiological and molecular mechanisms involved in their interactions with plants.

Pl P 590. Special Topics. Cr. 1 to 3 each time taken. F.S.SS. *Prereq: 10 credits in biological sciences, permission of instructor.*

Pl P 591. Plant Disease Control. (2-3) Cr. 3. Alt. F., offered 2001. *Prereq: 407 or 416 or 503.* Martinson. Principles and practices of disease control. Use of biological control, cultural practices, resistance and chemical control in disease management.

Pl P 594. Seed Pathology. (2-3) Cr. 3. Alt. S., offered 2003. *Prereq: 407 or 503.* McGee. Significance of diseases on the major phases of seed production; growing, harvesting, conditioning, storing, and planting seed. Pathogens considered include fungi, bacteria, viruses, nematodes, and abiotic agents. Emphasis on control, epidemiology, host-parasite relationships, and seed health testing.

Courses for Graduate Students

Pl P 608. Molecular Virology. (Same as V MPM 608.) See *Veterinary Microbiology and Preventive Medicine.*

Pl P 691. Field Plant Pathology. (0-6) Cr. 2 each time taken. Alt. SS., offered 2002. *Prereq: 407 or 416 or 503.* Diagnosis of plant diseases, plant disease assessment methods, and the integration of disease management into commercial crop production practices. Objectives are to familiarize students with common diseases of Midwest crops and landscape plants, and to provide experience in disease diagnosis. Field trips include commercial operations, agricultural research facilities, and ornamental plantings.

Pl P 692. Molecular Biology of Plant-Pathogen Interactions. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 506 or BBMB 405 or Gen 411 or Micro 402 or course in molecular biology.* Miller. Molecular and physiological mechanisms of plant disease and resistance. Host-pathogen recognition and response, resistance gene function, signal transduction, *Agrobacterium,* virus-host interactions.

Pl P 694. Colloquium in Plant Pathology. (2-0) Cr. 2 each time taken. F.S. *Prereq: 407 or 416 or 503, permission of instructor.* Advanced topics in plant pathology, including biological control, cultural control, risk assessment of resistance gene deployment, genetic engineering for disease resistance, chemical control, tropical diseases, fungal genetics, and professional communications.

Pl P 698. Seminar. Cr. 1 each time taken. F.S.

Pl P 699. Thesis and Dissertation Research. Cr. var. F.S.SS.

Plant Physiology

(Interdepartmental Graduate Major)

Supervisory Committee: D. Hannapel, Chair; M. James, M. Spalding, M. Westgate, E. Wurtele

Work is offered for the degrees master of science (thesis option only) and doctor of philosophy with a major in plant physiology in the following participating departments: Agronomy; Biochemistry, Biophysics and Molecular Biology; Botany; Forestry; Horticulture; Plant Pathology; and Zoology and Genetics. In the Interdepartmental Plant Physiology Major at Iowa State University, students use modern, interdisciplinary approaches to understand plant processes at the molecular, cellular and whole-plant levels. Graduates have a broad understanding of basic, functional plant biology with emphases on fundamental biology, biochemistry, and molecular biology. They are able to address complex research and policy problems in agriculture, biotechnology, and basic plant biology.

All M.S. students must meet the following minimum requirements: (1)make two seminar presentations and enroll each term in the interdepartmental plant physiology seminar (Bot 696 or its cross-listed equivalent); (2) complete two courses chosen from the following: Agron 516, Bot 512, Bot 513; and (3) complete the following courses: BBMB 404 and 405 or 501 and 502; and Stat 401. A higher level course in biochemistry is recommended.

All Ph.D. students must complete the following requirements, in addition to those for the M.S.: (1) two more seminar presentations in Bot 696 (for a total of four); (2) Agron 516, Bot 512, Bot 513; (3) one course chosen from Bot 545, Gen 520 or 620, BBMB 675 or 676; and (4) one biochemistry course beyond the level of BBMB 404/405 or 501/502. Suggested courses include BBMB 451, 607, 622, 632, 642, or 660. Stat 402 or Agron 526 or a computational biology course are strongly recommended.

In consultation with his or her major professor and the POS committee, a student may select additional courses from an approved list avail

able from the chair of the supervisory committee of the interdepartmental major.

Courses for Graduate Students

P Phy 512. Plant Growth and Development. (Same as Bot 512.) See *Botany*.

P Phy 513. Plant Metabolism. (Same as Bot 513.) See *Botany*.

P Phy 545. Plant Molecular Biology. (Same as Bot 545.) See *Botany*.

P Phy 696. Seminar in Plant Physiology and Molecular Biology. (Same as Bot 696.) See *Botany*.

Political Science

www. iastate.edu/~polsci/

James M. McCormick, Chair of Department

University Professor: Schmidt

Professors: Dearin, Dobratz, James, Kihl, Lee, Maney, Mansbach, McCormick, Moses, Shelley, Smith, Snow

Distinguished Professor (Emeritus): Rasmussen

Professors (Emeritus): Boles, Parks, Talbot

Associate Professors: Coates, Hutter, Lowry

Associate Professor (Emeritus): Whitmer

Assistant Professors: Clark-Daniels, Ho, Kaelberer, Nemacheck, Potoski, Tuckness, Weibust

Assistant Professors (Adjunct): Bystrom, Waggoner

Undergraduate Study

For the undergraduate curriculum in Liberal Arts and Sciences, with major in political science, leading to the degree of Bachelor of Arts, see *Liberal Arts and Sciences, Curriculum*.

The study of political science is designed to enable students to become familiar with theories of public values and patterns of national, regional, and international political systems. A political science major should complete a broad liberal arts program, which would maximize opportunities for study in related social science disciplines, as well as in various areas of the humanities. Students will understand the interrelationships of the subfields of political science, develop skills in analysis and critical thinking, and be able to apply research methods relevant to the discipline.

The political science major is often chosen by students preparing for a career in law. Students with this goal should consult with the department in selecting courses. See also *Preprofessional Study*.

Several internship options are available to the political science major, offering students the opportunity to experience practical application of the knowledge learned in academic courses.

Requirements for the Major:

For the purpose of defining undergraduate requirements in the Department of Political Science, the Department employs four subfields within the discipline, with the following courses in each:

I. Theory and Methods (Pol S 230, 301, 305, 306, 313, 356, 406, 430, 431, 433, 470, 490B).

II. American Government and Politics (Pol S 215, 310, 311, 312, 320, 344, 358, 359, 360, 361, 370, 371, 385, 410, 413, 417, 420, 421, 464, 475, 476, 477, 478, 480, 482, 486, 490A).

III. Comparative Politics (Pol S 241, 314, 340, 341, 342, 343, 346, 348, 349, 350, 440, 490C).

IV. International Relations (Pol S 251, 315, 355, 356, 357, 358, 359, 381, 422, 451, 452, 453, 490D).

To complete the major in Political Science a student must earn 33 semester credits of courses in Political Science subject to the following conditions:

a. Students must satisfactorily complete Pol S 101.

b. Students must complete at least two courses in each of the four subfields listed above. Students may apply only one half semester mini-course (Pol S 312, 313, 314, 315) in each group.

c. At least 18 credits of Political Science courses must be numbered 300 or above.

d. Students must pass one statistics course from among Stat 101, 104, 227 or 231.

e. Students must develop a research tool by following one of the following options: (1) two years (four semesters) of a single college-level foreign language as demonstrated by successful completion of a foreign language class numbered 202, (2) successful completion of Pol S 301, or (3) passing a national-level examination demonstrating an intermediate level of proficiency in a language other than English. Students whose first language is not English may fulfill the research tool requirement via the options described above or by providing documentation of at least 3 years full-time course work in a secondary school, or one year of course work in a college or university, in which the language of instruction is other than English.

f. No more than six credits of Pol S 490 or 499 (alone or in combination) can be used to fulfill any of these requirements. A maximum of three credits of Pol S 490 can be applied to meet any of the four subfield requirements.

g. A maximum of six credits from half semester mini-courses (Pol S 312, 313, 314, 315) can be applied to satisfy the above requirements.

h. At least 15 credits of Political Science coursework must be earned at Iowa State University.

English Proficiency: Majors must earn at least a C+ in both Engl 104 and 105. Those who do not must complete Engl 309 or 314 with a grade of C or higher.

The department offers a minor in political science that may be earned by completing 15 credits beyond the 100-level of coursework in political science, nine of which must be at the 300 level or above. A student minoring in Political Science normally will be expected to take at least 9 credits in Political Science coursework at Iowa State University. Only 3 credits of Pol S 490 or Pol S 499, alone or in combination, and only 2 credits of Pol S 312-315 may be included in the total of 15 credits required for the minor. All minors in the College of Liberal Arts and Science required a minimum of 6 credits in courses numbered 300 and above taken at ISU with a grade of C or higher. Credits earned in Pol S 499, offered on a satisfactory/fail basis only, will not fulfill this requirement.

Graduate Study

The department offers work for a Master of Arts degree (M.A.), with a major in political science, and minor for students in other departments. The department also offers work for a Master of Public Administration (M.P.A) degree or a Certificate of Public Management (C.P.M) for those interested in an educational certificate program that requires less work than a full masters program. Brochures with detailed requirements for all graduate degrees may be obtained from the department office or at the department's web page at www.iastate.edu/ ~polsci/graduate.html.

The M.A. program is designed to enable its graduates to engage in governmental research, enter public service or private industry, teach, or pursue further graduate study. Graduate students may also wish to work for certification for high school or junior college teaching. A thesis is required for this degree. A specialization in public administration is possible. The department also has a joint Master of Arts/Juris Doctor (M.A./J.D.) program with the Law School of Drake University. Detailed information for the M.A./J.D. can be found at the ISU Political Science webpage as well as the Drake Law School website (under Joint Degree): www.law.drake.edu/admissions/specprograms.html. Students wishing to pursue this joint degree must submit separate applications to both Drake University and Iowa State University and be accepted by both institutions.

M.A. graduates have a broad substantive understanding of the political process and the academic study of politics. They also have in-depth knowledge of one or more subfields in political science. Graduates are skilled at conducting research and preparing thorough research summaries. They are able to identify and address complex political questions, taking into account related ethical, legal, economic, and social issues.

The usual prerequisites for major graduate work in the M.A. program normally are completion of at least 15 credits in political science, the GRE (Graduate Record Examination), one year of a foreign language (equivalent to 8 semester hours) and a course in basic statistics (equivalent to Stat 101). If the basic statistics requirement has not been met, the student may remedy the deficiency by passing equivalent courses, for which no graduate credit will be received. During their program of study, all students are expected to complete Stat 401, a core class of Pol S 502 or Pol S 503, and a thesis. Students normally do concentrated course work in at least one of the following three areas: international relations, comparative politics, or American politics. The student's program of study committee may require additional work.

The M.P.A. program is designed for current or aspiring administrators in city, county, state, federal, or international government work as well as those who work in nonprofit organiza-

tions. It is a professional degree, which may lead to further graduate work, but is generally considered the terminal degree for those working in the public sector. M.P.A. graduates have broad understanding of organizational processes, change management, administrative and collaborative leadership, human resource issues, policy and statistical analysis, political processes, ethical and values questions, and financial management among other issues. The program offers current practitioners networking opportunities and skills expansion; pre-service students participate in internship opportunities to provide real-world experience to complement their academic studies. Students may elect to concentrate in public management, budgeting and finance, public policy and administration, and educational leadership. Students may take their coursework in Ames or in Des Moines, and may move freely between the two locations. Classes are available over the ICN but only the Certificate of Public Management can be completed fully in this medium.

Requirements for admission normally are a graduate school application, an essay stating purposes for study, college transcripts, the GRE (waived for those with five or more years of public sector experience), three letters of recommendation, and the TOEFL for international students. During the program the students are required to complete a core of six classes (Pol S 503, 570, 571, 572, 573, 574, and Stat 401), a concentration area of 12 credits, an internship if the student has not worked in the public sector, and a creative component. The program requires a minimum of 37 credits.

The C.P.M. (the Certificate of Public Management) is a 15-credit educational certificate for those taking classes over the ICN, those pursuing other degrees and who seek the equivalent of a minor, or for those not interested in pursuing a full masters at this time. The admission process is identical to the M.P.A. program; therefore, those students later electing to continue work on a full masters degree do not need to reapply. Generally, three classes must come from the M.P.A. core and the other two courses are considered electives.

The department cooperates in the interdepartmental program in industrial relations, interdepartmental majors in transportation and water resources, and an interdepartmental minor in gerontology (see *Index)*.

Courses open for nonmajor graduate credit: 350, 370, 406, 410, 413, 417, 420, 421, 422, 430, 431, 433, 440, 451, 452, 453, 470, 475, 476, 477, 478, 480, 482, 486.

Refer to the Schedule of Classes (www.iastate.edu/~catalog/) or consult the department (www.iastate.edu/~polsci/graduate.html) for up-to-date scheduling information.

Courses Primarily for Undergraduate Students

Pol S 101. Orientation to Political Science. (2-0) Cr. 1. 8 weeks, F.S. *Prereq: Political Science and Open Option majors only or permission of the instructor.* Introduction to the discipline and sub-fields of Political Science, including an introduction to analytical thinking, and research skills relevant to political science. Orientation to university, college, and departmental structure, policies, and procedures; student roles and responsibilities; degree planning and career awareness. Offered on a satisfactory-fail grading basis only.

Pol S 215. American Government: Institutions and Policies. (3-0) Cr. 3. F.S. Fundamentals of American democracy; constitutionalism; nature of federalism; rights and duties of citizens; institutions and processes of the executive, legislative, and judicial branches of government; role of public opinion, interest groups, and political parties. Policies and problems of national government.

Pol S 230. Introduction to Law and Politics. (3-0) Cr. 3. F.S. A general introduction to the basic concepts and theories of the state and of law, including such philosophic issues as authority, power, legitimacy, freedom, and political obligation. Readings from theories in political philosophy, jurisprudence, constitutionalism, and related areas of thought.

Pol S 241. Introduction to Comparative Government and Politics. (3-0) Cr. 3. F.S. Basic concepts and major theories; application to selected political systems, including non-western political systems.

Pol S 251. Introduction to International Politics. (3-0) Cr. 3. F.S. Dynamics of interstate relations pertaining to nationalism, the nation state; peace and war; foreign policy making; the national interest; military capability and strategy; case studies of transnational issues, such as population, food, energy, and terrorism.

Pol S 298. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of department cooperative education coordinator; sophomore classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Pol S 301. Introduction to Empirical Political Research. (3-2) Cr. 4. F.S. *Prereq: 3 credits in political science; one statistics course required.* Techniques of empirical political research and analysis; surveys; methods of data collection; applications of statistics and computer techniques.

Pol S 305. Political Behavior. (3-0) Cr. 3. F. *Prereq: Sophomore classification.* Empirical theories and descriptions of political behavior, including decision-making, opinion, and attitudes, with an emphasis on groups and political elites.

Pol S 306. Political Decision-Making and Conflict Resolution. (3-0) Cr. 3. *Prereq: 3 credits in political science.* Study of domestic and international political conflict. Simulation and games will be used to illustrate the process through which conflict is resolved.

Pol S 310. State and Local Government. (3-0) Cr. 3. S. *Prereq: 3 credits in political science.* Role of state and local governments in the American federal system. Structures of participation: political parties, elections, interest groups. Major governmental institutions: legislative, executive, and judicial. Structure and functions of local governments.

Pol S 311. Municipal Government and Politics. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 215.* Legal position of municipal corporation; forms of organization; administration of municipal services; problem-solving in municipal government; urban and metropolitan political process; implications of federal urban policies.

Pol S 312. Minicourse in American Government and Politics. (3-0) Cr. 2. 8 weeks. F.S. *Prereq: Sophomore classification.* Half-semester courses on selected topical issues in American government and politics. Designated repeat not permitted. Use of credit in Pol S major and minor is limited. See *Undergraduate Study* for information.

Pol S 313. Minicourse in Theory and Methods. (3-0) Cr. 2. 8 weeks. F.S. *Prereq: Sophomore classification.* Half-semester course on selected topical issues in theory and methods in political science. Designated repeat not permitted. Use of credit in Pol S major and minor is limited. See *Undergraduate Study* for information.

Pol S 314. Minicourse in Comparative Politics. (3-0) Cr. 2. 8 weeks. F.S. *Prereq: Sophomore classification.* Half-semester course on selected topical issues in comparative politics. Designated repeat not permitted. Use of credit in Pol S major and minor is limited. See *Undergraduate Study* for information.

Pol S 315. Minicourse in International Relations. (3-0) Cr. 2. 8 weeks. F.S. *Prereq: Sophomore classification.* Half-semester course on selected topical issues in international relations. Designated repeat not permitted. Use of credit in Pol S major and minor is limited. See *Undergraduate Study* for information.

Pol S 320. American Judicial Process. (Same as C J St 320.) (3-0) Cr. 3. S. *Prereq: 215.* The genesis, structure, processes, and personnel of American courts; basic juridical concepts; restraints on exercise of the judicial power; major eras of American constitutional history; an overview of civil liberties; impact of court decisions on public policy.

Pol S 340. Politics of Developing Areas. (3-0) Cr. 3. Alt. S., offered 2002. Examination of economic and political development as they relate to the political process of developing states. Impact of social and technological change on political systems of developing areas. Some case studies.

Pol S 341. Politics of Japan. (3-0) Cr. 3. Alt. S., offered 2002. Political traditions and cultures. Contemporary governmental structures and processes. Examination of public policy issues in Japan as a post-industrial society.

Pol S 342. Politics of China. (3-0) Cr. 3. Alt. F., offered 2002. The Chinese Revolution: origins, political theory and practice, party and government. China as a modernizing nation including the problems of leadership succession and economic transformation.

Pol S 343. Latin American Government and Politics. (3-0) Cr. 3. Political institutions, processes, and contemporary issues. Selected countries examined intensively to illustrate generalizations. Role of parties, military, church, human rights, women, environmental issues, interest groups, ideology, and globalization.

Pol S 344. Public Policy. (3-0) Cr. 3. S. How agendas come to be set in public policy, theories describing the policy-making process, forces molding policy choices and the impact of such choices.

Pol S 346. European Politics. (3-0) Cr. 3. S. Comparative study of political institutions of Europe and the European Union; emphasis on parties, elections, and governmental structures. Substance and process of public policies in selected problem areas.

Pol S 348. Israeli Government and Politics. (3-0) Cr. 3. Alt. S. *Prereq: 241 or comparable background in Middle East/Israeli history.* Major factors that have shaped and continue to influence the distinctive nature of Israeli society and politics. Patterns and determinants of Mideast international relations, as reflected in Arab-Israeli conflict, foreign policymaking in Israel, and American involvement since 1945.

Pol S 349. Soviet and Post-Soviet Politics and Government. (3-0) Cr. 3. Alt. F., offered 2002. Nation-states of the former Soviet Union. Analysis of Soviet Communist system 1917-85 and the politics and revolutionary conflict leading to the dissolution of the Soviet Union from 1985 through 1991. Problems of post-Soviet nation-states of Russia and Central Eurasia since 1991.

Pol S 350. Introduction to the Middle East. (3-0) Cr. 3. S. Introduction to the Middle East as a region and to issues of political importance to the Middle East and its place in the world. Topics covered include Islam, regional conflicts and alliances, local leaders, economic issues, and gender and social relations. Nonmajor graduate credit.

Pol S 355. Soviet and Post-Soviet Foreign Policy. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 251 or comparable background in Soviet/Russian history.* History and determinants of Soviet foreign policy from 1941 through 1991, emphasizing Soviet relations with Europe, the United States, China, and the Third World. Foreign relations of the post-Soviet states of Russia and Central Eurasia since 1991.

Pol S 356. Theories of International Politics. (3-0) Cr. 3. Introduction to essential theoretical concepts and approaches, both classical and contemporary on world politics including realism, empiricism, liberalism, and postpositivism; for example, war and conflict, peace and cooperation, political economy, crisis decision-making, systemic theory, dependence and interdependence.

Pol S 357. International Security Policy. (3-0) Cr. 3. Alt. F., offered 2002. The major theoretical approaches in security policy—strategy and deterrence, game theory, bargaining theory, compellance, and coercive diplomacy, and crisis diplomacy. Illustration of these various approaches through historical and contemporary cases.

Pol S 358. United States Foreign Policy. (3-0) Cr. 3. F. *Prereq: 215 or 251, or Hist 467 or 470 or 471.* U.S. foreign policy since World War II with emphasis on changing American values in foreign policy, the role of the President, Congress, and the bureaucracy in policy making, and a survey of current foreign policy issues and problems.

Pol S 359. Current Issues in American Foreign Policy. (3-0) Cr. 3. S. *Prereq: 215, 251, or 358.* Examination of contemporary U.S. foreign policy issues (e.g., U.S. policy in the Middle East; defense budgeting in the post-Cold War era; conventional and nuclear arms control policy). The course will explore alternate methods to analyze policy, survey the evolution of each issue, and discuss different policy alternatives.

Pol S 360. Congress and the State Legislatures. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 215.* Theory of representation in democratic government. Organization, procedures, voting patterns, and leadership roles of United States Congress and state legislatures.

Pol S 361. The President and the State Governors. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 215.* Creation and historical development of the office of chief executive; character and behavior of past chief executives; selection and control; powers, roles, functions; executive staff; relations with Congress, press, public opinion.

Pol S 370. Religion and Politics. (Same as Relig 370.) See *Religious Studies.* Nonmajor graduate credit.

Pol S 371. Introduction to Public Administration. (3-0) Cr. 3. F. *Prereq: 215.* The development of public administration in federal, state, and local government. Analysis of the organization and operations of public agencies.

Pol S 381. Introduction to Political Economy. (3-0) Cr. 3. S. Introduction to the theoretical perspectives on international political economy. Exploration of specific issues such as the changing international trade regime, international finance, and Third World development under conditions of globalization.

Pol S 385. Women in Politics. (Same as W S 385.) (3-0) Cr. 3. S. Examination of the entry and participation of women in politics in the United States and other countries including a focus on contemporary issues and strategies for change through the political process.

Pol S 398. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of department cooperative education coordinator; junior classification.* Required of all cooperative education students. Students must register for this course prior to commencing work period.

Pol S 406. Public Opinion and Voting Behavior. (3-0) Cr. 3. S. *Prereq: 6 credits in political science or junior classification.* The formation of political opinions and attitudes, political participation, and voting behavior of the general public, and their influences on American politics; polling as a means of assessing public opinions and behaviors. Nonmajor graduate credit.

Pol S 410. Iowa Government and Politics. (3-0) Cr. 3. S. *Prereq: 215.* Analysis of Iowa government and politics: public opinion and political participation, governmental institutions, and major policy issues. Nonmajor graduate credit.

Pol S 413. Intergovernmental Relations. (Dual-listed with 513.) (3-0) Cr. 3. S. *Prereq: 6 credits in American government.* Theories and practices of the American federal system. Politics and policy making among federal, state, and local governments. Nonmajor graduate credit.

Pol S 417. Campaign Rhetoric. (Same as Sp Cm 417.) See *Speech Communication.* Nonmajor graduate credit.

Pol S 420. Constitutional Law. (3-0) Cr. 3. F. *Prereq: 215; junior classification.* Development of the United States Constitution through judicial action; influence of public law and judicial interpretations upon American government and society. Nonmajor graduate credit.

Pol S 421. Constitutional Freedoms. (3-0) Cr. 3. S. *Prereq: 320 or 420.* Leading Supreme Court cases interpreting the Bill of Rights and the Fourteenth Amendment. Emphasis on religion, speech, privacy, due process, and equal protection. Nonmajor graduate credit.

Pol S 422. International Law. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 215 or 251; junior classification.* Development of the principles of international law of peace and war; analysis of theories concerning its nature and fundamental conceptions; its relation to national law; problems of international legislation and codification. Nonmajor graduate credit.

Pol S 430. Western Political Thought: Plato to Machiavelli. (Same as Cl St 430.) (3-0) Cr. 3. *Prereq: 6 credits in political science, philosophy, or European history.* Major concepts in original texts of classical, medieval, and renaissance authors: justice, community, man's basic nature; natural law; force; society outside the political order. Nonmajor graduate credit.

Pol S 431. Modern Political Thought. (Dual-listed with 531.) (3-0) Cr. 3. *Prereq: 6 credits in political science, philosophy, or European history.* Texts of political thinkers beginning with Thomas Hobbes. Human nature and its influence on contract theory; private rights; differing conceptions of liberty; sovereignty; constitutionalism; bureaucracy; law and democratic theory. Nonmajor graduate credit.

Pol S 433. American Political Thought. (3-0) Cr. 3. S. *Prereq: 6 credits in political science or in American history.* Review of major political concepts and theorists in American political history. Analysis of current concepts in U.S. political thought, and their possible impacts on our political institutions. Nonmajor graduate credit.

Pol S 440. Comparative Politics of the Middle East. (3-0) Cr. 3. *Prereq: 241 and coursework on the Middle East.* Applies comparative methodology to the analysis of problems and issues affecting the Middle East as a region. Focus on democratization and economic liberalization. Nonmajor graduate credit.

Pol S 451. International Politics of Asia. (3-0) Cr. 3. F. *Prereq: 241 or 251.* International politics of Asia; emphasis on shifting power balance, role of major powers, security dilemma, foreign policies of small nations, prospect for regional integration. Nonmajor graduate credit.

Pol S 452. Comparative Foreign Policy. (Dual-listed with 552.) (3-0) Cr. 3. S. *Prereq: 251.* Various theoretical approaches to explain foreign policy making and behavior through the use of case studies of selected nations. Nonmajor graduate credit.

Pol S 453. International Organizations. (3-0) Cr. 3. S. *Prereq: 251.* Private and public organizations such as the United Nations, other specialized agencies, and multinational organizations, and their influence on our daily lives. Nonmajor graduate credit.

Pol S 464. Political Parties and Interest Groups. (3-0) Cr. 3. F. *Prereq: 215; junior classification.* Interest groups and American political parties, their principles, organizations and activities.

Pol S 470. Public Choice. (Same as Econ 470.) See *Economics.* Nonmajor graduate credit.

Pol S 475. Management in the Public Sector. (Dual-listed with 575.) (3-0) Cr. 3. F. *Prereq: 371.* Literature and research on organizational behavior and management theory with emphasis on applied aspects of managing contemporary public sector organizations. Topics include distinctions between public and private organizations, leadership, productivity, employee motivation, organizational structure, and organizational change. Nonmajor graduate credit.

Pol S 476. Administrative Law. (Dual-listed with 576.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 215; junior classification.* Constitutional problems of delegation of governmental powers, elements of fair administrative procedures, judicial control over administrative determinations. Nonmajor graduate credit.

Pol S 477. Government, Business, and Society. (Dual-listed with 577.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: Junior classification.* Diverse perspectives on the changing roles and relationships of business, government and society so as to open the way for more effective policy decisions on corporate-government affairs. Topics may include the changing economy; transformation of workplace and community conditions; consumerism; social responsibilities of businesses; economic policies and regulations; and politics in the business-government relationship. Nonmajor graduate credit.

Pol S 478. Politics of the Bureaucracy. (Dual-listed with 578.) (3-0) Cr. 3. *Prereq: Senior classification and 371, or 6 credits of political science.* Examination of the interaction between government and politics. Emphasis placed on public administration theorists, and on current behavior among the bureaucracy, Congress, and the executive branches of government. Nonmajor graduate credit.

Pol S 480. Ethics and Public Policy. (Dual-listed with 580.) (3-0) Cr. 3. *Prereq: 6 credits in political science.* Major ethical concepts in U.S. political philosophy. The controversy over public versus private morality in political policy making. Analysis of public decision-making case studies, with emphasis on ethical considerations. Major proposals and legislation related to improving the quality of ethical criteria and decisions in public policy making. Nonmajor graduate credit.

Pol S 482. Environmental Politics and Policies. (Dual-listed with 582; same as Env S 482.) (3-0) Cr. 3. F. *Prereq: 3 credits in political science or 3 credits in Environmental Studies; junior classification.* Major ideologies relation to conservation and ecology. Processes, participants, and institutions involved in state, national, and global environmental policymaking. Case studies of environmental controversies and proposals for policy reform. Nonmajor graduate credit.

Pol S 486. Science, Technology and Public Policy. (Dual-listed with 586.) (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 6 credits in Political Science; junior or senior classification.* Examines the development of science and technology policy in the United States, including the historical evolution of the government's role in science and technology, the dynamics of government-university-industry relations on technological advancement, and the impact of science and technology on global politics. Nonmajor graduate credit.

Pol S 490. Independent Study. Cr. var. F.S. *Prereq: 6 credits in political science.* No more than 9 credits of Pol S 490 may be counted toward graduation. Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See *Undergraduate Study* for information.

A. American Government and Politics
B. Theory and Method
C. Comparative Politics
D. International Relations
E. Extended credit. The student may earn an additional 1 or 2 credits for extra study done for any 300- or 400-level course, with instructor's approval.
G. Catt Center Project
H. Honors

Pol S 495. Capstone Project in Political Science. (3-0) Cr. 3. S. *Prereq: 21 credits in political science and permission of instructor.* Capstone project for political science majors; integrating research, analysis and participation.

Pol S 498. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of department cooperative education coordinator; senior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Pol S 499. Internship in Political Science. Cr. var. F.S.SS. *Prereq: 6 credits in political science; junior or senior classification; and permission of internship coordinator.* Work experience with a specific nongovernmental or governmental agency at the local, state, national, or international level, combined with academic work under faculty supervision. Offered on a satisfactory-fail grading basis only. Use of credit in Pol S major and minor is limited. See *Undergraduate Study* for information.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

Pol S 502. Political Analysis. (3-0) Cr. 3. S. *Prereq: 6 credits in political science.* Introduction to systematic reasoning and analysis in political science. Concepts, hypotheses, and major theories introduced. Alternative methods of analysis surveyed.

Pol S 503. Political Research. (3-0) Cr. 3. S. *Prereq: 6 credits in political science.* Principles of scientific, empirical research applied to political data and public policies. Research design, ethics, role of theory, types and sources of data. Survey research, voting analysis, program evaluation, computer utilization, interviewing, review of algebra and the role of statistical techniques in research.

Pol S 504. Proseminar in International Politics. (3-0) Cr. 3. F. *Prereq: 6 credits in political science or graduate standing.* An overview of the major theoretical and empirical works in the study of international politics and foreign policy. Among the major theoretical approaches surveyed and applied to international politics are realism, neo-realism, liberalism, functionalism, rational choice theory, game theory, and decision-making theory. Seminal writings by leading scholars will be reviewed.

Pol S 506. Proseminar in American Politics. (3-0) Cr. 3. S. *Prereq: 6 credits in political science or graduate standing.* A presentation of the major theories and research on American government and politics. Substantive topics include modern democratic theory, institutional performance, and mass political behavior. A variety of research methodologies are examined, including normative theory, behavioralism, and rational choice analysis.

Pol S 510. State Government and Politics. (3-0) Cr. 3. *Prereq: 310.* Comparative analysis of state political systems. Role of interest groups, political parties, legislatures, courts, and governors in state politics. Possible determinants of public policy outputs at the state level.

Pol S 513. Intergovernmental Relations. (Dual-listed with 413.) (3-0) Cr. 3. S. *Prereq: 6 credits of American government.* Theories and practices of the American federal system. Politics and policy making among federal, state, and local governments.

Pol S 531. Modern Political Thought. (Dual-listed with 431.) (3-0) Cr. 3. *Prereq: 6 credits in political science, philosophy, or European history.* Texts of political thinkers beginning with Thomas Hobbes. Human nature and its influence on contract theory; private rights; differing conceptions of liberty; sovereignty; constitutionalism; bureaucracy; law and democratic theory.

Pol S 535. Contemporary Political Philosophy. (Same as Phil 535.) See *Philosophy.*

Pol S 544. Comparative Public Policy. (3-0) Cr. 3. *Prereq: 6 credits in political science.* Examines how, why, and to what effect governments deal with substantive policy problems differently. Environmental factors, ideologies, cultures, domestic policy making processes, and interest groups.

Pol S 547. Political Leadership and Elites. (3-0) Cr. 3. *Prereq: 6 credits in political science.* Various forms of leadership and leader-follower relations. Obligations, exchanges, incentives, coercion, corruption, bossism in both the U.S. and foreign experience.

Pol S 549. Comparative Political Behavior. (3-0) Cr. 3. *Prereq: 305 or 405.* Empirical analysis of political behavior in cross-national perspective, including activist participation, level of political sophistication, cleavage structures and voting, role of partisan identification.

Pol S 552. Comparative Foreign Policy. (Dual-listed with 452.) (3-0) Cr. 3. S. *Prereq: 251.* Various theoretical approaches to explain foreign policy making and behavior through the use of case studies of selected nations.

Pol S 559. International Relations Theory. (3-0) Cr. 3. F. *Prereq: 6 credits in international studies.* Selected theoretical writings, both classical and contemporary, on world politics. Realism, war and conflict, peace and cooperation, political economy, crisis decision making, and transnational relations.

Pol S 560. Legislative Behavior. (3-0) Cr. 3. *Prereq: 360 or equivalent.* Principles, procedures, and problems of the legislative process. Policy-making in state legislatures and the U.S. Congress.

Pol S 561. The Chief Executive. (3-0) Cr. 3. *Prereq: 6 credits in American government.* Legal and political forces influencing the U.S. president, governors, and other governmental executives in decision making, developing and administering programs of government, leading public opinion, and influencing legislation.

Pol S 571. Organizational Theory in the Public Sector. (3-0) Cr. 3. F. *Prereq: 6 credits in political science.* Major theories of administrative organization, including motivations of administrators and organizations, comparisons of organizational arrangements, factors affecting organizational arrangements, and formal and informal decision-making structures.

Pol S 572. Public Budgeting and Financial Management. (3-0) Cr. 3. F. *Prereq: 6 credits in political science.* The process of public budgeting. Alternative budget systems including taxation, the appropriation process, program evaluation, and debt and risk management at federal, state, and local levels.

Pol S 573. Public Personnel Administration. (3-0) Cr. 3. S. *Prereq: 6 credits in political science.* Recruitment, retention, and development of employees; merit systems, collective bargaining, and grievance procedures.

Pol S 574. Policy and Program Evaluation. (3-0) Cr. 3. S. *Prereq: 9 credits in political science.* Integration, application, and utilization of public administration and public policy concepts in the interpretation of results and effectiveness of public programs and the prediction of consequences for policymakers and administrators.

Pol S 575. Management in the Public Sector. (Dual-listed with 475.) (3-0) Cr. 3. F. *Prereq: 6 credits in political science.* Literature and research on organizational behavior and management. Theory with emphasis on applied aspects of managing contemporary public sector organizations. Topics include distinctions between public and private organizations, leadership, productivity, employee motivation, organizational structure, and organizational change.

Pol S 576. Administrative Law. (Dual-listed with 476.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: Graduate classification.* Constitutional problems of delegation of governmental powers, elements of fair administrative procedures, judicial control over administrative determinations.

Pol S 577. Government, Business, and Society. (Dual-listed with 477.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: Graduate classification.* Diverse perspectives on the changing roles and relationships of business, government and society so as to open the way for more effective policy decisions on corporate-government affairs. Topics may include the changing economy; transformation of workplace and community conditions; consumerism; social responsibilities of businesses; economic policies and regulations; and politics in the business-government relationship.

Pol S 578. Politics of the Bureaucracy. (Dual-listed with 478.) (3-0) Cr. 3. *Prereq: Graduate classification and 371, or 6 credits of political science.* Examination of the interaction between government and politics. Emphasis placed on public administration theorists, and on current behavior among the bureaucracy, Congress, and the executive branches of government.

Pol S 580. Ethics and Public Policy. (Dual-listed with 480.) (3-0) Cr. 3. *Prereq: 6 credits in political science.* Major ethical concepts in U.S. political philosophy. The controversy over public versus private morality in political policy making. Analysis of public decision-making case studies, emphasis on ethical considerations. Major proposals and legislation related to improving the quality of ethical criteria and decisions in public policy making.

Pol S 581. International Political Economy. (3-0) Cr. 3. S. *Prereq: 6 credits in political science.* An overview of the international political economy since the end of World War II. Special emphasis on national (primarily U.S.) development assistance and agricultural/food politics and policies, and those of the international food organizations, the World Bank, and the regional development banks.

Pol S 582. Environmental Politics and Policies. (Dual-listed with 482.) (3-0) Cr. 3. F. *Prereq: 3 credits in political science or 3 credits in Environmental Studies; graduate classification.* Major ideologies relating to conservation and ecology. Processes, participants, and institutions involved in state, national, and global environmental policymaking. Case studies of environmental controversies and proposals for policy reform.

Pol S 586. Science, Technology and Public Policy. (Dual-listed with 486.) (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 6 credits in Political Science.* Investigates the dynamics of interaction between science and politics at the national and international level and how this interaction shapes policy for science, human welfare, and global concerns. The topics include the evolutionary relationship between science and government; the old and new social contract for science; national innovation policy; and global economic and environmental concerns.

Pol S 590. Special Topics. Cr. 2 to 5 each time taken. F.S. *Prereq: 15 credits in political science, written permission of instructor.*

A. American Political Institutions
B. Public Law
C. Political Theory and Methodology
D. Comparative Government
E. International Relations
F. Political Parties and Policy Formation
G. Public Administration and Public Policy
I. Internship
T. Teaching Preparation

Pol S 598. Public Administration Internship. Cr. 3-6. F.S. *Prereq: 15 credits in political science, permission of the instructor.* Supervised internship with administrative agencies, legislative organizations, judicial branch offices, and nonprofit groups.

Pol S 599. Creative Component.

Courses for Graduate Students

Pol S 610. Graduate Seminars. (3-0) Cr. 3 for each seminar. F.S. *Prereq: 15 credits in political science.*

A. American Political Institutions
B. Public Law
C. Political Theory and Methodology
D. Comparative Government
E. International Relations
F. Policy Process
G. Public Administration and Public Policy

Pol S 699. Research.

Preprofessional Study

Requirements for admission to most professional academic programs can be met by study at Iowa State University. These requirements may be met in the course of obtaining a bachelor's degree from Iowa State or at a level below that of a degree, depending on the intended field of study. The specific courses taken in a preprofessional program will depend primarily upon the admission requirements of the professional schools to which a student wants to apply. In some programs requiring three years of preprofessional work, a student may, by careful planning, complete requirements for the bachelor's degree upon transferring to Iowa State up to 32 semester credits of professional coursework. Generally these credits will be counted as electives, but a maximum of 24 may be used as major credits in interdisciplinary studies and a smaller number as major credits in appropriate departments.

Students who have not declared a major upon entry should enter as preprofessional students, i.e., premedical, prelaw, PHP (preprofessional health programs), or GENPV (General Undergraduate Studies Pre Vet), until they choose a major or transfer to a professional school. All students, whether they have selected a major or not, are encouraged to identify their interest in a professional career by designating it on their application or by completing a preprofessional interest form during registration.

Information about preprofessional program admissions requirements and career opportunities in human health or law may be obtained in the Liberal Arts and Sciences Advising Center. Information about veterinary medicine admissions requirements and career opportunities may be obtained from the coordinator of the preveterinary program in the Office of the Dean of the College of Veterinary Medicine.

Clinical Laboratory Science/Medical Technology

Clinical laboratory scientists, still commonly referred to as medical technologists, are important members of health-care teams. They perform the chemical, microscopic, radioassay, and microbiological tests that are necessary in disease diagnosis, and they type and cross-match blood samples to facilitate blood transfusions. They usually work under the supervision of a physician in a hospital or clinic laboratory, but may also be employed by a pharmaceutical company or by manufacturers of analytical instruments. The professional training requires 12 months in a hospital-based CLS/MT program following at least 3 years of college study that emphasizes chemistry and the biological sciences. Students may earn a bachelor's degree by completing the admissions requirements of the CLS/MT program and most of the degree requirements in 3 years on campus, then spending their fourth year in one of the hospital programs that are affiliated with Iowa State University. Before beginning the off-campus studies, students must earn at least 94.5 credits; the 32 most recent credits must have been earned in residence at ISU. A maximum of 32 semester credits earned in professional CLS/MT school can be used to partially fulfill the requirements for the bachelor's degree. Students who complete all degree requirements in residence at the university may apply to any school of medical technology for which the admission requirements have been met.

The following CLS/MT programs are affiliated with Iowa State University:

Mercy Hospital Medical Center, Des Moines, Iowa. Program Director: Stacy Sime. Medical Director: Vijaya L. Dhannavada

St. Luke's Methodist Hospital, Cedar Rapids, Iowa. Education Coordinator: Nadine Sojka. Medical Director: Dorryl Buck.

University of Iowa Hospitals, Iowa City, Iowa. Program Director: Mark Bowman. Medical Director: Robert D. Tucker.

Cytotechnology

A cytotechnologist works in a medical laboratory preparing, staining, mounting, and evaluating specimens of human body tissues in order to find those cells that are abnormal. The abnormal specimens are then submitted to the pathologist supervising the laboratory for confirmation and interpretation. The training requires 12 months in a school of cytotechnology after at least 3 years of college study that includes a minimum of 20 semester credits in biological sciences, 8 semester credits in chemistry, and 3 semester credits in math. Certification as a cytotechnologist requires a baccalaureate degree. Students may enter the professional school after earning a bachelor's degree in a related field. Alternatively, they may use up to 32 semester credits from an affiliated cytotechnology school in partial fulfillment of requirements for a B.S. degree.

An Interdisciplinary Studies major must earn 94.5 credits before off-campus study; the most recent 32 credits must have been earned in residence at ISU.

Iowa State University is affiliated with the cytotechnology programs of the State Laboratory of Hygiene at the University of Wisconsin-Madison and Mercy Hospital Medical Center in Des Moines.

Dental Hygiene

A dental hygienist screens dental patients for oral defects, performs clinical procedures such as cleaning teeth, and may participate in oral health education programs. Most work with dentists in private practice, but some have positions in public health centers and schools. Certification as a dental hygienist requires 2 years in a professional program of study. Admissions requirements for these programs vary. A student may study for 2 years at Iowa State University and then transfer to an institution that grants the bachelor's degree in dental hygiene. Alternatively, a student may earn a bachelor's degree in another field at Iowa State before entering a professional program.

Dentistry

Dentists diagnose, treat, and try to prevent diseases and injuries of the teeth, jaws, and mouth. Usually a general practitioner will have spent 3 or 4 years taking preprofessional courses at the undergraduate level and 4 years in dental school earning the degree of doctor of dental surgery (D.D.S.) or doctor of dental medicine (D.M.D.). Learning a specialty requires at least 2 more years. The courses necessary for admission to most dental schools include English, biology, general and organic chemistry, and physics. Students may earn a degree in any major that Iowa State University offers as they meet the admission requirements; they should choose their major to reflect their own interests and abilities. Highly qualified students may be accepted into dental school after 3 years of preprofessional study without earning a baccalaureate degree.

Health Information Management

Health information managers serve as supervisors of medical records departments in hospitals, clinics, nursing homes, and other health-care institutions. To be certified as registered record administrators (R.R.A.) they must have completed a program leading to a bachelor's degree in medical record administration. Most professional programs are 2 years in length and follow 2 years of college study in chemistry, biology, the humanities, social sciences, languages, and philosophy. Students may take the preprofessional courses at Iowa State University and then transfer to a university offering the professional program or they may earn a bachelor's degree at Iowa State University before entering a health information management program.

Hospital and Health Administration

Administrators of health care organizations manage and guide the varied activities in hospitals, clinics, nursing homes, and mental health facilities. The professional requirement may be for a master's degree or a bachelor's degree, depending upon the size of the institution and whether an upper or middle entry-level position is desired. Students at Iowa State may take general education courses for two or more years and then transfer to a university offering a bachelor's degree in health administration, or they may spend four years earning a bachelor's degree in any department before entering a master's degree program at the University of Iowa or other university. Courses required for admission to master's degree programs in hospital and health admin-

istration vary, but may include introductory accounting, management, statistics, and economics.

Human Medicine

Physicians study, diagnose, and treat illness and injury. They may work in offices, clinics, hospitals, or laboratories, in private practice or for government or industry. Their professional training usually consists of 4 years of study in a college of medicine to earn the doctor of medicine (M.D.) degree, and then 3 or more years in hospital residency learning a specialty such as family medicine, pediatrics, surgery, obstetrics, or psychiatry. A degree of doctor of osteopathy (D.O.) is awarded to those students who complete 4 years in a college of osteopathic medicine before their residency. All medical schools recommend a broad preprofessional education that includes courses in biology, chemistry, physics, mathematics, English, the social sciences, arts and humanities. Although many medical schools admit a small number of exceptionally well-qualified applicants after 3 years of preprofessional study, most students earn a bachelor's degree while taking the courses required for admission to medical school. This degree can be from any college and in any curriculum or major offered by the university. The major should reflect the student's interests and provide appropriate preparation for an alternative career.

Law

A lawyer assists the legal, peaceful resolution of conflicts in many different ways. Most lawyers are engaged in private practice, but many are employed by government agencies and private business. At least 3 years are needed to complete a law school program leading to a doctor of jurisprudence (J.D.) or a bachelor of laws (LL.B.) degree, and a bachelor's degree is required for admission to nearly all law schools. A student planning to enter law school may major in any field. The courses taken should develop skill in critical thinking, comprehension and expression of ideas, and understanding of human institutions and values. Perhaps most valuable are courses in English language and literature, government, economics, history, mathematics, Latin, logic and scientific method, and philosophy.

Library and Information Science

Librarians are essential in educational institutions, medical facilities, government agencies, industries, and public information centers. The professional preparation for library administration is provided by master's degree programs. Admission requirements for the University of Iowa's program, for example, include a bachelor's degree with at least 85 semester credits in the arts and humanities and the natural and social sciences. Iowa State students may choose majors that reflect their own interests and that may provide a foundation for working in medical, law, or other specialized libraries.

Nuclear Medicine Technology

The use of radioactive chemicals in the diagnosis and treatment of disease is the distinguishing feature of nuclear medicine. Under the supervision of a physician in a hospital or clinic, the technologist prepares and administers these radiochemical tracers, uses sophisticated detectors and computers to trace the movement and localization of the tracers in the human body, and analyzes biological specimens to determine levels of hormones, drugs, and other chemicals in the body. One year in a training program such as that at the University of Iowa College of Medicine is required to become a certified nuclear medicine technologist (C.N.M.T.). Admission to this program requires at least 94 semester credits of preprofessional coursework in chemistry, physics, zoology, English, mathematics, computer science, statistics, the social sciences, and humanities. Students at Iowa State University can transfer to a university offering a nuclear medicine technology program after 2 or 3 years of preprofessional courses, and then receive the bachelor's degree at that institution. Alternatively, the student may earn a bachelor's degree before entering the 1-year professional program or may spend 3 years at Iowa State University meeting the admissions requirements of the program and completing requirements for a B.S. degree using a maximum of 32 semester credits that may be transferred to Iowa State University from the professional school.

Nursing

A professional nurse may do clinical nursing, teaching, or research, in hospitals, private practice, public health centers, schools, or industry. Although becoming a registered nurse (R.N.) does not require a bachelor's degree, the student who completes the bachelor of science degree in nursing (B.S.N.) has college-level preparation for clinical nursing and an essential base for graduate study. Iowa State University does not offer a nursing degree but does participate in a transfer program with the University of Iowa and Grand View College in Des Moines. Students take specified courses for 2 years at Iowa State University and, if accepted in the University of Iowa College of Nursing, complete the B.S.N. requirements and the R.N. examination in another 2 years. If accepted at Grand View College, they may complete the B.S.N. requirements and take the R. N. examinations in 2 years. Students may also elect to transfer to a B.S.N. program at another college or university. Most of these programs require a minimum of 3 years of resident study, but their requirements vary, so early planning for transfer is essential.

Occupational Therapy

Occupational therapists provide purposeful activities to help those who have been disabled by physical illness or injury, birth defects, emotional disorder, aging, drug abuse, or other problems to learn to cope with everyday living. Therapists treat patients in hospitals, school systems, and rehabilitation centers. Students may complete a bachelor's degree in a related area at Iowa State University, and then enter a certification, master's or doctoral degree program at another university; or they may complete 1 or 2 years of preoccupational therapy courses at Iowa State and then transfer to another university to complete the requirements for a bachelor's degree in occupational therapy. The prerequisites for admission to an occupational therapy program usually include English, art, biology, chemistry, physics, psychology, sociology, anthropology, and statistics, but vary from one school to another.

Optometry

Optometrists examine, diagnose, treat and manage diseases of the visual system, the eye and associated structures. Treatment may include corrective glasses or contacts, vision therapy and therapeutic drugs. Optometrists usually set up their own offices or work in group practice. Professional study requires 4 years in a school or college of optometry and leads to the doctor of optometry (O.D.) degree. All optometry schools require at least 90 semester credits of preprofessional courses, including biology, chemistry, physics, mathematics, and English. Certain optometry schools require a bachelor's degree. Students wishing to earn the bachelor's degree from Iowa State University may choose any major and take the courses required for graduation with that major as they take the courses required for admission to a professional optometry program. Alternatively, students may take only courses required for admission to the professional school without earning a bachelor's degree.

Physical Therapy

Physical therapists work with people who have been disabled by injury, illness, or birth defects. They assist in evaluating the physical problems and administer therapeutic agents such as massage and exercise, heat, baths, ultrasonics, and electricity; they work in hospitals, clinics, nursing homes, schools, rehabilitation centers, and private practice. Students have several options in planning their education. They may transfer after two years at Iowa State University to a college or university offering physical therapy as a bachelor's degree program. They may complete three years of undergraduate courses including prerequisites before transferring to a three-year professional curriculum such as the master's degree program at St. Ambrose University or the doctoral degree program at Creighton University. Usually, students earn a bachelor's degree in a related field at ISU before spending two years in a professional school to earn a master's degree or certificate. Admission to the master's degree program at the University of Iowa requires a bachelor's degree. The bachelor's degree from ISU may be earned in any department, provided that the physical therapy prerequisites are completed. Earning a bachelor's degree prior to entering professional school allows a student to apply to a range of graduate level programs and builds a strong liberal arts foundation. Courses required for admission to a professional program include biology, chemistry, physics, psychology, mathematics, and statistics.

Physician Assistant

A physician assistant provides medical services under the supervision of a licensed physician, frequently in a rural or inner-city clinic. The responsibilities may include taking patients' histories, physical examinations, prescription of laboratory studies, diagnosis and treatment, follow-up care, and counseling. Certification as a physician assistant requires 2 years in a professional program at the master's or bachelor's degree level. Students applying

to a bachelor's degree program must have completed at least 60 semester credits of college work including general and organic chemistry, zoology, behavioral science, and humanities. Mathematics and physics courses are recommended, and applicants who have had health-care experience with direct patient contact are preferred. Admission to a master's degree program requires similar coursework and experience in addition to a bachelor's degree.

Podiatry

Podiatrists diagnose, treat, and try to prevent diseases and disorders of the human foot and ankle. They treat patients in private and group practice, hospitals, and, increasingly, in industrial and sports-related positions. Professional training requires 4 years in a college of podiatric medicine and leads to the degree of doctor of podiatric medicine (D.P.M.). This is usually followed by 1 to 3 years in a hospital residency. All podiatric colleges require at least 3 years of preprofessional study, including courses in biology, general and organic chemistry, physics, and English. Most entrants have a bachelor's degree, which may be in any major. A few students may complete the admission requirements and most of the bachelor's degree requirements in 3 years. If so, a maximum of 32 semester credits may be transferred to Iowa State University from the first year in an accredited podiatric college in order to complete the requirements for the bachelor's degree.

Theology or Religious Studies

The professional education of a student of religion can follow one of two paths. The path to a profession as a pastor, priest, rabbi or other leadership position in a religious tradition usually requires 3 years in a program leading to the master of divinity (M.Div.) offered at a school of divinity or of theology. The path to a profession as a teacher of religious studies at the college level requires 4-7 years in a program leading to the Ph.D. at a graduate school of Religious Studies. Both seminaries and graduate schools require a bachelor's degree for admission. The American Association of Theological Schools recommends the following areas of study as the best preparation for theological studies: English language and literature; history, including non-Western culture; philosophy; natural sciences, social sciences, especially psychology, sociology and anthropology; the fine arts; Biblical and modern languages; and religion, both Western and Eastern. Although students in a variety of major fields may qualify for admission to a theological school, interested persons are advised to review their proposed programs with a representative of the Religious Studies Program in the Department of Philosophy and Religious Studies.

Veterinary Medicine

About 75% of all veterinarians are engaged in private practice. In a mixed practice, they diagnose and treat health problems among a variety of animals. Others specialize in one species (e.g., feline, pet bird) and still others specialize in a specific discipline within veterinary medicine (e.g., cardiology, ophthalmology). Veterinarians may also choose public and corporate practice (e.g., public health, education, research, food safety, industry, laboratory animal medicine, aquatic animal medicine, poultry medicine, and military veterinary medicine).

The professional program requires four years at a college of veterinary medicine and leads to the doctor of veterinary medicine degree (D.V.M.). Admission to a veterinary college involves at least two years of preprofessional college education. Candidates must take courses in biology, chemistry, genetics, physics, English, humanities, social sciences, speech, anatomy and physiology, and biochemistry. (For Iowa State University see *Veterinary Medicine, Admission Requirements; for most recent information, consult the College of Veterinary Medicine Web site: www.vetmed.iastate.edu.*)

Students may pursue their preveterinary preparation in any college at Iowa State University. A major (preveterinary medicine is not a major) should be selected that is allied to each student's vocational interests in veterinary medicine or that otherwise offers vocational satisfaction in the event that plans for entry into the College of Veterinary Medicine change. Students are encouraged to pursue a bachelor's degree; the most effective progress toward a bachelor's degree is made when a major is selected upon entry and no change occurs before graduation. However, students who have not even considered a career other than veterinary medicine may need some time to explore possibilities before selection of a major.

To assist students who have indicated interest in the preveterinary program for the College of Veterinary Medicine and are undecided about a major, an advising category is available known as GENPV (General Undergraduate Studies Pre Vet). Orientation and advising services for these students are designed to help students fulfill preveterinary course requirements, to introduce available majors and careers allied to veterinary medicine, and to introduce career options in veterinary medicine. GENPV students must select a major by the end of their second semester. Some Iowa State University majors allow, by careful planning, the opportunity for a student to earn the bachelor's degree by combining credits from three years of preprofessional study and one year of professional study in the College of Veterinary Medicine.

Production/ Operations Management

(Administered by the Department of Logistics, Operations and Management Information Systems)

Michael R. Crum, Chair of Department

Distinguished Professors: *Allen, Baumel*

Professors: *Crum, Poist, Wacker*

Professors (Emeritus): *Thompson, Voorhees*

Associate Professors: *Hendrickson, Lummus, Mennecke, Nilakanta, Norris, Premkumar, Walter*

Assistant Professors: *Hackbarth, Johnson, Montabon, Ruben, Strader, Suzuki, Zhu*

Instructors (Adjunct): *Blanshan, Choobineh, Clayton*

Undergraduate Study

For undergraduate curriculum in business, major in production and operations management, see *College of Business, Curricula.*

Production/operations management is the planning, control, and implementation of the processes used to transform inputs into finished goods and services. A majority of the firm's investment, personnel, and purchases of materials and equipment are often controlled by the operations function. The efficient management of these resources is critical to the success of the firm. Although operations management principles apply to all types of organizations, the production/operations management major focuses on the application of these principles in manufacturing systems. Students learn how to efficiently organize and manage the labor, equipment, material, and information systems resources required to deliver products that satisfy customer needs. The major provides business students with the understanding of manufacturing planning and control systems, continuous process improvement techniques, lean manufacturing methods, strategic quality management systems, and other manufacturing practices needed to become gainfully employed in manufacturing industries.

Students are required to take three courses - POM 420, 422, and 424, plus three additional courses from an approved list.

The department also offers a minor for College of Business students with a different major. They are required to take 15 credits from a list of approved courses, 9 credits of which may not be used to satisfy any other requirement.

Graduate Study

The production/operations management major participates in two graduate programs: the M.S. in Business and the full-time and part-time M.B.A. programs. The M.S. program is a 30-credit curriculum culminating in a thesis.

The M.B.A. program is a 48-credit, nonthesis, noncreative component curricula. Twenty-four

of the 48 credit hours are core courses and the remaining 24 are graduate electives.

Students can obtain a manufacturing and quality specialization in the MBA program by taking 12 credit hours of graduate courses from a selected set of courses.

Courses open for nonmajor graduate credit: POM 420, 422, 424, 428.

Courses Primarily for Undergraduate Students

POM 320. Production/Operations Management. (3-0) Cr. 3. *Prereq: Stat 227.* Introduction and analysis of the basic concepts in production/operations management. Topics include: applied forecasting, aggregate planning, scheduling, shop floor control, total quality management, inventory management, facility layout, and project management.

POM 420. Decision Models for Business. (3-0) Cr. 3. *Prereq: Stat 227.* Topics include: Business applications of decision theory, inventory theory, business forecasting, optimization models, the transportation algorithm with trans-shipment, introduction to decision support systems, and network models. Nonmajor graduate credit.

POM 422. Manufacturing Planning and Control. (3-0) Cr. 3. *Prereq: 320.* In-depth analysis of integrated operations management systems with emphasis on operations planning and control, material requirements planning, master scheduling, forecasting, capacity planning, and related topics. Nonmajor graduate credit.

POM 424. Competitive Manufacturing Management. (3-0) Cr. 3. *Prereq: 320.* Advanced topics in operations management focused on concepts, techniques, and systems used to improve a company's competitive advantage in manufacturing, with an emphasis on lean manufacturing, continuous improvement, time-based competition, bar coding, electronic data interchange (EDI), and theory of constraints. Nonmajor graduate credit.

POM 428. Special Topics in Operations Management. (3-0) Cr. 3 each time elected. *Prereq: 320.* In-depth analysis of current issues, problems, and systems in operations management with emphasis on new theoretical and methodological developments. Topics may include in different semesters, supply chain management, productivity and quality improvement, management of technology and innovation, information technology in operations management, quick response manufacturing, and service operations management. Nonmajor graduate credit.

POM 490. Independent Study. Cr. 1 to 3 each time taken. *Prereq: 320, senior classification, permission of instructor.*

Courses Primarily for Graduate Students. Open to Qualified Undergraduate Students

POM 502. Operations Management and Strategy. (2-0) Cr. 2. *Prereq: Graduate classification, Stat 328.* The design, analysis, planning, and control of business processes to achieve desired performance objectives. Topics include: the fit between operations strategy, competitive priorities, and process structure; the impact of process structure on process performance; process performance measures and their relationships; process performance evaluation; and managerial levers for improving and controlling process performance.

POM 521. Strategic Quality Management. (3-0) Cr. 3. *Prereq: Stat 328 or equivalent, graduate classification.* Management and technical issues related to quality problem solving, including the strategic importance and economic impacts of quality, managerial issues in planning and designing quality assurance systems, control of quality systems, employee involvement, statistical concepts relevant to designing for quality, inspection and measurement, process control, and acceptance sampling. Uses projects to experience diagnosing and solving real quality problems.

POM 525. Manufacturing Strategy. (3-0) Cr. 3. *Prereq: 502 or equivalent.* Formulation, implementation, and evaluation of manufacturing strategies for achieving competitive advantage. Topics include strategic issues related to global competitiveness, quality, productivity, delivery performance, manufacturing flexibility, inventory, information technology, and performance measurement.

POM 528. Intelligent Systems for Business. (3-0) Cr. 3. *Prereq: Graduate classification or permission of instructor.* Design of intelligent systems such as neural networks, genetic algorithms, and fuzzy logic for manufacturing and business applications. Hands-on practice on bankruptcy prediction, credit approval, data mining for marketing, manufacturing cell formation, automated inspection, and scheduling.

POM 590. Special Topics. Cr. 1 to 3 each time taken. *Prereq: Permission of instructor.* For students wishing to do individual research in a particular area of POM.

Professional Agriculture

(Interdepartmental Program administered by the Department of Agricultural Education and Studies)

Supervisory Committee: Eric Hoiberg, Kenneth Holscher, Steve Jungst, Paul Lasley, Sergio Lence, Dan Loy, Kenneth Moore, Gary Munkvold, James Pease

Undergraduate Study

Through the College of Agriculture, Iowa State University offers the bachelor of science degree in professional agriculture designed specifically for those students who choose to study away from the Ames campus. Graduates have a broad base of agricultural knowledge, the ability to communicate effectively, and skills in problem solving. They have an understanding of technology and the ability to live and work in a global society. Many students take a portion of their coursework from colleges in close proximity to their homes and transfer the credit to ISU. The agricultural coursework (a minimum of 45 credits) is a well-rounded mix of agricultural topics delivered via video-tapes, world wide web, interactive video, off-campus site classes, and on-campus workshops and laboratories. For curriculum detail see *Professional Agriculture, College of Agriculture, Curricula.*

Visit our website at www.ag.iastate.edu/centers/proag/

Graduate Study

The graduate major in professional agriculture is an off-campus program leading to the degree master of agriculture. The program is considered to be a professional master's degree and not preparation for further graduate study. Graduates have a broad base of knowledge in one or more agriculture disciplines. They have the ability to communicate effectively and make decisions based on knowledge. To earn the 32 credits necessary for graduation, students must complete 24 semester credits of formal coursework, 4 semester credits of workshops, and 4 credits of creative component. Courses are delivered via video-tapes, interactive video, world-wide web, on and off campus classes and workshops. Specific courses offered in the program and the location of the off-campus classes may be obtained from the departmental course listings, off-campus course catalog, or by contacting the Professional Agriculture Coordinator, 201 Curtiss Hall.

Psychology

psych-server.iastate.edu/

Craig A. Anderson, Chair of Department

Distinguished Professors: *Wells*

Professors: *Anderson, Andre, Bonett, Borgen, Conger, Cutrona, Gerrard, Gibbons, Hughes, Larson, Peters, Phye, Russell*

Distinguished Professors (Emeritus): *Ahmann*

University Professors (Emeritus): *Brown*

Professors (Emeritus): *Avant, Bath, Charles, Edwards, Hannum, Karas, Layton, Lewis, Schuster, Strahan, Warman, Wolins, Zytowski*

Associate Professors: *Bushman, Cooper, Cunnick, Dark, Epperson, Hanisch, Scott, Venkatagiri*

Assistant Professors: *Cross, Day, Madon, Vogel*

Assistant Professors (Adjunct): *Mason*

Undergraduate Study

For the undergraduate curriculum in Liberal Arts and Sciences, with a major in psychology, leading to the degrees of bachelor of arts and bachelor of science, see *Liberal Arts and Sciences, Curriculum.*

An undergraduate major in psychology may be taken as liberal arts education, as preparation for graduate study in psychology, or as background for professional education in law and in the health professions. A student with an undergraduate psychology major and with a concurrent major or minor in departments such as business administration, family environment, or sociology may qualify with a bachelor's degree for positions in business and social welfare systems as well as for professional work in correctional, rehabilitation, and developmental disability centers. Such diversified education must be planned early in the undergraduate's career in close consultation with an adviser.

The requirements of the program enable graduates to understand and apply the scientific principles, facts, and basic methods of psychology in their personal and professional activities. Graduates learn to think scientifically about human behaviors and mental processes. They can communicate effectively in speech and in writing, respect individual and cultural differences in behaviors, and appreciate ethical issues in both the science and practice of psychology. Professional work with a job title of psychologist in academic, business, clinical, government, and school settings requires graduate degrees.

Departmental requirements for the B.A. and B.S. include the following supporting courses: 6 credits in philosophy including 201; two of the following courses: Biol 109 or 201, Zool 155, Chem 163, Gen 260; one of the following courses: Stat 101, 104, or 227; and a course in mathematics acceptable in group IIIa. In addition to the supporting courses specified above, students electing a B.S. degree must complete a minimum of 10 more supporting credits (3 in group IIIa, 6 in group IIIb, and 1 in a laboratory course in group IIIb). Students electing a B.A. degree must complete a minor.

The major must include the following psychology courses: 101, 102, 111, 201, 301, and 440 with a minimum grade of C- . The major also must include five courses distributed across at least four of the following five areas: Area A - 230; Area B - 280; Area C - 310, 315; Area D - 312, 313, 316; Area E - 360, 460. Two additional 3-credit courses must be taken either from these areas or from any of the other courses offered by the department, excluding 470, 490, 491, and 492. Students electing a B.S. degree also must complete 302 with a minimum grade of C-. In accordance with college requirements, the student must earn a C average or better in the courses used to satisfy the major.

See also the B.S./M.S. program under *Graduate Study*.

The department offers a minor in psychology which may be earned by completing 18 credits in psychology, including 101 and 301. At least 9 of the 18 credits must be in 300 level courses and above and no more than 3 of the 9 credits may be in Psych 490, 491, and 492. The student must earn a C average or better in the courses used to satisfy the requirements for the minor. Contact the psychology advising office for more information.

English proficiency requirement: The department requires a grade of C– or better in each of English 104 and 105 (or 105H), and in one of the following courses: Psych 302, Psych 490 (2 credits minimum), or Engl 302, 309, or 314.

Graduate Study

The department offers the degrees master of science and doctor of philosophy in psychology, and a minor to students with a major in other departments.

Within the major of psychology, the department offers a doctoral specialization in counseling psychology (APA accredited) and doctoral areas of concentration in cognitive psychology and social psychology. The department also offers a non-thesis master's degree program in general psychology.

Students seeking a graduate major in psychology must have graduated from an accredited college in a curriculum substantially equivalent to the undergraduate curriculum in Liberal Arts and Sciences at Iowa State University. Prerequisite to admission is at least 15 credits of basic psychology, which should include a laboratory course, a measurement course, and a statistics course.

Graduates function as academic psychologists in higher education or as professional psychologists in applied settings. They have an extensive knowledge of psychological principles and the conceptual and quantitative skills to conduct psychological research, communicating the results to the scientific community, students in the classroom, and the general public. Graduates in applied programs have specialized knowledge in counseling and program development. They are skilled in delivering such programs and services to diverse clientele in a variety of settings.

The department also participates in the interdepartmental programs in industrial relations and neuroscience, and in the interdepartmental minor in gerontology (see *Index*).

A formal class and a supervised practicum in the teaching of psychology is recommended for all doctoral students whose future plans may include teaching at the college level. A 12-month internship in a training site or agency approved by the faculty is required of all doctoral students in counseling psychology.

The department also offers a B.S./M.S. program in psychology that allows the student to obtain both the B.S. and M.S. degrees in five years. Students interested in this program should contact the chair of the department's Graduate Program Committee. Application for admission to the Graduate College and department should be made near the end of the junior year of undergraduate study.

Courses open for nonmajor graduate credit: Psych 401, 413, 422, 436, 440, 450, 460, 484, 485, 488. CmDis 471.

Courses Primarily for Undergraduate Students

Psych 101. Introduction to Psychology. (3-0) Cr. 3. F.S.SS. Fundamental psychological concepts derived from the application of the scientific method to the study of behavior and mental processes. Applications of psychology. 101H: (2-2) F. Honors section. (For students in the University Honors Program only.)

Psych 102. Laboratory in Introductory Psychology. (0-2) Cr. 1. F.S. *Prereq: Credit or enrollment in 101.* Laboratory to accompany 101.

Psych 111. Orientation to Psychology. (1-0) Cr. R. F.S. Program requirements and degree/career options. Required of psychology majors. Offered on a satisfactory-fail grading basis only.

Psych 131. Academic Learning Skills. (0-2) Cr. 1. F.S. Efficient methods of study and reading. Offered on a satisfactory-fail grading basis only.

Psych 201. Exploring Psychology at ISU. (0-2) Cr. 1. F.S. Survey of psychological research and practice. Psychology majors only. Offered on a satisfactory-fail grading basis only.

Psych 230. Developmental Psychology. (3-0) Cr. 3. F.S.SS. Life-span development of physical traits, cognition, intelligence, social and emotional behavior, personality, and adjustment.

Psych 280. Social Psychology. (3-0) Cr. 3. F.S.SS. Individual human behavior in social contexts. Emphasis on social judgments and decisions, attitudes, perceptions of others, social influence, attraction, aggression, and group pressure.

Psych 298. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; sophomore classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Psych 301. Research Design and Methodology. (3-0) Cr. 3. F.S.SS. *Prereq: Stat 101; 1 course in psychology.* Survey of the principal research techniques used in psychology with an emphasis on the statistical analysis of psychological data.

Psych 302. Research Methods in Psychology. (2-2) Cr. 3. F.S. *Prereq: 301.* Discussion of and experience in designing research studies, collecting and analyzing data, and preparing research reports in psychology.

Psych 310. Brain and Behavior. (Same as Zool 310.) (3-0) Cr. 3. F.S. *Prereq: 101; Biol 109 or 201 or Zool 155; Chem 163.* Survey of basic concepts in the neurosciences with emphasis on brain mechanisms mediating sensory processes, arousal, motivation, learning, and abnormal behavior.

Psych 312. Sensation and Perception. (3-0) Cr. 3. F.S. *Prereq: 101.* Survey of the physiology and psychology of human sensory systems including vision, audition, smell, taste, the skin senses, and the vestibular senses.

Psych 313. Learning and Memory. (3-0) Cr. 3. F.S. *Prereq: 101.* Fundamental concepts and theories of learning and memory derived from human and animal research.

Psych 314. Motivation. (3-0) Cr. 3. F.S. *Prereq: 101.* Concepts and topics of motivation including curiosity, pain, emotion, sex, aggression, love, play, addiction, sleep, fatigue, and work.

Psych 315. Drugs and Behavior. (3-0) Cr. 3. F.S. *Prereq: 101; Biol 109 or 201 or Zool 155.* A biological perspective on fundamentals of psychoactive drugs and their use in experimental, therapeutic, and social settings.

Psych 316. Cognitive Processes. (3-0) Cr. 3. F.S. *Prereq: 101.* Human information processing during thinking, problem solving, reading and language. Fundamental processes in perceiving, coding, storing, and retrieving information from short-term and long-term memory, including underlying brain mechanisms.

Psych 333. Educational Psychology. (Same as C I 333.) See *Curriculum and Instruction.*

Psych 346. Psychology of Women. (Same as W S 346.) (3-0) Cr. 3. S. *Prereq: 2 courses in psychology including 101.* Survey of psychological literature relating to biological, developmental, interpersonal, and societal determinants of the behavior of women.

Psych 360. Psychology of Normal Personality. (3-0) Cr. 3. F.S.SS. *Prereq: 101.* Theories and research in the study of development and functioning of normal personality.

Psych 381. Social Psychology of Small Group Behavior. (Same as Soc 381.) (3-0) Cr. 3. S. *Prereq: 280 or Soc 305.* A survey of small group research and theory from a social psychological perspective. Major theories of interpersonal behavior such as exchange theory, equity theory, and status consistency theory, and major areas of research such as leadership, power, conformity, bargaining, status, norms, and roles.

Psych 398. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; junior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Psych 401. History of Psychology. (3-0) Cr. 3. F.S. *Prereq: 4 courses in psychology.* Philosophy and science backgrounds of psychology. Development of theories and causes of events in academic and applied psychology. Nonmajor graduate credit.

Psych 413. Psychology of Language. (Same as Ling 413.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 101.* Psychological and linguistic processes involved in language related activities, like speaking, listening, reading and writing. Nonmajor graduate credit.

Psych 422. Counseling Theories and Techniques. (2-2) Cr. 3. F. *Prereq: 3 courses in psychology.* Survey of major theoretical approaches in counseling and related assessment and treatment techniques. Supervised practice in basic counseling skills. Nonmajor graduate credit.

Psych 434. Applied Behavior Analysis. (Dual-listed with 534.) (3-0) Cr. 3. *Prereq: 9 credits in human development and family studies or psychology.* Design and evaluation of behavioral interventions in applied settings such as classrooms, institutions, and families. Design of single subject experiments.

Psych 436. Individual Differences and Exceptional Patterns of Development. (3-0) Cr. 3. *Prereq: 230.* Behaviors, abilities, and needs of retarded, gifted, handicapped, and other atypical persons; differences associated with race, sex, and socio-economic status. Nonmajor graduate credit.

Psych 437. Characteristics of Giftedness. (Dual-listed with 537; same as HD FS 437.) (3-0) Cr. 3. *Prereq: 9 credits in human development and family studies or psychology, including Psych 230 or HD FS 102; junior classification.* Understanding of giftedness and talent from cognitive, developmental, and social perspectives using a life-span approach. Current conceptualizations and research regarding gifted children and adults. Implications for education and guidance.

Psych 440. Psychological Measurement I. (2-2) Cr. 3. F.S.SS. *Prereq: 301 and 9 credits in psychology, Stat 101.* Principles of psychological measurement, including concepts of reliability and validity; interpretation of scores; factors influencing performance; construction and use of measures of ability, achievement, and personality. Nonmajor graduate credit.

Psych 450. Industrial Psychology. (3-0) Cr. 3. F.S. *Prereq: 2 courses in psychology including 101, Stat 101.* Content and methods of industrial psychology. Selection and placement techniques, performance appraisal, training, testing in industry, techniques of interviewing, human error, accidents, and job analysis. Statistics including regression and correlation are used throughout the course. Nonmajor graduate credit.

Psych 460. Abnormal Psychology. (3-0) Cr. 3. F.S.SS. *Prereq: 3 courses in psychology including 101.* Description of major forms of maladaptation including anxiety, mood disorders, personality disorders, substance dependence, and schizophrenia. Factors in the development of behavior deviations. Research pertinent to the description, development, and maintenance of abnormal behavior. Nonmajor graduate credit.

Psych 470. Seminar in Psychology. (1-0 to 3-0) Cr. 1 to 3 each time taken. *Prereq: 12 credits in psychology.* Current topics in psychological research and practice.

A. Counseling
B. Experimental
C. Individual Differences
D. Social

Psych 484. Psychology of Close Relationships. (3-0) Cr. 3. *Prereq: 9 credits in psychology including 280.* Theories and research concerning the functions, development, and deterioration of close relationships. Influence of psychological processes on friendship, romantic, marital, and family relationships. Topics include mate selection, interdependence, trust and commitment, power and dominance in relationships, sexuality, divorce, gender roles, and family interaction. Nonmajor graduate credit.

Psych 485. Health Psychology. (3-0) Cr. 3. F. *Prereq: Junior classification, 6 credits in psychology.* Application of psychological theory and research methods to issues in physical health. Psychological factors in illness prevention, health maintenance, treatment of illness, recovery from injury and illness, and adjustment to chronic illness. Nonmajor graduate credit.

Psych 488. Cultural Psychology. (3-0) Cr. 3. S. *Prereq: 280 and 301; junior classification.* Examination of psychological differences among people living in different parts of the world with a focus on cross-cultural research related to social, developmental, and personality psychology. Nonmajor graduate credit.

Psych 490. Independent Study. Cr. var., maximum 3 per semester. F.S.SS. *Prereq: Junior classification, 6 credits in psychology, and permission of instructor.* No more than 9 credits of 490 may be counted toward a degree in psychology. Supervised reading in an area of psychology. Writing requirement.

Psych 491. Research Practicum. Cr. var. F.S.SS. *Prereq: Junior classification, permission of instructor, and credit or enrollment in 301.* No more than 9 credits of 491 may be counted toward a degree in psychology. Supervised research in an area of psychology. Primarily for students intending to pursue graduate education.

Psych 492. Fieldwork Practicum. Cr. var. F.S.SS. *Prereq: Junior classification, 12 credits in psychology, and permission of instructor.* No more than 9 credits of 492 may be counted toward a degree in psychology. Supervised fieldwork in a human service agency or other appropriate setting. Offered on a satisfactory-fail grading basis only.

Psych 498. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; senior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

Psych 507. Applications of Multivariate Methods in Psychology. (3-0) Cr. 3. *Prereq: Stat 401, Stat 402.* Training in the application of multivariate methods in the analysis of psychological data using standard statistical packages. Techniques that are covered include exploratory and confirmatory factor analysis, MANOVA, multiple regression models, logistic regression, survival analysis, path analysis, and structural equation analysis with latent variables.

Psych 508. Research Methods in Applied Psychology. (3-0) Cr. 3. *Prereq: 440, Stat 401.* Methods and issues in applied psychological research. Role of theory in research, fidelity of measurement, selection of subjects, sampling, ethical issues, experimenter bias, data collection methods, power analysis, meta-analysis, and professional standards for writing research articles. Emphasis on research methodological issues, not statistical issues.

Psych 511. Advanced Physiological Psychology. (3-0) Cr. 3. *Prereq: 310.* Neurophysiological correlates of behavior.

Psych 512. Advanced Perception. (3-0) Cr. 3. *Prereq: 312.* Survey of current theory and research in perception with an emphasis on vision.

Psych 514. Advanced Human Learning and Memory. (3-0) Cr. 3. *Prereq: 313 or 316 or 9 hours in psychology.* Historical and contemporary survey of human learning and memory.

Psych 516. Advanced Cognition. (3-0) Cr. 3. *Prereq: 316.* Theoretical models and empirical research in human cognition, including pattern recognition, attention, visual imagery, text processing, short-and long-term memory, problem solving, decision making, language, and hemispheric specialization.

Psych 517. Psychopharmacology. (3-0) Cr. 3. *Prereq: 310, 315, or equivalent and permission of instructor.* Fundamentals of drug-behavior interactions with emphasis on psychoactive drugs and their use in experimental, therapeutic, and social settings.

Psych 519. Cognitive Neuropsychology. (3-0) Cr. 3. *Prereq: Permission of instructor.* Psychological models and related neurological substrates underlying cognition in normals and brain-damaged patients. Topics of investigation include spatial perception, object and face recognition, voluntary motor control, language processing, memory, and problem solving.

Psych 533. Psychology of Learning, Cognition, and Motivation in Educational Settings. (Same as C I 533.) See *Curriculum and Instruction.*

Psych 534. Applied Behavior Analysis. (Dual-listed with 434.) (3-0) Cr. 3. *Prereq: 9 credits in human development and family studies or psychology.* Design and evaluation of behavioral interventions in applied settings such as classrooms, institutions, and families. Design of single subject experiments.

Psych 537. Characteristics of Giftedness. (Dual-listed with 437; same as HD FS 537.) (3-0) Cr. 3. *Prereq: 9 credits in human development and family studies or psychology, including Psych 230 or HD FS 102; junior classification.* Understanding of giftedness and talent from cognitive, developmental, and social perspectives using a life-span approach. Current conceptualizations and research regarding gifted children and adults. Implications for education and guidance.

Psych 538. Developmental Disabilities in Children. (Same as HD FS 538.) See *Human Development and Family Studies*.

Psych 540. Psychological Measurement II. (3-0) Cr. 3. *Prereq: 9 credits in psychology, 3 credits in statistics, and permission of instructor or graduate classification in psychology.* Nature of psychological measurement. Measurement and scaling theory. Theoretical and statistical definitions of reliability and validity. Test and scale construction strategies.

Psych 542. Psychoeducational Assessment. (3-0) Cr. 3. F. *Prereq: 440.* Theory and research concerning assessment of intelligence and achievement with emphasis on developmental patterns and diagnosis of learning problems. Critical examination of current assessment practices in clinical and educational settings.

Psych 544. Practicum in Assessment. *Prereq: 542 and permission of instructor.* Supervised practice in designing and implementing observational systems and in administering, scoring, interpreting, and reporting individual tests.

A. Behavioral Assessment (2-1) Cr. 2.
B. Individual Tests: Children (2-1) Cr. 2.
C. Testing: Adult Ages (1-2) Cr. 2.

Psych 545. Individual Differences. (3-0) Cr. 3. *Prereq: 540.* Psychometric assessment of human attributes (abilities, personality, and vocational interests) and their role as behavioral determinants in school, work, and interpersonal settings. Methodological issues encountered in the assessment of psychological traits (construct validity) and the developmental etiology of these attributes (nature/nurture).

Psych 550. Advanced Industrial and Organizational Psychology. (3-0) Cr. 3. *Prereq: 440, Stat 402.* Critical examination of theories, methods, and applications in industrial and organizational psychology. History and legal issues, predictor and criteria relationships, employee attitudes and behaviors, employee training and motivation, and human factors.

Psych 560. Advanced Personality Psychology. (3-0) Cr. 3. *Prereq: 4 courses in psychology, including 360.* Analysis of theories of personality, concepts, methods, and current research issues.

Psych 561. Psychopathology and Behavior Deviations. (3-0) Cr. 3. *Prereq: 460.* Critical review of theoretical perspectives and current research on the development and maintenance of the major forms of maladaptation including schizophrenic, anxiety, affective, drug use, personality, psychosexual, reactive, and childhood disorders.

Psych 562. Personality Assessment. (3-0) Cr. 3. *Prereq: 360, 440, Stat 401.* Principles, concepts, and methods of personality assessment. Though not a practicum course, exposure is given to a variety of objective, projective, and situational tests.

Psych 563. Developmental Psychopathology. (3-0) Cr. 3. *Prereq: 230 and 460 or graduate classification.* Theory and research related to major disorders of childhood and adolescence with an emphasis on assessment, etiology, and developmental processes, and multimodal interventions.

Psych 580. Advanced Social Psychology: Psychological Perspectives. (3-0) Cr. 3. *Prereq: 4 courses in psychology, including 280.* Current theories, methods, and research in social psychology with an emphasis on cognitive and interpersonal process-

es such as attribution, social cognition, attitude change, attraction, aggression, and social comparison.

Psych 581. Applications of Social Psychology Theories. (3-0) Cr. 3. *Prereq: 12 credits in psychology, including 280.* Application of social psychological theory to various applied topics, including physical and mental health, stress, and coping.

Psych 586. Research Methods in Social Psychology. (3-0) Cr. 3. *Prereq: Stat 402 and permission of instructor.* Ethical issues, generating testable hypotheses, operationalizing independent and dependent variables, sampling and design issues, laboratory procedures, and interpretation of results in experimental research. Issues in analysis of variance, Bayesian reasoning, and effect size estimation will be emphasized, as will writing and publication strategies.

Psych 588. The Meta-Analytic Review. (3-0) Cr. 3. *Prereq: Stat 401.* Presentation of and hands-on experience with all stages of meta-analytic reviews, including problem formation, data collection, data evaluation, data analysis and interpretation, and public presentation.

Psych 590. Special Topics. Cr. var. *Prereq: 12 credits in psychology, and permission of instructor.* Guided reading on special topics or individual research projects.
A. Counseling
Q. Cognitive
R. Social
Z. General

Psych 592. Seminar in Psychology. (1-0 to 3-0) Cr. 1 to 3 each time taken. *Prereq: 12 hours in psychology.*
A. Counseling
B. Industrial-Organizational
M. Professional Issues and Ethics
P. Research Methods and Psychometrics
Q. Cognitive
R. Social
Z. General

Psych 593. Advanced Workshop in Psychology. Cr. var. Intensive examination of a particular topic in psychology.

Psych 597. Internship in Psychology. Cr. R. *Prereq: M.S. degree candidacy; permission of instructor.* Full-time, non-clinical, supervised experience in a setting relevant to psychology. Intended for master's degree level internships.

Psych 599. Creative Component. Cr. Var. Offered on a satisfactory-fail grading basis only.

Courses for Graduate Students

Psych 601. History of Philosophy of Psychology. (3-0) Cr. 3. *Prereq: 4 courses in psychology.* Origins of psychology in philosophical, medical, and related thought. Development as an independent discipline in the nineteenth and twentieth centuries as a science and as a practice including traditional and contemporary theory and philosophy.

Psych 621. Psychological Counseling: Theory and Process. (2-0) Cr. 2. F. *Prereq: 4 courses in psychology including 440 and 460, and permission of instructor.* Combined survey of theoretical issues and approaches. Didactic coverage of theoretical viewpoints at an introductory level.

Psych 621L. Techniques in Counseling. (0-6) Cr. 3. F. *Prereq: 621 or concurrent enrollment in 621 and permission of instructor.* Development of basic counseling skills and techniques through observation, role-playing, case studies, and supervised counseling sessions.

Psych 623. Vocational Behavior. (3-0) Cr. 3. *Prereq: 3 courses in psychology.* Theoretical views, research, and issues in career development through the life span. Methods of career counseling, including appraisal interviewing, assessment, test interpretation, and use of information sources.

Psych 626. Group Counseling. (2-2) Cr. 3. *Prereq: 621L, 691A.* Theory, research, ethical issues, and therapeutic considerations relevant to group counseling. Participation in lab exercises for development of group counseling skills and observation of ongoing groups.

Psych 628. Advanced Counseling Theory. (2-0) Cr. 2. *Prereq: Practicum in counseling psychology.* In-depth coverage of major theoretical positions, including comparative analysis. Coverage and evaluation of research on counseling interventions.

Psych 633. Teaching of Psychology. (2-0) Cr. 2. *Prereq: Enrollment in degree program in psychology, completion of at least 1 year of graduate study, permission of instructor.* Orientation to teaching of psychology at college level: academic issues and problems, instructional and evaluative techniques.

Psych 635. Interventions with Children and Adolescents. (3-0) Cr. 3. *Prereq: Graduate classification and permission of the instructor.* Research and theory underlying application of behavioral and cognitive psychology to the treatment of childhood and adolescent psychopathology with an emphasis on internalizing disorders, developmental processes, and multimodal interventions.

Psych 691. Practicum in Psychology. Cr. var. *Prereq: Permission of instructor.* Supervised practice and experience in the following fields of specialization in applied psychology:
A. Counseling
E. Group Counseling. Prereq: 626, 691A (satisfactory-fail grading basis only)
F. Advanced Counseling. Prereq: 691A (satisfactory-fail grading basis only)
T. Teaching. Prereq: 633 (satisfactory-fail basis grading only)
Z. General

Psych 692. Research Seminar. (1-0 to 3-0) Cr. 1 to 3 each time taken. *Prereq: Permission of instructor.*
A. Counseling
Q. Cognitive
R. Social
Z. General

Psych 697. Internship in Counseling Psychology. Cr. R. *Prereq: Ph.D. candidacy in the Counseling Psychology program, approved dissertation proposal, and permission of instructor.* Full time supervised predoctoral internship experience in a setting relevant to counseling psychology.

Psych 699. Research. Offered on a satisfactory-fail grading basis only.

Communication Disorders (CmDis)

(Administered by the Department of Psychology)

The following courses are part of the Speech Communication program. For more information refer to that section. CmDis 170, 275, 286, 371, 471.

Courses Primarily for Undergraduate Students

CmDis 170. Speech Improvement for Nonnative Speakers. (2-0) Cr. 2. For nonnative speakers of English only. Development of effective English vowel and consonant productions, accommodation processes that occur in context, intelligibility in conversational English, and appropriate stress patterns. Offered on a satisfactory-fail grading basis only.

CmDis 275. Introduction to Communication Disorders. (Same as Ling 275.) (3-0) Cr. 3. Survey of nature, causes, and types of major communication disorders including phonological, adult and child language, voice, cleft palate, fluency, and hearing disorders.

CmDis 286. Basic Sign Language. (Same as Ling 286.) (3-0) Cr. 3. Development of basic skills in the use and understanding of signed English, a modification of American Sign Language. Overview of the types, causes and consequences of hearing impairment, deaf culture and the education of hearing-impaired children.

CmDis 371. Phonetics and Phonology. (Same as Ling 371. (3-0) Cr. 3. *Prereq: 275 or Engl 219.* Analysis of speech through study of individual sounds, their variations, and relationships in context; English phonology; practice in auditory discrimination and transcription of sounds of American English; description of speech sounds in terms of their production, transmission, and perception.

CmDis 471. Language Development. (Same as Ling 471.) (3-0) Cr. 3. *Prereq: 275 or Psych 230 or Engl 219.* Definition of components of language. Overview of theories and developmental processes related to each component of linguistic skill (semantics, lexicon, syntax, morphology, phonology, pragmatics). Overview of normative information available for infants, children, adolescents, and adults. Attention to metalinguistic skills and the complementary nonlinguistic and paralinguistic skills. Nonmajor graduate credit.

Sociology

www.soc.iastate.edu

Robert S. Schafer, Chair of Department

University Professors: *Goudy*

Professors: *Blake, Bruton, Butler, Bystydzienski, Conger, Dobratz, C. Flora, J. Flora, Hoiberg, Hoyt, Hraba, Jones-Johnson, Keith, Klonglan, Korsching, Lasley, Lorenz, Padgitt, Ryan, Schafer, Simons, Wells, Whitbeck, Woodman*

Distinguished Professors (Emeritus): *Beal*

Professors (Emeritus): *Bultena, Chang, Cohen, Lee, Miller, Mulford, Tait*

Associate Professors: *Aigner, Bell, Besser, Harrod, Mazur, Roberts, Sapp, Sawyer*

Assistant Professors: *Allen, Anderson, Bird, Cast, DeLisi, Hinrichs, Hochstetler, Litt, Morton, Munoz, Schweingruber*

Assistant Professors (Adjunct): *Waggoner*

Assistant Professors (Collaborators): *Schor*

Undergraduate Study

The department offers course work leading to either a bachelor of arts or bachelor of science in sociology. Additionally, a bachelor of science in Public Service and Administration in Agriculture is offered. The department offers course work for a minor in Criminal Justice Studies. Programs of study in sociology offered in both the College of Agriculture and the College of Liberal Arts and Sciences are outlined in this section. For the undergraduate curriculum in Liberal Arts and Sciences, with a major in sociology leading to the degrees of bachelor of arts and bachelor of science, see *Liberal Arts and Sciences, Curricula*. For the undergraduate curriculum in agriculture, with major in public service and administration in agriculture, leading to the degree bachelor of science, see *Agriculture, Curriculum in Public Service and Administration in Agriculture*. For the undergraduate curriculum in Liberal Arts and Sciences, with a minor in criminal justice studies, see *Liberal Arts and Sciences, Curriculum.*

Graduates understand how social institutions, communities, and organizations work and change; they can examine the causes and consequences of conformity, deviance, and inequality. They can apply sociological understanding of human behavior to practical work situations and everyday life. Graduates can

read critically, think independently, and communicate effectively about social issues and social policy.

College of Liberal Arts and Sciences—Sociology

A major in sociology can serve as a liberal arts education; as preparation for various positions in social service and related occupations in business and industry; as background for professional education in such areas as law and theology or as a basis for graduate professional training as a sociologist in academic, government, business, and industrial settings.

Departmental requirements for all majors include the following supporting course: Philosophy including 230 and one upper level Philosophy course; English 302 or 309 or 314; One of the following courses: Statistics101 or 104; At least three additional credits with a Mathematics designator.

A program of study that meets the needs and interests of the student and department requirements will be developed in consultation with the major adviser. Programs of study will include 115, 130 or 134, 202, three credits from 310, 380 or 420, 302, 305, three credits from 327, 330, 331 or 332, 401, 9 credits of upper level electives. Majors must receive grades of C or better in Engl 104 and 105, and a grade of C or better in either Engl 302 or 309 or 314. Programs leading to a bachelor of arts degree will emphasize additional coursework in groups I, II and IV of the general education requirements. Programs leading to a bachelor of science degree will emphasize additional coursework in groups III and IV of the general education requirements. Some of the possible fields of concentration are criminal justice systems, community (urban and rural) sociology, family sociology, sociology of work, social science teaching, research methods and statistics, social change and development, complex organizations, human population and ecology, social inequality, social psychology, and sociological theory.

In consultation with their advisers, students may gain work experience and develop their skills in their field of concentration through the field observation and practice options of 454 and 460.

The department offers a minor in sociology which may be earned by completing 15 credits in sociology including: Sociology 130 or 134; 3 credits from 310, 380 or 420; 3 credits from 264, 305 or 381; an additional 6 credits in sociology courses. At least 9 of the 15 credits must be at the 300 level or higher, 6 of these credits must be taken at ISU with a minimal grade of C.

College of Agriculture—Public Service and Administration in Agriculture

The curriculum in public service and administration in agriculture is designed for students who desire an interdisciplinary education to pursue a career with agriculturally related governmental and private agencies, or with businesses and industries that are concerned with public services in agriculture. Students will explore the planning and implementing of rural and agriculturally related programs in organizations, communities (town, city, or county), multicounty areas, states, regions, and at the federal level.

The curriculum has a broad base of general education subjects including credits in communications, mathematics, physical and biological sciences, social sciences, and humanities. The technical subjects represent a combination of sociology, economics, government, and technical agriculture, with emphases on social and economic change, history of public services, complex organizations, interagency relationships, community leadership, community action, adoption and diffusion, group dynamics, and political and legal behavior as they relate to agriculture and rural areas.

Graduate Study

The department offers work for the degrees master of science and doctor of philosophy with majors in sociology and rural sociology and minor work for students majoring in other departments. For M.S. and Ph.D. departmental requirements, see Program of Graduate Study for Degrees in Sociology and Rural Sociology, available from the department office. The department offers concentrations in a number of areas, e.g., family, inequality, life course and aging; food systems, agriculture and environment; methodology; social change and development; social deviance and mental health; community studies and development; social organization; and social psychology. The Department of Sociology does not offer a nonthesis master's program.

Graduates have a broad understanding of sociology, address complex societal problems, and communicate effectively with scientific colleagues and the general public in both formal and informal settings. They understand sociological theory, conduct research, and are prepared to educate college students and contribute to public policy.

Although the department stipulates no language requirement for either the degree master of science or the degree doctor of philosophy, specifying competence in one or more languages may be desirable in some instances.

The department also participates in the interdepartmental program in industrial relations, interdepartmental majors in sustainable agriculture, transportation and water resources, and interdepartmental minors in gerontology (see *Index*).

Courses open for nonmajor graduate credit: 377, 401, 411, 415, 420, 425, 450, 473, 476.

Courses Primarily for Undergraduate Students

Soc 110. Orientation to Public Service and Administration in Agriculture. (1-0) Cr. R. F. Survey of public service and administration in agriculture. Exploration of career tracks and career planning. Recommended during first semester of freshman year or as soon as possible after transfer into the department.

Soc 115. Orientation to Sociology. (1-0) Cr. R. F. Orientation to sociology. A familiarization with University and LAS College requirements and procedures. Occupational tracks and career options open to sociology; introduction to career planning. Recommended during second semester of freshman year, or as soon as possible after transfer into the department. Offered on a satisfactory-fail grading basis only.

Soc 130. Rural Institutions and Organizations. (3-0) Cr. 3. F.S. An introductory analysis of sociological concepts and theories as they relate to rural institutions and organizations. Emphasis on the static structure and function of these institutions and organizations and on their dynamic adaptation to changing societal, environmental, and economic conditions. General sociological principles and perspectives. Credit for only 130 or 134 may be applied toward graduation.

Soc 134. Introduction to Sociology. (3-0) Cr. 3. F.S.SS. Social interaction and group behavior with emphasis on contemporary U.S. society, including issues relating to socialization, inequality, and changing rural and urban communities. Analysis of relationships among the institutions of family, religion, political participation, work, and leisure. Credit for only 130 or 134 may be applied toward graduation.

Soc 202. Introduction to Research Methods. (3-0) Cr. 3. F.S. *Prereq: 130 or 134, credit in Stat 101 or concurrent enrollment in Stat 101.* A survey of the principal research methods used in sociological analysis.

Soc 219. Sociology of Pre-Marital and Marital Relationships. (3-0) Cr. 3. F.S.SS. *Prereq: 130 or 134.* Sociological analysis of courtship and marriage relationships across the life cycle. Attention also given to alternative and single lifestyles, to parenting, and to family life.

Soc 235. Social Problems. (3-0) Cr. 3. F.S. *Prereq: 130 or 134.* Sociological concepts and methods employed in the analysis of various social problems, including crime, substance abuse, problems with institutions, rural and urban problems, and international concerns. Consideration of various solutions.

Soc 241. Youth and Crime. (Same as CJ St 241.) (3-0) Cr. 3. F. *Prereq: 130 or 134.* An examination of delinquency that focuses on the relationship between youth as victims and as offenders, social and etiological features of delinquency, the role of the criminal justice system, delinquents' rights, and traditional and alternative ways of dealing with juvenile crime.

Soc 264. Small Group Dynamics. (3-0) Cr. 3. F.S. *Prereq: 130 or 134.* An introduction to intra- and intergroup dynamics in small groups. Group decision-making, coalitions, conformity, intergroup relations, status and role effects, leadership, group development and group conflict. Includes student participation in small group processes.

Soc 298. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; sophomore classification.* Required of all cooperative education students. Students must register for this course prior to commencing the work period.

Soc 302. Advanced Research Methods. (2-2) Cr. 3. F.S. Alt. SS., offered 2002. *Prereq: 202; Stat 101.* Experience in designing research projects, collecting and analyzing data and reporting results.

Soc 305. Social Psychology: A Sociological Perspective. (3-0) Cr. 3. F.S.SS. *Prereq: 130 or 134.* Examination of human behavior in a social environment with emphasis on development of the self, interpersonal relations, attitudes, and small groups.

Soc 310. Community. (3-0) Cr. 3. F.S. *Prereq: 130 or 134.* Comparative analysis of the institutional structure of rural, urban, and suburban communities; community as an ecological and social system; power relationships; analysis of planned and unplanned processes of social change.

Soc 325. Agriculture in Transition. (3-0) Cr. 3. S. The impacts of agricultural changes on farm families, rural communities, and consumers. Past, present, and future trends in family farms and their social implications.

Soc 327. Sex and Gender in Society. (Same as W S 327.) (3-0) Cr. 3. F.S.SS. *Prereq: 130 or 134.* How the biological fact of sex is transformed into a system of gender stratification. The demographics and social positions of women and men in the family, education, media, politics, and the economy. Theories of the social-psychological and sociological bases for behavior and attitudes of women and men. The relationship between gender, class, and race.

Soc 328. Sociology of Masculinities and Manhood. (Same as W S 328.) (3-0) Cr. 3. S. *Prereq: Soc 130, 134, or W S 201.* Examination of socially constructed and idealized images of manhood, the nature of social hierarchies and relations constructed on the basis of imagery, ideologies, and norms of masculinity. Theories on gender (sociological, psychological, and biological). Particular attention given to theory and research on gender variations among men by race, class, ethnicity, sexual orientation, physical ability and age.

Soc 330. Ethnic and Race Relations. (Same as Af Am 330.) (3-0) Cr. 3. F.S.SS. *Prereq: 130 or 134.* Analysis of ethnic and race relations, particularly in America; emphasis on the sociology and psychology of race and ethnic relations.

Soc 331. Social Class and Inequality. (3-0) Cr. 3. F.S.SS. *Prereq: 130 or 134.* Social stratification and processes resulting in poverty; implications of status, class, and poverty for people of different races, ethnicity, and gender.

Soc 332. The Latino/Latina Experience in U.S. Society. (3-0) Cr. 3. F. *Prereq: 130 or 134.* Examination of the social, historical, economic and political experience of varied Latino ethnic groups in the U.S. - primarily focusing on Mexican, Puerto Ricans, and Cubans.

Soc 340. Deviant and Criminal Behavior. (Same as CJ St 340.) (3-0) Cr. 3. S.SS. *Prereq: 130 or 134.* Theory and research on the etiology of types of social deviance; issues relating to crime, antisocial behavior and social policies designed to control deviant behavior.

Soc 341. Criminology. (Same as CJ St 341.) (3-0) Cr. 3. F. *Prereq: 130 or 134.* The nature of crime and criminology; the concept of crime; statistics and theories of criminality; major forms of crime; official responses to crime and control of crime.

Soc 345. Population Problems and Society. (Same as Env S 345.) (3-0) Cr. 3. F. *Prereq: 130 or 134.* Human overpopulation; impact on food, resources, and services; population growth and development; trends of births, deaths, and geographic movement; projecting future population; population control and family planning; population policies and laws; comparison of the United States with other societies throughout the world.

Soc 371. High Risk Children and Adolescents. (3-0) Cr. 3. S. *Prereq: 130 or 134.* This class traces life course developmental risk and resiliency through early adulthood. Its focus is on contextual factors that contribute to or impede prosocial outcomes in young people with special emphasis on the origins and processes associated with cumulative risk. It reviews the literature on children and adolescents in high risk social contexts such as runaway and homeless adolescents, inner city adolescents, and gangs.

Soc 377. Social Dimensions of Religion. (Same as Relig 377.) See *Religious Studies*. Nonmajor graduate credit.

Soc 380. Sociology of Work. (3-0) Cr. 3. F.S. *Prereq: 130 or 134.* Inequalities (gender, race, class) related to jobs, occupations, firms, and industries. Satisfactions, rewards, alienation, discrimination, and other topics of importance to workers are examined.

Soc 381. Social Psychology of Small Group Behavior. (Same as Psych 381.) (3-0) Cr. 3. S. *Prereq: Soc 305 or Psych 280.* A survey of small group theory and research from an interdisciplinary, social psychological perspective.

Soc 382. Environmental Sociology. (Same as Env S 382.) (3-0) Cr. 3. F.S. *Prereq: Soc 130, 134 or Env S 201.* Environment-society relations; social construction of nature and the environment; social and environmental impacts of resource extraction, production, and consumption; environmental inequality; environmental mobilization and movements; U.S. and international examples.

Soc 398. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; junior classification.* Required of all cooperative education students. Students must register for this course prior to commencing the work period.

Soc 401. Contemporary Sociological Theories. (3-0) Cr. 3. F.S.SS. *Prereq: 9 credits in sociology.* Both historical and modern social theories as applied to understanding and researching the social world. Nonmajor graduate credit.

Soc 411. Social Change in Developing Countries. (3-0) Cr. 3. S. *Prereq: 130 or 134 plus 3 credits in social sciences.* Social change and development in developing countries; international interdependence; causes and consequences of persistent problems in agriculture, city growth, employment, gender equality, basic needs; local and worldwide efforts to foster social change and international development. Nonmajor graduate credit.

Soc 412. Senior Seminar on Career Development. (1-0) Cr. 1. F. *Prereq: Most of major core courses, senior classification.* Transition from student to professional. Career development procedures including self-assessment, short- and long-term goals, strategies for the job search, development of contacts and sources, resumes and interviews. Enrollment preferred in first semester as senior. Offered on a satisfactory-fail grading basis only.

Soc 415. Sociology of Technology. (3-0) Cr. 3. F. *Prereq: 130 or 134 plus 3 credits in social sciences.* Review of physical, biological, and social approaches to technology evaluation. Examination of public responses to complex and controversial technology. Strategies for gaining adoption/rejection of technology. Applications to topics in agriculture, development, and marketing. Nonmajor graduate credit.

Soc 420. Complex Organizations. (3-0) Cr. 3. F.SS. *Prereq: 130 or 134 plus 3 credits in social sciences.* Study of bureaucracies and other large organizations as social systems through the perspective of basis social processes and structural variables. Incorporates topics of organizational effectiveness, power and change. Nonmajor graduate credit.

Soc 425. Social Movements and Revolution. (3-0) Cr. 3. S. *Prereq: 6 credits in sociology.* Theoretical approaches and contemporary evidence of the origins, development, and impact of social movements including social-psychological, organizational, and structural dimensions. Nonmajor graduate credit.

Soc 431. Chicanos/Chicanas in Contemporary Society. (3-0) Cr. 3. S. *Prereq: 130 or 134.* An interdisciplinary examination of Chicanos/as, the largest U.S. Latino ethnic group. Special attention will be given to social conflict and social transformation as it relates to contemporary Chicano/a issues, particularly in the Midwest.

Soc 435. Urban Society. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 130 or 134 plus 3 credits in social sciences.* Development of cities and urban systems; human and spatial ecology; urban transformation, decline, and revitalization; housing issues and homelessness; residential segregation; poverty; immigration and subcultures; urban social movements; local governance; alternative solutions and planning for cities; international comparisons.

Soc 450. Demographic Analysis, Projections, and Modeling. (3-0) Cr. 3. Alt. SS., offered 2003. *Prereq: 6 credits in sociology.* Methods and techniques for analyzing, projecting, and modeling demographic behavior and change. Focus on fertility, migration, and mortality; extensions made to aging, education, labor force, housing, service utilization, resource consumption, and consumer markets. Integrating population variables into planning processes. Applications using surveys, census data, and other indicators. Nonmajor graduate credit.

Soc 454. Field Observation and Practice. Cr. var., maximum of 12. F.S.SS. *Prereq: Junior or senior classification; permission of faculty internship coordinator; major or minor in sociology or PSA or 201, 302, 305.* Supervised practice in industrial plants, business organizations, and governmental agencies. Not more than 12 credits of field experience (Soc 454 and 460) may be counted toward meeting the required 47 credits of upper level courses and the total of 124.5 credits required for graduation. No credits in Soc 454 may be used to satisfy minimum sociology requirements for sociology majors. Offered on a satisfactory-fail grading basis only.

A. General Sociology
B. Rural Sociology

Soc 460. Criminal and Juvenile Justice Practicum. (Same as CJ St 460.) Cr. var., maximum of 12. F.S.SS. *Prereq: Junior or senior classification; permission of criminal justice studies coordinator; major or minor in sociology, criminal justice studies minor, or PSA; 241 or 340.* Study of the criminal and juvenile justice systems and social control processes. Supervised placement in a police department, prosecutor's office, court, probation and parole department, penitentiary, juvenile correctional institution, community-based rehabilitation program, or related agency. Not more than 12 credits of field experience (Soc 454 and 460) may be counted toward meeting the required 47 credits of upper level courses and the total of 124.5 credits required for graduation. No credits in Soc 460 may be used to satisfy minimum sociology requirements for sociology majors. Offered on a satisfactory-fail grading basis only.

Soc 461. Life Course Sociology. (3-0) Cr. 3. F. *Prereq: 6 credits in sociology.* Theoretical and empirical perspectives on individuals facing developmental tasks, age related norms, values, and subcultures. Decisions and issues faced by individuals as they progress through stages of the life cycle.

Soc 464. Community Action and Leadership. (3-0) Cr. 3. S.SS. *Prereq: 6 credits in sociology.* Methods of planning, organizing, and conducting planned social change and other action programs in communities. Strategies of change, change agent roles, client need identification, community organization strategies, citizen participation, leadership identification and development, program planning and evaluation.

Soc 473. Youth and Society. (3-0) Cr. 3. Alt. S., offered 2002. SS. *Prereq: 6 credits in sociology.* Analysis of problems of adolescents and youth created by the impact of changing institutional structure on the transition from childhood to adulthood. Nonmajor graduate credit.

Soc 476. The Aged in American Society. (Same as Geron 476.) (3-0) Cr. 3. S. *Prereq: 6 credits in sociology.* A survey of sociological problems of the aging and the social implications of a sizable aged population. Nonmajor graduate credit.

Soc 484. Topical Studies in Criminal and Juvenile Justice. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 6 credits in sociology and permission from instructor.* Thematic or topical issues and studies dealing with the sociology of police, judiciary, institutional and community-based corrections, gender/ethnicity and crime/delinquency, criminal and delinquent gangs, and crime and delinquency prevention.

Soc 485. Sociology of the Family. (3-0) Cr. 3. S. *Prereq: 6 credits in sociology.* The contemporary family in developing, industrial, and post-industrial societies. Effects of modernization and family policies on family structures and functions.

Soc 490. Independent Study. Cr. 1 to 3 each time taken. *Prereq: 6 credits in sociology and permission of instructor.* Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

A. General Sociology
B. Rural Sociology
H. Honors
E. Senior Seminar

Soc 496. Agriculture and Rural Development in Ireland. (3-0) Cr. 3. S. Comparative analysis of the agricultural and rural development needs of Ireland and the U.S. Course involves a 2 week tour of the Irish countryside where students can observe and experience small town and farm life.

Soc 498. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; senior classification.* Required of all cooperative education students. Students must register for this course prior to commencing the work period.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

Soc 505. Historical Sociological Theory. (3-0) Cr. 3. F. *Prereq: 401.* Survey of the evolution of social thought from Ancient Greece through European Medieval and Renaissance eras with special emphasis on the Enlightenment. Focusing on the origins of positivism, conflict, and functionalist traditions, organicism, and sociology of knowledge perspectives.

Soc 509. Agroecosystem Analysis. (Co-listed with Agron 509, SusAg 509, Anthr 509.) (3-0) Cr. 3. SS. *Prereq: 6 credits in social sciences, 6 credits in natural, biological or engineering sciences and senior or above classification.* Field study of commercial farming systems within the context of global energy flows and biogeochemical cycles, including ecological, agronomic, and social perspectives.

Soc 511. Intermediate Research Methods. (2-2) Cr. 3. S. *Prereq: 302, Stat 401.* Research methods in sociology including problem selection, research design, hypothesis formulation, sampling, alternative data collection techniques, introduction to computer systems.

Soc 512. Sociological Measurement. (3-0) Cr. 3. Alt. F, offered 2002. *Prereq: 511.* Reliability and validity for observed and latent variables; exploratory and confirmatory factor analysis in the construction and evaluation of measurement models. Applications using LISREL, AMOS, and other programs.

Soc 513. Qualitative Research Methods. (2-2) Cr. 3. Alt. F., offered 2001. *Prereq: 511.* Applied qualitative research methods in sociology. Design and implementation of a course-based research project including data collection, analysis, and presentation of results. Qualitative data gathering techniques using observational, historical, in-depth interviewing or content analysis approaches. Laboratory emphasis on completion of data gathering, analysis, and report writing.

Soc 520. Social Psychology: A Sociological Perspective. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 305 or Psych 280.* Examination of cognitive, symbolic interaction, exchange, role-reference group, and dramaturgical approaches. Assessment of contemporary issues in social psychology.

Soc 521. Small Groups. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 305 or Psych 280.* Examination of alternative theoretical models and methods of studying small groups.

Soc 522. Attitude and Attitude Change. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 305 or Psych 280.* Analysis of theories of attitude and attitude change; current controversies between the theories examined, as well as supporting research.

Soc 528. Sociology of Gender. (Same as W S 528.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 6 credits in sociology.* Examination of the social construction of gender and the social organization of gender inequality. Analysis of gender identity in socialization, interpersonal behavior, the media, and the economy. Investigation of the intersection of gender, race, and class.

Soc 529. Racial and Ethnic Inequality. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 6 credits in sociology.* Analysis of racial and ethnic inequality in the United States and the world; focus on the implications of the changing world social and economic order for differences in racial and ethnic groups relative to wealth, status, and power; a critical examination of majority-group domination of minority groups in various societies.

Soc 530. Social Organization. (3-0) Cr. 3. Alt.S., offered 2002. *Prereq: 6 credits in sociology.* Methodological and analytical issues associated with the study of group structure; contemporary theories of social organization.

Soc 532. Organizations and Their Environments. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 6 credits in sociology.* Comparative analysis of complex organizations; complex organizations as semi-open systems. Interorganizational relations and organizational effectiveness.

Soc 533. Models of Community. (3-0) Cr. 3. Alt. F. offered 2001. *Prereq: 6 credits in sociology.* Emphasis on different models or frames of reference used in community analysis. Theoretical and methodological tools, current views of community problems, and explanation of social and cultural change are presented for each model.

Soc 534. Social Stratification. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 6 credits in sociology.* Critical examination of the causes and consequences of social stratification and inequality; classical theories, contemporary frameworks, and recent empirical studies; international stratification patterns.

Soc 535. Urban Sociology. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 6 credits in social sciences.* Theoretical, conceptual, and methodological approaches to understanding transformation of urban society in comparative perspective; interrelations among demographic, social, economic, and political dimensions of persistent urban problems and of urban development; examination of case studies.

Soc 541. Technological Innovation, Social Change, and Development. (Same as T SC 541, U St 541.) (3-0) Cr. 3. Alt. F. offered 2002. *Prereq: 6 credits in social sciences.* Sources, theories and models of technological innovation, social, institutional, cultural, economic and political contexts of technology transfer; issues and methods of assessing impacts of technological change; planning technology related social change; local and international case studies.

Soc 542. Rural Development. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 6 credits in sociology.* Sociological perspectives on contemporary theory and practice in rural development. Emphasis on the U.S. with international comparisons. Rural development approaches examined in a global context. The role of local, state, and national agencies, institutions of higher education, and the private sector in rural development will be assessed.

Soc 544. Sociology of Food and Agricultural Systems. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 6 credits in sociology.* Social organization of food and fiber production, processing, and distribution systems. Sociological comparison of conventional and alternative production systems; gender roles in agriculture and food systems; local, national and global food systems; perspectives on food and agricultural research and policy.

Soc 546. Organizational Strategies for Diversified Farming Systems. (Co-listed with SusAg 546, Hort 546, Agron 546.) (3-0) Cr. 3. Alt.S., offered 2002. *Prereq: SusAg 509.* The day-to-day operation and social relations of the complex, diversified farm. Alternative organizational strategies for the diversified and sustainable farm. Farm family dynamics and goal setting. Cooperation between farmers. The social relations of alternative marketing, including green labeling, community supported agriculture, farmers' markets, and relationship marketing.

Soc 547. Sociology of Adoption and Diffusion. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 6 credits in sociology.* Sociological and social-psychological theories related to adoption and diffusion of new ideas; analysis of adoption and diffusion models; methods of field research; factors related to rates and intensity of adoption and diffusion; new directions in diffusion research.

Soc 548. Sociology of the Environment. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 6 credits in sociology.* Social causes and social consequences of environmental problems. Interrelationship between social inequality and environmental inequality. Social construction and social experience of the environment. Contemporary developments in the social theory of the environment. International and domestic implications.

Soc 561. Life Course Research. (Same as Geron 561.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 6 credits in sociology.* A survey of current research and theory in life course sociology. The social antecedents and consequences of developmental transitions throughout the life course.

Soc 564. Community Action Practice and Theory. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 6 credits in sociology.* Methods of planning, organizing, and conducting planned social change and other action programs in communities; strategies of change, change agent roles, client need identification, community organization strategies, citizen participation, leadership identification and development, program planning and evaluation.

Soc 566. Political Sociology. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 6 credits in sociology and/or political science.* The relationship between state and society with emphasis on American society. Analysis of theoretical frameworks, political participation, power, social movements, elites, democracy, and capitalist society.

Soc 576. Sociological Perspectives on Aging. (Same as Geron 576.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 6 credits in sociology.* Theoretical perspectives on the aging process; social and social-psychological changes accompanying aging; emphasis on research techniques and findings.

Soc 582. Theories of Social Deviance. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 6 credits in sociology.* Theory and research regarding causes of and reactions to deviant behavior. Mental illness, homicide, family violence, and property crime are among the types of deviant behavior considered.

Soc 583. Sociology of Mental Health. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 6 credits in sociology.* A review of contemporary sociological research and theory in mental health; social implications of the incidence and prevalence of mental disorders in various populations; the social antecedents and consequences of mental health.

Soc 584. Current Issues in Crime and Justice. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 6 credits in sociology.* Discussion of current research and theory in crime and delinquency; topics include the purpose and role of law in social life; emerging theoretical directions in criminology; recent work on specific forms of criminality; controversies in the criminal justice system.

Soc 585. Contemporary Research in the Family. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 6 credits in sociology.* A survey of current research in the family; emphasis on new methodologies and theories.

Soc 590. Special Topics. Cr. 1 to 3 each time taken. *Prereq: 6 credits in sociology; senior or graduate classification.*

A. General Sociology
B. Rural Sociology

Soc 591. Orientation to Sociology. (1-0) Cr. R. F. *Prereq: Formal admission into the sociology graduate program.* Introduction to the department, current graduate student policies at department and university levels, departmental administrative procedures. Required of graduate students. Offered on a satisfactory-fail grading basis only.

Soc 592. Teaching Sociology. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: Graduate classification in sociology.* Pedagogical and substantive issues in the teaching of sociology at the college level focusing on course organization, instructional objectives, techniques of presentation, and instruments for evaluation of learning and instruction.

Soc 595. Internship. Arr. Cr. Var. F.S.SS. *Prereq: 12 graduate credits in sociology, approval of major professor and internship coordinator.* Supervised practice for students to apply sociological knowledge and skills to work with client groups.

Soc 599. Research for Master's Thesis.

A. General Sociology
B. Rural Sociology

Courses for Graduate Students

Soc 607. Contemporary Sociological Theory. (3-0) Cr. 3. S. *Prereq: 6 graduate credits in sociology.* Survey of theoretical developments since 1925, including the rise of structural-functionalism, symbolic interactionism, conflict theories, phenomenology, exchange theory, and others.

Soc 610. Society and Technology in Sustainable Food System. (Co-listed as SusAg 610, A E 610, cross-listed as Agron 610.) (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: SusAg 509.* Social and technological dimensions of sustainability in food systems. Emphasis on strategies and ethics for evaluating existing and emerging options.

Soc 611. Advanced Theory Construction for Categorical Outcomes. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 511; Stat 404.* Rationale for and interpretation of various quantitative methods of analyzing categorical and ordered categorical variables, including log-linear, logit, logistic, and event history analysis; models for censored data.

Soc 613. Advanced Theory Construction and Causal Modeling. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 512 and Stat 404.* Formal strategies of research design and analysis using structural equations with latent variables. Strategies for the analysis of multi-informant and panel data, with emphasis on distributional problems and diagnostics.

Soc 640. Comparative Social Change. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 6 graduate credits in sociology.* Contemporary theories of social change, modernization, dependency, and development are critically examined; methodological issues identified; supporting research explored; applicability of theoretical models, concepts, and strategies to current national and international needs are evaluated.

Soc 675. Current Topics in Family and the Life Course. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 6 credits in sociology.* An advanced seminar on current developments in a selected area of study in the sociology of family and the life course. Deals with theoretical, empirical, and methodological issues.

Soc 698. Seminars in Sociology. (3-0) Cr. 3 each.
- A. Family and Life Course
- B. Methodology
- C. Community Studies and Development
- D. Social Change and Development
- E. Social Deviance and Mental Health
- G. Social Organization
- H. Social Psychology
- I. Social Inequality
- J. General
- K. Food Systems, Agriculture and Environment

Soc 699. Dissertation Research.
- A. General Sociology
- B. Rural Sociology

Speech Communication

(Administered by the College of Liberal Arts and Sciences)

Undergraduate Study

The cross-disciplinary program in speech communication offers introductory courses designed for all students as part of their general education, as a complement to professional training, and as an introduction to further study within the discipline.

Students who major or minor in speech communication can prepare themselves for a wide variety of future employment opportunities, depending upon individual interests, background, and abilities. Present curricula can prepare students for the study of law or theology; for positions in business and industry or education; and for graduate level work in speech communication, or related disciplines.

A student electing to major in speech communication must meet the particular requirements of one of the following options: interpersonal and rhetorical communication, or speech education (bachelor of arts).

The general requirement for majors in speech communication is that no credits in 290, 493, 499, and 590 may be applied toward the minimum required credits within any prescribed option. (IRC: 33 credits; SpEd: 47 credits.) Specific requirements for the major in speech communication with its various options are listed under their respective descriptions.

The English proficiency requirement may be met by (1) completion of Engl 104, 105 (or 105H), or its equivalent, with a grade in each of 2.0 or better; (2) one additional writing course beyond Engl 105 with a grade of 2.0 or better from the following approved list: Engl 302-305, 309, 314, 415; Jl MC 201.

The requirements for minors in speech communication may be fulfilled by credit in Sp Cm 212 plus at least 15 additional hours, of which 9 credits are in courses numbered 300 or above. All 15 credits must be taken within interpersonal and rhetorical communication. No credits in 290, 490, 493, 499, and 590 may apply toward the minor.

The program participates in the following interdisciplinary undergraduate minor programs: the interdisciplinary program in linguistics, and the interdisciplinary program in technology and social change, and the undergraduate program in gerontology.

Speech Communication Education

Students fulfilling the requirements for teacher licensure prepare to teach speech communication, dramatic arts, and media at the secondary school level. In addition, they prepare to direct co-curricular and extracurricular activities.

Each student seeking teacher licensure in speech communication must fulfill the requirements outlined in the Teacher Education section of this bulletin. In addition, each student must maintain a 2.5 grade point average in all courses taken to be admitted to the College of Education.

Communication Studies (ComSt)

The communication studies major is administered by the Greenlee School of Journalism and Communication, (See *Index*).

Interpersonal and Rhetorical Communication (Sp Cm)

The interpersonal and rhetorical communication area provides a thorough understanding of communication theories, principles, and applications. Students will be required to complete courses which provide a solid grounding in the theories of communication, the nature of rhetorical principles in communication, and the role of communication in creating, maintaining, and changing human relationships. The following courses are required for an emphasis in interpersonal and rhetorical communication: ComSt 101; Sp Cm 212, 305, 327, 412, and 497 (Capstone Seminar) plus an additional 15 credits from courses in interpersonal and rhetorical communication (Sp Cm).

Emphasis in the area prepares students for graduate study, the study of law or theology, to teach speech communication in high school, or enter a variety of communication-related careers and occupations in business and professional organizations. Communication internships in business and professional settings are available for qualified students. The area's courses also provide a minor concentration for students in business, English, journalism, foreign languages and literatures, and the social sciences.

Theatre

The theatre program is administered by the Department of Music, (see *Index*).

Graduate Study

The program offers courses for a graduate minor in speech communication as well as supporting work for other disciplines. The Program of Speech Communication also participates in the interdepartmental program leading to a master's degree in Interdisciplinary Graduate Studies.

Courses open for nonmajor graduate credit: Sp Cm 305, 321, 323, 327, 410, 412, and 417.

Communication Studies (ComSt)

(For those interested in the study of mass communication, see *Index, Journalism and Mass Communication.*)

Interpersonal and Rhetorical Communication (Sp Cm)

Courses Primarily for Undergraduate Students

Sp Cm 110. Listening. (3-0) Cr. 3. F.S.SS. Theory, principles, and competency development in comprehensive, therapeutic, critical, consumer, and appreciative listening. The impact of listening in relationships and partnerships.

Sp Cm 212. Fundamentals of Public Speaking. (3-0) Cr. 3. F.S.SS. Theory and practice of basic speech communication principles applied to public speaking. Practice in the preparation and delivery of extemporaneous speeches.

Sp Cm 223. Intercollegiate Debate and Forensics. Cr. 1 each time taken, maximum of 6 credits. F.S. *Prereq: Permission of instructor.* Participation in intramural and intercollegiate debate and other forensic events.

Sp Cm 290. Special Projects. Cr. 1 to 2 each time taken, maximum of 4 credits. F.S.SS. *Prereq: 3 credits in speech communication; permission of department chair.*

Sp Cm 305. Semantics. (3-0) Cr. 3. F.S.SS. *Prereq: Engl 105.* The study of symbolic processes and how meaning is encoded in words, phrases, sentences, and utterances; discussion of modern theories of meaning; and an exploration of relationships among language, thought and action. Nonmajor graduate credit.

Sp Cm 312. Business and Professional Speaking. (3-0) Cr. 3. F.S.SS. *Prereq: 212.* Theory, principles, and competency development in the creation of coherent, articulate business and professional oral presentations.

Sp Cm 313. Communication for the Classroom Teacher. (3-0) Cr. 3. S.SS. *Prereq: 212.* Communication in the teaching profession; training in classroom-oriented communication activities; use of video recorder for analysis of presentation.

Sp Cm 321. Communication with the Elderly. (Same as Geron 321.) (3-0) Cr. 3. S. Communication theory and practice presented with applications and strategies for interactions with elderly persons. Interpersonal competencies in social conversations and interviewing developed. Nonmajor graduate credit.

Sp Cm 322. Argumentation, Debate, and Critical Thinking. (3-0) Cr. 3. F.SS. *Prereq: 212.* Practice in preparing and presenting argumentative and debate speeches; emphasis on critical thinking and ethical and logical duties of the advocate; analysis, evidence, reasoning, attack, defense, research, case construction, and judging.

Sp Cm 323. Gender and Communication. (Same as W S 323.) (3-0) Cr. 3. F. *Prereq: 212.* The rhetorical strategies women and men use to succeed in oral communication; the theory, principles, and practice of effective gender communication in a variety of settings. Nonmajor graduate credit.

Sp Cm 325. Nonverbal Communication. (Same as ComSt 325.) See *Communication Studies*. .

Sp Cm 327. Persuasion. (3-0) Cr. 3. F.S.SS. *Prereq: 212.* Examination of persuasive theories, strategies and research in persuasion. Emphasis on application and analysis; logical, emotional, and ethical proofs. Nonmajor graduate credit.

Sp Cm 404. Seminar. (Dual-listed with 504.) Cr. 3 each time taken, maximum of 9. *Prereq: 18 credits in speech communication.*
A. Interpersonal and Rhetorical Communication.
B. Speech Education.

Sp Cm 410. Classical Rhetoric. (3-0) Cr. 3. S. *Prereq: 12 hours in speech communication.* Greek and Roman tradition in rhetorical theory, practice, criticism, and pedagogy. Nonmajor graduate credit.

Sp Cm 412. Rhetorical Criticism. (3-0) Cr. 3. S. *Prereq: 212 and 6 credits in speech communication.* Development of rhetorical theory and practice from Corax to modern times. Application of principles of criticism to current public speaking practices. Nonmajor graduate credit.

Sp Cm 416. American Public Address. (3-0) Cr. 3. S. Relationship between public persuasions and leaders; process of preparing major public addresses; selected speakers and speeches as linked with political or historical events.

Sp Cm 417. Campaign Rhetoric. (Same as Pol S 417.) (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 212.* Backgrounds of candidates for state and national elections; selected speeches and issues; persuasive strategies and techniques of individual speakers. Nonmajor graduate credit.

Sp Cm 490. Independent Study. Cr. 1 to 3 each time taken, maximum of 9. F.S.SS. *Prereq: 18 credits in speech communication, junior classification, permission of department chair.* Only one independent study enrollment is permitted within the department per semester.

Sp Cm 495A. Directing Speech Activities. (1-0) Cr. 1. S. *Prereq: C I 301; 9 credits in speech communication; minimum grade point of 2.5 in speech communication courses.* Problems, methods, and materials related to directing speech activities in secondary schools.

Sp Cm 495B. Teaching Speech. (Same as C I 495B.) (3-0) Cr. 3. F. *Prereq: Sp Cm 313; 9 credits in speech communication; minimum grade point average of 2.5 in speech communication courses.* Problems, methods, and materials related to teaching speech, theatre, and media in secondary schools.

Sp Cm 497. Capstone Seminar. (3-0) Cr. 3. S. *Prereq: 15 credits in speech communication; junior or senior classification.* Students synthesize relevant theory and research culminating in a capstone project/paper.

Sp Cm 499. Communication Internship. Cr. var. 1 to 3, each time taken, maximum of 6. F.S.SS. *Prereq: 18 credits in speech communication courses, other courses deemed appropriate by faculty adviser; 2nd semester junior or senior standing; cumulative GPA of at least 2.5 overall and 3.0 in speech communication; and permission of the internship committee. Applications should be submitted in the term prior to the term in which the internship is desired.* Supervised application of interpersonal and rhetorical communication in professional settings.

Courses Primarily for Graduate Students, open to qualified undergraduates

Sp Cm 504. Seminar. (Dual-listed with 404.) Cr. 3 each time taken, maximum of 9. F.S.SS. *Prereq: 9 credits in speech communication.* Topics may include the following:
A. Interpersonal and Rhetorical Communication
B. Speech Education

Sp Cm 513. Proseminar: Teaching Fundamentals of Public Speaking. (0-2) Cr. 1. F. Required of all new Speech Communication 212 teaching assistants. Introduction to the teaching of public speaking. Support and supervision of teaching assistants of Sp Cm 212. Discussion of lesson planning, teaching methods, development of speaking assignments, and evaluation of student speaking.

Sp Cm 590. Special Topics. Cr. 1 to 4 each time taken, maximum of 12 credits. *Prereq: Permission of department chair.*

Statistics

www.public.iastate.edu/~stat/

Dean L. Isaacson, Chair of Department

Distinguished Professors: Athreya, Fuller, Meeker

University Professors: *Koehler, Stephenson*

Professors: *Amemiya, Bailey, Bonett, Isaacson, Kennedy, Lahiri, Lorenz, Morris, Shelley, Stern, Stufken, Vardeman*

Professor (Collaborator): *Therneau*

Distinguished Professor (Emeritus): *H. A. David*

University Professors (Emeritus): *D. Cox, H. T. David, Groeneveld, Hinz*

Professors (Emeritus): *C. Cox, Harville, Hickman, Hotchkiss, Pollak, Strahan, Wolins*

Associate Professors: *Carriquiry, Cook, Dixon, Kaiser, Marasinghe, Nusser, Roberts, Rollins, Sherman*

Associate Professor (Emeritus): *Sukhatme*

Assistant Professors: *Daniels, Duckworth, Froelich, Nettleton, Opsomer, Wu, Yang*

Assistant Professors (Collaborators): *Sloan*

Undergraduate Study

For the undergraduate curriculum in liberal arts and sciences, major in statistics, leading to the degree bachelor of science, see *Liberal Arts and Sciences, Curriculum.*

The curriculum in liberal arts and sciences with a major in statistics is designed to prepare students for (1) entry level statistics positions requiring the B.S. degree in statistics in business or commerce, nonprofit institutions, and in state or federal government; (2) graduate study in statistics. Entry-level positions include the following types of work: statistical design, analysis and interpretation of experiments and surveys; data processing and analysis using modern computation facilities and statistical computing systems; application of statistical principles and methods in commercial areas such as finance, insurance, industrial research, marketing, manufacturing, and quality control. Nonprofit organizations such as large health study institutions have entry-level positions for B.S. graduates in statistics. Also, there are opportunities for work in statistics that require a major in a subject-matter field and a minor in statistics.

Students completing the undergraduate degree in statistics should have a broad understanding of the discipline of statistics. They should have a clear comprehension of the theoretical basis of statistical reasoning and should be proficient in the use of modern statistical methods and computing. Such graduates should have an ability to apply and convey statistical concepts and knowledge in oral and written form. They should be aware of ethical issues associated with polling and surveys and in the summarization of the outcomes of statistical studies.

Undergraduate majors in this department usually include in their programs: (a) Statistics 101 or an alternative introductory course (104 or 227), (b) Mathematics 165, 166, 265 (or 165H, 166H, 265H), 307 (or 317) and Computer Science 103, and (c) Statistics 341, 342, 401, 402, 421, 479, 480.

These courses plus at least two additional courses in statistics at the 400 level or above constitute the major. With the permission of the department, I E/Stat 361 may be substituted for one of these 400 level courses. It is advisable to have a minor in a field of application.

The department offers a minor in statistics which may be earned by completing one of three options. Option I: one of 101, 104 or 105; 231 or 401. Option II: 341, 342; 231 or 401. Option III: 227, 328. Additional courses in statistics at the 300 level or above are required for each option to yield a total of at least 15 credits in statistics courses.

English and Speech proficiency requirement: The department requires a grade of C– or better in each of Engl 104 and 105 (or 105H), and completion of one of Engl 302 or 314 with a grade of C- or better. The department requires a passing grade in ComSt 102 or Sp Cm 212.

Students intending to do graduate work in statistics normally will take additional courses in mathematics.

Graduate Study

The department offers the degrees master of science and doctor of philosophy with a major in statistics, and minor work for students majoring in other departments. Within the statistics major the student may select areas of specialization in experimental design, probability, statistical methods, statistical theory, statistical computing, survey sampling, quality control, spatial statistics, time series, reliability, or applied statistics (e.g., biometrics, econometrics, environmental statistics, psychometrics,

sociometrics, etc.). A major in operations research leading to a master of science degree is offered in cooperation with the Department of Industrial and Manufacturing Systems Engineering. The doctor of philosophy degree is offered as a co-major with other departments. Such departments have included Animal Science, Botany, Economics, Educational Leadership and Policy Studies, Genetics, Industrial and Manufacturing Systems Engineering, Mathematics, Meteorology, and Psychology.

M.S. graduates have a basic understanding of statistical theory and methods. Elective courses in statistics provide areas of specialization based on the student's career goals. Communication skills are developed through course projects, assistantship duties and creative components. Ph.D. graduates study advanced theory and methods and are able to do independent research in statistics and collaborative research outside of statistics.

Prerequisite to major graduate work is the completion of an undergraduate curriculum essentially equivalent to the curriculum in liberal arts and sciences at this institution including at least a year of calculus.

The degree master of science may be earned on either a thesis or nonthesis basis. The nonthesis option requires the completion of at least 34 credits of acceptable graduate work, including the completion of a creative component and satisfactory performance on a written examination. The thesis option requires the completion of 34 credits of acceptable graduate work, including the completion of a thesis and satisfactory performance on a written examination.

The department encourages students to prepare themselves in foreign languages and in computer languages, but specific requirements for the degrees master of science and doctor of philosophy are at the discretion of the student's advisory committee.

The department participates in the interdisciplinary program in business administrative sciences and in the interdepartmental major in genetics.

Courses open for nonmajor graduate credit: 328, 330, 361, 401, 402, 403, 404, 407, 415, 421, 432, 447, 451, 479, 480, 493, 495, 496.

Courses Primarily for Undergraduate Students

Stat 100. Orientation in Statistics. (1-0) Cr. R. F. Opportunities, challenges, and the scope of the curriculum in statistics. For students planning or considering a career in this area.

Stat 101. Principles of Statistics. (3-2) Cr. 4. F.S.SS. *Prereq: 1 1/2 years of high school algebra.* Statistical concepts in modern society; descriptive statistics and graphical displays of data; the normal distribution; data collection; elementary probability; elements of statistical inference; estimation and hypothesis testing; linear regression and correlation; contingency tables. Credit for only one of the following courses may be applied toward graduation: 101, 104, 105, 227.

Stat 104. Introduction to Statistics. (2-2) Cr. 3. F.S.SS. *Prereq: 1 1/2 years of high school algebra.* Statistical concepts and their use in science; collecting, organizing and drawing conclusions from data; elementary probability; binomial and normal distributions; regression; estimation and hypothesis testing. For students in the agricultural and biological sciences. Credit for only one of the following courses may be applied toward graduation: 101, 104, 105, 227.

Stat 105. Introduction to Statistics for Engineers. (3-0) Cr. 3. F.S. *Prereq: Math 165 (or 165H).* Statistical concepts with emphasis on engineering applications. Data collection; descriptive statistics; probability distributions and their properties; elements of statistical inference; regression; statistical quality control charts; use of statistical software; team project involving data collection, description and analysis. Credit for only one of the following courses may be applied toward graduation: 101, 104, 105, 227. Credit for both 105 and 305 may not be applied for graduation.

Stat 201. Applied Regression Analysis for Business. (2-0) Cr. 2. F.S. *Prereq: 101 or 104 or 105, Math 150 or 165.* Brief review of required descriptive and inferential statistics; statistical process monitoring and applications in quality control; use of computers to analyze data; simple linear regression analysis; multiple regression analysis; diagnostic checking and model building; application of regression techniques to analysis of variance and time series analysis. Credit for both 201 and 227 may not be applied toward graduation.

Stat 227. Introduction to Business Statistics. (4-2) Cr. 5. F.S.SS. *Prereq: Math 150 or 165.* Obtaining, presenting, and organizing statistical data; measures of location and dispersion; probability concepts; the normal distribution; sampling and sampling distributions; estimation and confidence intervals; statistical process monitoring and applications in quality control; use of computers to analyze data; simple linear regression analysis; multiple regression analysis. Credit for only one of the following courses may be applied toward graduation: 101, 104, 105, 227. Credit for both 201 and 227 may not be applied toward graduation.

Stat 231. Probability and Statistical Inference for Engineers. (4-0) Cr. 4. F.S. *Prereq: Credit or enrollment in Math 265.* Emphasis on engineering applications. Basic probability; random variables and probability distributions; joint and sampling distributions; propagation of error. Descriptive statistics; confidence intervals; hypothesis testing; simple linear regression; multiple linear regression; one way analysis of variance; use of statistical software.

Stat 305. Engineering Statistics. (3-0) Cr. 3. F.S. *Prereq: Math 165 (or 165H).* Statistics for engineering problem solving. Principles of engineering data collection; descriptive statistics; elementary probability distributions; principles of experimentation; confidence intervals and significance tests; one-, two-, and multisample studies; regression analysis; use of statistical software; team project involving engineering experimentation and data analysis. Credit for both 105 and 305 may not be applied for graduation.

Stat 322. Probabilistic Methods for Electrical Engineers. (Same as E E 322.) (3-0) Cr. 3. F.S. *Prereq: E E 321.* Introduction to probability with applications to electrical engineering. Sets and events, probability, reliability of systems. Discrete and continuous random variables, associated probability modes, extensions to multivariate random vectors. Expectation, moments, correlation, functions of random variables. Random processes, including Poisson, Gaussian, and Markov.

Stat 328. Applied Business Statistics. (2-2) Cr. 3. F.S. *Prereq: 201 or 227.* Application of statistical methods to problems in business and economics; review of multiple regression; residual analysis; model building; analysis of variance; introduction to experimental design concepts; time series analysis and forecasting. Nonmajor graduate credit.

Stat 330. Probability and Statistics for Computer Science. (3-0) Cr. 3. F.S. *Prereq: Math 166.* Topics from probability and statistics applicable to computer science. Basic probability; Random variables and their distributions; Elementary probabilistic simulation; Queuing models; Basic statistical inference; Introduction to regression. Nonmajor graduate credit.

Stat 341. Introduction to the Theory of Probability and Statistics. (Same as Math 341.) (3-0) Cr. 3. F.S. *Prereq: Math 265 (or 265H).* Probability; distribution functions and their properties; classical discrete and continuous distributions; moment generating functions. Credit for both 341 and 447 may not be applied toward graduation.

Stat 342. Introduction to the Theory of Probability and Statistics. (Same as Math 342.) (3-0) Cr. 3. S. *Prereq: 341, Math 307 or 317.* Theory of estimation and tests of hypotheses; regression and correlation; linear model theory; enumerative data.

Stat 361. Quality Control. (Same as I E 361.) See *Industrial Engineering.* Nonmajor graduate credit.

Stat 398. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of department head.* Off-campus work periods for undergraduate students in a field of statistics.

Stat 401. Statistical Methods for Research Workers. (3-2) Cr. 4. F.S.SS. *Prereq: 101 or 104 or 105 or 201 or 227. Graduate students without an equivalent course should contact the department.* Methods of analyzing and interpreting experimental and survey data. Statistical concepts and models; estimation; hypothesis tests with continuous and discrete data; simple and multiple linear regression and correlation; introduction to analysis of variance. Nonmajor graduate credit.

Stat 401I. Statistical Methods for Field Biologists. (Same as Ia LL 401I.) See *Iowa Lakeside Laboratory.*

Stat 402. Statistical Design and the Analysis of Experiments. (3-0) Cr. 3. F.S. *Prereq: 401.* The role of statistics in research and the principles of experimental design. Experimental units, randomization, replication, blocking, subdividing and repeatedly measuring experimental units; factorial treatment designs and confounding; extensions of the analysis of variance to cover general crossed and nested classifications and models that include both classificatory and continuous factors. Nonmajor graduate credit.

Stat 403. Nonparametric Statistical Methods. (2-0) Cr. 2. Alt. F., offered 2002. *Prereq: 231 or 328 or 401.* Analysis of data when the dependent variable has ordinal or nominal properties; statistical inference for ranked data; Mann-Whitney and Kruskal-Wallis procedures; rank correlation; efficiency of nonparametric procedures and robustness of comparable parametric procedures. Nonmajor graduate credit.

Stat 404. Statistics for the Social Sciences. (2-2) Cr. 3. F. *Prereq: 401.* Lorenz, Roberts. Applications of generalized linear regression models to social science data. Assumptions of regression; diagnostics and transformations; analysis of variance and covariance; path analysis. Nonmajor graduate credit.

Stat 407. Methods of Multivariate Analysis. (2-2) Cr. 3. F. *Prereq: 401, knowledge of matrix algebra.* Carriquiry. Techniques for analyzing multivariate data including comparing group mean vectors using Hotelling's T^2, multivariate analysis of variance, reducing variable dimension with principal components, grouping/classifying observations with cluster analysis and discriminant analysis. Imputation of missing multivariate observations. Nonmajor graduate credit.

Stat 415. Advanced Statistical Methods for Research Workers. (2-2) Cr. 3. Alt. S., offered 2003. *Prereq: 401.* Advanced statistical methods using modern computer methods for modeling and analyzing data. Examples from a wide variety of scientific and engineering disciplines. Nonmajor graduate credit.

Stat 421. Survey Sampling Techniques. (2-2) Cr. 3. S. *Prereq: 231 or 328 or 401.* Methods of designing and analyzing survey investigations; simple random, stratified, and multistage sampling designs; methods of estimation including ratio and regression; construction and use of sample frames. Nonmajor graduate credit.

Stat 432. Applied Probability Models. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 231 or 341 or 447.* Probabilistic models in engineering and the physical sciences; probability; Markov chains; Poisson and renewal processes; applications to queuing, scheduling, control, and other quantitative problems. Nonmajor graduate credit.

Stat 447. Statistical Theory for Research Workers. (4-0) Cr. 4. F.S.SS. *Prereq: Math 151 and permission of instructor, or Math 265.* Amemiya, Yang. Primarily for graduate students not majoring in statistics. Emphasis on aspects of the theory underlying statistical methods. Probability, population distributions and their properties, sampling distributions, point and interval estimation, tests of hypotheses, simple regression. Credit for both 341 and 447 may not be applied toward graduation. Nonmajor graduate credit

Stat 451. Applied Time Series. (3-0) Cr. 3. S. *Prereq: 231 or 328 or 401.* Meeker. Methods for analyzing data collected over time; review of multiple regression analysis. Elementary forecasting methods: moving averages and exponential smoothing. Autoregressive-moving average (Box-Jenkins) models: identification, estimation, diagnostic checking, and forecasting. Transfer function models and intervention analysis. Nonmajor graduate credit.

Stat 479. Computer Processing of Statistical Data. (3-0) Cr. 3. F. *Prereq: 401.* Marasinghe. Structure, content and programming aspects of a modern statistical package. Advanced techniques in the use of a statistical software system for data analysis. Introduction to graphical methods in statistics and a matrix programming language. Nonmajor graduate credit.

Stat 480. Statistical Applications of Digital Computers. (3-0) Cr. 3. S. *Prereq: 231 or 328 or 401, Com S 103.* Modern statistical computing. Data management; spread sheets, verifying data accuracy, transferring data between systems. Data and graphical analysis with microcomputer statistical software packages. Macro programming. Simulation. Interface with the World Wide Web. Software reliability. Nonmajor graduate credit.

Stat 490. Independent Study. Cr. var. *Prereq: 10 credits in statistics.* No more than 9 credits in Stat 490 may be counted toward graduation. H: Honors.

Stat 493. Workshop in Statistics. (1-0 or 2-0) Cr. 1 or 2. Off-campus, offered as demand warrants. *Prereq: 101 or 104 or 227.* Planning, executing, and interpreting experiments by understanding experimental design and utilizing the statistical concepts of linear models. Designed for master of agriculture program only. Nonmajor graduate credit.

Stat 495. Applied Statistics for Industry. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 101 or 104 or 105 or 201 or 227; Math 166 (or 166H). Graduate students without an equivalent course should consult the department.* Statistical thinking applied to industrial processes. Assessing, monitoring and improving processes using statistical methods. Analytic/enumerative studies; graphical displays of data; process monitoring; control charts; capability analysis. Nonmajor graduate credit.

Stat 496. Applied Statistics for Industry. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 495.* Statistical design and analysis of industrial experiments. Concepts of control, randomization and replication. Simple and multiple regression; factorial and fractional factorial experiments; reliability; analysis of lifetime data. Nonmajor graduate credit.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

Stat 500. Statistical Methods. (3-2) Cr. 4. F. *Prereq: 101.* Introduction to methods for analyzing data from experiments and surveys. Graphical data summaries. Comparison of groups using t-tests, analysis of variance, and nonparametric analogs. Uses of randomization, blocking, factorial designs, and nested units in experiments. Correlation and regression models, model selection and assessment, effects of collinearity. Introduction to SAS statistical software.

Stat 501. Multivariate Statistical Methods. (3-0) Cr. 3. S. *Prereq: 500 or 402; 447 or 542; knowledge of matrix algebra.* Statistical methods for analyzing and displaying multivariate data: dynamic graphics, principal components, factor analysis, canonical correlations, cluster analysis, classification methods, Hotelling's T^2, multivariate analysis of variance. Statistical software: SAS, S-Plus, and XGOBI.

Stat 505. Environmental Statistics. (2-2) Cr. 3. Alt. S., offered 2002. *Prereq: 341 or 447; 401.* Basic ideas of statistical modeling for environmental applications; causation versus association; ecotoxicology; limits of detection; spatial statistics; geostatistics, kriging, spatial sampling; hierarchical modeling, Bayesian methodology.

Stat 511. Statistical Methods. (3-0) Cr. 3. S. *Prereq: 500 or 402 or 404; 447 or 542 and current enrollment in 543; knowledge of matrix algebra.* Introduction to the general theory of linear models, projections and distributions of quadratic forms; LInear models with both fixed and random factors, variance components, dealing with missing data and unbalanced designs. Introduction to non-linear and generalized linear models, maximum likelihood estimation, local smoothing methods. Requires use of S-Plus statistical software.

Stat 512. Design of Experiments. (3-0) Cr. 3. F. *Prereq: 511.* Stufken. Basic ideas of experimental design and analysis; completely randomized, randomized complete block, and Latin Square designs; randomization analysis; factorial experiments, confounding, fractional replication; split-plot and incomplete block designs; crossover designs.

Stat 513. Response Surface Methodology. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 402 or 512, knowledge of elementary matrix theory.* Morris. Design criteria and optimality; determination of optimum operating conditions; exploration of response surfaces; robust estimation and transformations; mixture experiments; construction of optimal designs. Optimization for multiple-response problems.

Stat 514. Scheduling and Inventory Theory. (Same as I E 514.) See *Industrial Engineering.*

Stat 515. Theory and Applications of Nonlinear Models. (3-0) Cr. 3. F. *Prereq: 447 or 543, 511.* Kaiser. Construction of nonlinear statistical models; random and systematic model components, review of likelihood-based inferences. Iterative algorithms for maximum likelihood estimation. Nonlinear regression models using additive error with nonconstant variance, transform both sides models, generalized linear models and their extensions. Introduction to compartment models, growth curves and pharmaco-kinetic models. Basic random parameter models, beta-binomial and gamma-Poisson mixtures. Requires use of instructor-supplied and student-written S-plus functions.

Stat 521. Theory and Applications of Sample Surveys. (3-0) Cr. 3. S. *Prereq: 401; 447 or 542.* Opsomer. Practical aspects and basic theory of design and estimation in sample surveys for finite populations, with emphasis on applications. Simple random, systematic, stratified, cluster and multistage sampling. Horvitz-Thompson estimation of totals and functions of totals: means, proportions, regression coefficients. Model-assisted ratio and regression estimation. Two-phase sampling. Non-response effects. Small area estimation.

Stat 531. Quality Control and Engineering Statistics. (Same as I E 531.) (3-0) Cr. 3., Alt. S., offered 2003. *Prereq: 401; 342 or 447.* Vardeman. Statistical methods and theory applicable to problems of industrial process monitoring and improvement. Statistical issues in industrial measurement; Shewhart, CUSUM, and other control charts; feedback control; process characterization studies; estimation of product and process characteristics; acceptance sampling, continuous sampling and sequential sampling; economic and decision theoretic arguments in industrial statistics; experimentation for process improvement.

Stat 533. Reliability. (Same as I E 533.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 342 or 432 or 447.* Meeker. Probabilistic modeling and inference in reliability; analysis of systems; Bayesian aspects; product limit estimator, probability plotting, maximum likelihood estimation for censored data, accelerated failure time and proportional hazards regression models with applications to accelerated life testing; repairable system data; planning studies to obtain reliability data.

Stat 534. Ecological Statistics. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 447 or 542.* Statistical methods for analysis of data from ecological field studies. Sampling strategies for estimation of diversity and species richness. Comparison of ecological quantities among regions and across time. Statistical formulation of ecological concepts such as competition and biodiversity. Effects of time and space on population dynamics models. Ordination and analysis of complex multivariate data. Statistical methods discussed will include randomization and permutation tests, spatial point processes, bootstrap estimation of standard error, changepoint regression models, random parameter models and Empirical Bayes methods.

Stat 535. Methods in Biostatistics. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 500; 543 or 447.* Daniels. Statistical methods useful for biostatistical problems. Topics include analysis of observational studies and randomized clinical trials, techniques in the analysis of survival and longitudinal data, approaches to handling missing data, and meta-analysis. Examples will come from recent studies in cancer, AIDS, heart disease and psychiatry and from studies to evaluate health care in the U.S. (health services research).

Stat 536. Genetic Statistics. (Same as Gen 536.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 401, 447; Gen 320 or Biol 301 or permission of instructor.* Probability applied to genetic systems; random mating; selection, mutation and migration; theory of inbreeding; effects of finite population size; basic concepts in quantitative genetics; prediction of progress from artificial selection.

Stat 537. Statistics for Molecular Genetics. (Same as Gen 537.) (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 536 or permission of instructor.* Sampling designs and experimental designs to obtain information from markers; detecting major genes; linkage analysis and segregation analysis; finding alignments and similarities between DNA sequences; constructing phylogenetic trees.

Stat 538. Econometric Statistics. (Same as Econ 538.) (3-0) Cr. 3. F. *Prereq: 542 or Econ 573.* Generalized linear regression, nonlinear regression, measurement error models. Simultaneous equation systems, regression equations with autoregressive errors, large sample theory.

Stat 539. Game Theory. (Same as Econ 539, I E 539.) (3-0) Cr. 3. F. *Prereq: 341 or 432 or 447.* Zero-sum and bi-matrix non-cooperative two person games; games of timing; relation to mathematical programming; cooperative n-person games.

Stat 542. Theory of Probability and Statistics. (4-0) Cr. 4. F. *Prereq: 341; Math 414 or 465.* Sample spaces, probability, conditional probability; Random variables, expectation, inequalities; Common theoretical distributions; Joint distributions, conditional distributions; Introduction to point estimation including maximum likelihood estimation, method of moments, and Bayesian estimation; Introduction to stochastic processes with applications to Poisson Process, Brownian motion; Moment generating functions; Probability laws of transformations, sampling distributions, order statistics.

Stat 543. Theory of Probability and Statistics. (3-0) Cr. 3. S. *Prereq: 542.* Point estimation including maximum likelihood estimation, Bayes estimators, Loss function, Bayesian and minimax optimality, unbiasedness, sufficiency, completeness, Exponential family, Basu's theorem; Convergence in probability, convergence in distribution, laws of large numbers, central limit theorem; Confidence intervals, prediction intervals; Hypothesis testing, Neyman-Pearson Lemma, uniformly most powerful tests, likelihood ratio tests; Bayesian interval estimation and tests; Nonparametric methods, bootstrap.

Stat 544. Bayesian Statistics. (3-0) Cr. 3. S. *Prereq: 543.* Stern. Specification of probability models; subjective, conjugate, and noninformative prior distributions; hierarchical models; analytical and computational techniques for obtaining posterior distributions; model checking, model selection, diagnostics; comparison of Bayesian and traditional methods; empirical Bayes procedures; decision theory.

Stat 546. Theory of Nonparametric and Asymptotic Methods. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 542.* Introduction to nonparametric problems; tests based upon sample distribution functions, rank tests for location, scale and independence; local properties of rank tests; convergence of a sequence of random variables; limit theorems; asymptotic distributions of sample quantiles, U-statistics, rank statistics, chi-square and other goodness of fit test statistics; asymptotic efficiency of tests.

Stat 551. Time Series Analysis. (3-0) Cr. 3. F. *Prereq: 447 or 542.* Stationary and non-stationary time series; covariance and spectral properties of stationary time series; autoregressive moving average processes; best linear prediction; state space models and Kalman recursions; estimation techniques, model-building and diagnostics.

Stat 554. Introduction to Stochastic Processes. (Same as Math 554.) See *Mathematics.*

Stat 555. Theory of Stochastic Processes. (Same as Math 555.) See *Mathematics.*

Stat 557. Statistical Methods for Counts and Proportions. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 500 or 401; 543 or 447.* Koehler. Statistical methods for analyzing simple random samples when outcomes are counts or proportions; measures of association and relative risk, chi-squared tests, loglinear models, logistic regression and other generalized linear models, extensions to longitudinal studies, nested designs, models with fixed and random effects. Use of statistical software: SAS or S-Plus.

Stat 579. Orientation to Software Systems for Statistical Computing. (1-0) Cr. 1. F. *Prereq: Graduate classification in statistics.* Kennedy, Marasinghe. Orientation to scientific and statistical software available on campus. Offered on a satisfactory-fail grading basis only.

Stat 580. Computational Methods in Statistics. (3-0) Cr. 3. S. *Prereq: 500, 542.* Marasinghe. Linear and nonlinear least squares and regression computations, computations associated with maximum likelihood estimation problems, applications of Monte Carlo methods in statistics research, computer intensive applications including the bootstrap, evaluation of multiple integrals, EM algorithm, etc. Assignments will include applications of these methods using the S-Plus programming language.

Stat 581. Advanced Statistical Computing. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 511, 580 and programming in a scientific language.* Marasinghe, Kennedy. Numerical computations and algorithms with applications in statistics.These include discussions on random number generation, solution of nonlinear equations, optimization methods, numerical linear algebra, numerical integration and approximation methods.

Stat 590. Special Topics. Cr. var.
A. Theory
B. Methods
C. Design of Experiments
D. Design of Surveys

Stat 599. Creative Component.

Courses for Graduate Students

Stat 601. Advanced Statistical Methods. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 511; Math 514.* Kaiser. This course is designed to provide students with in-depth coverage of topics from current and recent developments in statistical modeling and applications. Recent topics have included Markov Chain Monte Carlo methods for Bayesian analysis of hierarchical models, conditionally specified statistical models, complex random parameter models, and Bayesian dynamic models. Applications have included problems of monitoring air and water quality, spatial modeling of organism abundance and disease rates, and population pharmacokinetic models. Requires some programming ability to deal with computationally intensive methods.

Stat 606. Spatial Statistics. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 511, 543.* General spatial models; spatial data analysis; continuous spatial variation, geostatistics, kriging; lattice data, conditional models, joint models; image analysis; point patterns, randomness, clustering, random sets.

Stat 611. Theory and Applications of Linear Models. (3-0) Cr. 3. F. *Prereq: 500 or 402 or 404, 542 or 447, a course in matrix algebra.* Stufken, Wu. Matrix preliminaries, estimability, theory of least squares and of best linear unbiased estimation, analysis of variance and covariance, distribution of quadratic forms, extension of theory to mixed and random models, inference for variance components.

Stat 612. Advanced Design of Experiments. (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 512.* Stufken. Design optimality criteria and optimal designs; Galois fields and finite geometries with applications to design construction; fractional factorial designs; theory of approximate designs and the equivalence theorem; crossover designs with applications.

Stat 621. Advanced Theory of Survey Sampling. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 521.* Advanced topics of current interest in design of surveys and analysis of survey data; criteria for choice of survey strategies including sufficiency, likelihood, and admissibility; super population models and their role in choice of optimal strategies; review of recent literature.

Stat 642. Advanced Probability Theory. (3-0) Cr. 3. S. *Prereq: 542, Math 514.* Athreya, Lahiri, Yang. Probability spaces; Kolmogorov's existence theorem for stochastic processes; expectation; Jensen's inequality and applications; Borel-Cantelli lemmas; Weak and strong laws of large numbers; convergence of moments; weak convergence of probability distributions; characteristic functions; continuity theorem; Lindeberg-Feller central limit theorem and its ramifications; conditional expectation and probability; discrete time martingales, discrete parameter Markov chains, Brownian motion.

Stat 643. Advanced Theory of Statistical Inference. (3-0) Cr. 3. F. *Prereq: 543, 642.* Lahiri, Vardeman. Sufficiency, completeness; Elements of decision theory; Bayesian paradigm of inference and theory of Markov Chain Monte Carlo; Invariance; Neyman-Pearson theory of testing hypotheses. Uniformly most powerful tests, introduction to unbiased tests, likelihood ratio tests,.Wald's tests, Rao's tests; Asymptotic theory of maximum likelihood estimation and likelihood ratio tests; Asymptotic efficiency; Resampling methods.

Stat 647. Multivariate Analysis. (3-0) Cr. 3. F. *Prereq: 543, knowledge of matrix algebra.* Amemiya. Multivariate normal distribution, Wishart distribution, multiple, partial, and canonical correlations, inference for mean vector, multivariate regression, principal components, discriminant analysis, factor analysis, covariance structure analysis, latent variable modeling.

Stat 648. Seminar on Theory of Statistics and Probability. Cr. var. Alt. S., offered 2002. *Prereq: 643.*

Stat 651. Time Series. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 551, 642.* Covariance and spectral representation of time series. Stationary and nonstationary autoregressive models. Fourier and periodogram analyses. Stochastic difference equations. Estimation and distribution theory.

Stat 690. Advanced Special Topics. Cr. Var. Prereq: Permission of instructor.
A. Theory
B. Methods
C. Design of Experiments
D. Design of Surveys
E. Statistical Computing
F. Graphics

Stat 699. Research.

Sustainable Agriculture

(Interdepartmental Graduate Major)

Coordinating Committee: *M. Liebman, Coordinator; M. Bell, L. M. Butler, K. Delate, J. Flora, N. Grudens-Schuck, M. Honeyman, S. M. Huang, C. Mize, J. Obrycki, T. Richard, R. Salvador, X.B. Yang.*

The Graduate Faculty Members in Sustainable Agriculture: *Acker, Anderson, Bell, Blackmer, Brummer, Butler, Cambardella, Cruse, Delate, DeWitt, Duffy, C. Flora, J. Flora, Gibson, Gleason, Grudens-Schuck, Harl, Hartzler, Hinrichs, Honeyman, Huang, Hurburgh, Ilahiane, Jannick, Keeney, Kirschenmann, Liebman, Logsdon, Loynachan, Mallorino, Martin, Mize, Morton, Muenchrath, Mullen, Munkvold, Nutter, Obrycki, Richard, Salvador, Sandor, Steward, Thompson, Trexler, Xin, Wells, Wiedenhoeft, Yang.*

The graduate program in sustainable agriculture is an interdepartmental major offered through faculty in ten participating departments: Agricultural and Biosystems Engineering, Agricultural Education and Studies, Agronomy, Animal Science, Anthropology, Entomology, Forestry, Horticulture, Plant Pathology, and Sociology. M.S. and Ph.D. degrees are offered within the major.

Master's students should have a bachelor's degree in one of the life, social, or engineering sciences, or a bachelor's degree plus equivalent experience in these areas. Doctoral students must have a master's degree and either an undergraduate or master's degree in one of the majors in the College of Agriculture or its equivalent.

Graduates of the program will be equipped with skills to design and manage agricultural systems that increase food security, enhance human communities, and protect environmental quality. To acquire these skills, students learn agroecological principles, study social relations underlying sustainable farming and food systems, and gain experience with practical techniques of sustainable agriculture. The program seeks to balance specialized, disciplinary knowledge with broader, system-level analyses. It integrates technical and social sciences through a sequence of team-taught interdisciplinary core courses emphasizing higher-order critical thinking skills and active, collaborative approaches to engaged learning. Students choose an area of specialization, and additional course work in this

area is developed via consultation with the student's Program of Study committee.

Graduates of the program will be qualified to work in a variety of settings, including university research, education, extension, agribusiness, governmental and non-governmental organizations, and farming.

Information on applications procedures, research interests of the faculty, and specific requirements of the major can be obtained from the office of Dr. Lorna Michael Butler, Henry A. Wallace Chair for Sustainable Agriculture, 110 Curtiss Hall, or from the following Internet address: http://www.sust.ag.iastate.edu/gpsa.

Courses for Graduate Students

SusAg 509. Agroecosystem Analysis. (Same as Agron 509, Anthr 509, Soc 509.) (3-0) Cr. 3. SS. *Prereq: 6 credits in social sciences, 6 credits in natural, biological or engineering sciences and senior or above classification.* Field study of commercial farming systems within the context of global energy flows and biogeochemical cycles, including ecological, agronomic, and social perspectives.

SusAg 515. Integrated Crop and Livestock Production Systems. (Same as A E 515, Agron 515, An S 515.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 509.* Managing productivity and minimizing ecological impacts of agricultural systems by understanding nutrient cycles, crop residue and manure management, grazing systems, and multispecies interactions. Consideration of crop and livestock production within landscapes and watersheds.

SusAg 530. Ecologically Based Pest Management Strategies. (Same as Agron 530, Ent 530, Pl P 530.) (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 509.* Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

SusAg 546. Organizational Strategies for Diversified Farming Systems. (Same as Agron 546, Hort 546, Soc 546.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 509.* The day-to-day operation and social relations of the complex, diversified farm. Alternative organizational strategies for the diversified and sustainable farm. Farm family dynamics and goal setting. Cooperation between farmers. The social relations of alternative marketing, including green labeling, community supported agriculture, farmers' markets, and relationships marketing.

SusAg 599. Creative Component. Cr. Var. F.S.SS. Pre-enrollment contract required. Advanced topic for creative component report in lieu of thesis.

SusAg 600. Sustainable Agriculture Colloquium. (1-0) Cr. 1. F.S. Weekly seminar for graduate students in the Sustainable Agriculture program.

SusAg 610. Society and Technology in Sustainable Food Systems. (Same as A E 610, Anthr 610, Soc 610.) (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 509.* Social and technological dimensions of sustainability in food systems. Emphasis on strategies and ethics for evaluation existing and emerging options.

SusAg 699. Research. Cr. Var. F.S.SS. M.S. and Ph.D. thesis and dissertation research.

Systems Engineering

(Interdepartmental Graduate Major)

Supervisory Committee: *D. Gemmill (Chair), D. Flugrad, E. Jones, A. Mann, G. Sheble.*

Work is offered for the master of engineering with a major in systems engineering. The graduate major in Systems Engineering is both an on- and off-campus program. It is an interdisciplinary program that allows students to take courses across a variety of departments. Graduates of the program will possess the analytical abilities needed to design, evaluate, and build complex systems involving many components and demanding specifications. They will have the ability to work across disciplinary boundaries, as the practice of modern engineering often requires. Graduates will have developed management capabilities and extended their disciplinary knowledge.

The program is broadly based and uses courses in the various departments of the College of Engineering and courses in other departments of the university. The 30 credits necessary for graduation includes 27 semester credits of formal coursework and 3 credits for a creative component. Completion of the program requires two courses in systems engineering, two courses in the major discipline of the student, three engineering courses with a systems engineering emphasis, two courses outside of the college, and a creative component. Courses are delivered to off-campus students both with the instructor present and through various distance education systems, including the Iowa Communications Network (ICN), satellite transmission, and videotape.

The program of study committee, in consultation with the student, determines the courses to be taken and the acceptability of transfer credits. The major professor should be selected from the discipline where a concentration of coursework will be taken.

Admission to the program requires a baccalaureate degree in engineering and admission to the graduate college. Students with degrees in other areas will be considered on an individual basis. The degree awarded is a Master of Engineering in Systems Engineering.

For additional information students should contact the Chair of the Supervisory Committee, 2019 Black Engineering Building, ISU, Ames, Iowa 50011.

Teacher Education

Walter H. Gmelch, Director, Teacher Education and Dean, College of Education

All students who are recommended by Iowa State University for teacher licensure must meet the requirements of the teacher education program and be recommended by the College of Education. An undergraduate seeking a bachelor's degree must be enrolled in the department in which he or she plans to major and must meet the graduation requirements of that department and the college in which it is located. Students already holding a bachelor's degree should consult with the coordinator of the area in which they plan to specialize so that an individualized program of study can be developed.

Admission to Undergraduate Teacher Education Program

A student seeking admission to a teacher education program must be accepted by a selection committee for the specific program which the student seeks to enter. Factors considered in evaluating applications include scholarship, interest in teaching, character, and physical and mental health. Recommendations by selection committees must be confirmed by the University Teacher Education Committee before admission to the program in teacher education is granted.

Students may apply as early as four semesters before the one in which they plan to enroll for student teaching; however, they must be fully admitted into the Teacher Education Program by mid-semester prior to their planned students teaching semester. Requirements for full admission to the Teacher Education Program are:

1. A minimum 2.5 cumulative grade point average that must be maintained through graduation to be recommended for licensure.
2. One of the following:

—Minimum ACT composite of 19.
—Minimum SAT I composite score of 910.
—PPST subtest scores in reading, writing and mathematics of 172, 172, and 170 respectively.

Details regarding the dates and fees for any of these tests are available in the Testing Office in Student Counseling Services.

3. Documented completion of 10 hours of prestudent teaching field experience.

Student Teaching

Student teaching is the culminating experience to the teacher preparation program at Iowa State University. To ensure that students are prepared for this experience, the following requirements must be met prior to student teaching:

1. Full admission to the teacher education program by mid-point of the semester prior to the semester when student teaching is planned.
2. A passing grade must have been earned in all required professional teacher education

courses (see *The Professional Teacher Education Requirement*).
3. Completion of the student teaching application by the first week of fall semester for spring student teaching and the first week of spring semester for fall student teaching. Details regarding application are available in the Field Experiences Office, E105 Lagomarcino Hall.
4. A minimum ISU cumulative grade point average of 2.50 or higher at time of application for student teaching.

Teacher Licensure

The Iowa Provisional License may be recommended for those who hold the bachelor's degree from Iowa State and who have completed the following:
1. All requirements of an approved teacher education program, including the human relations requirement of C I 406.

2. A minimum of 42 semester hours in courses designed to serve the general needs of college students. This total will include Engl 104 and 105, one course appropriate for developing interpersonal or group presentation skills (see college or department for appropriate courses), Psych 230 or HD FS 102, Lib 160, one course in each area of physical sciences, biological sciences and mathematics, and one course in American history or American government.

3. Additional requirements as designated by the State of Iowa that include, but are not limited to, a special education component and 50 hours of pre-student teaching field experience, 40 of which are to be taken after admission to the Teacher Education Program.

4. A minimum ISU cumulative grade point average of 2.50 or higher was maintained through graduation (or completion of the Teacher Education Program).

5. Documentation from the student teaching supervisor that the student has successfully completed the final assessment of his/her program portfolio.

Note: Specific courses taken to be used for licensure may not be taken pass/not pass.

Complete details of the State of Iowa requirements for licensure are outlined in the University Teacher Education Handbook that may be purchased at the University Bookstore.

Approval for the early childhood education license requires successful completion of the licensure curriculum through either the Department of Curriculum and Instruction or the Department of Human Development and Family Studies.

Graduate programs are available for those who seek approval as elementary and secondary school principals, superintendents, counselors, instructional media specialists, or teachers in community colleges (applied science and technology, vocational-technical or arts and sciences). Students also may pursue a program for approval to teach in the area of special education, art, agriculture, talented and gifted and reading.

Information concerning licenses not described above, as well as more detailed requirements for any license, may be obtained from the Education Student Services Office in the College of Education.

The General Education Requirement

All prospective teachers are required to complete a program in general education which is integrated with their professional preparation and extends through the undergraduate curriculum.

The student is expected to complete studies in five groups in general education. Usually, courses relating to a given area may be found in several different departments. Credits listed are minimum requirements.

Cr.	
9	I. Biological sciences, physical sciences, and mathematics (one course required in each area)
9	II. Social sciences
6	III. Humanities
9	IV. Communication skills
1	V. Health, dance, exercise and sport science, safety
34	
8	Additional credits in above areas
42	Total

This total will include Engl 104 and 105, one course appropriate for developing interpersonal or group presentation skills (see college department for appropriate course), Psych 230 or HD FS 102, and Lib 160, and one course in American history or government. Additional credits in general education may be required by departments preparing teachers.

The Professional Teacher Education Requirement

As part of a total educational program, the prospective teacher must complete certain studies related directly to the profession of teaching. All students in teacher education must take the following courses prior to student teaching: (See college department for appropriate course)

Cr.	
3	C I 201—Instructional Technology
3	C I 204—Social Foundations of American Education
3	C I 333—Educational Psychology
3	C I 406—Multicultural Awareness and Non-sexism in the Classroom
12-16	Student teaching (minimum—12 weeks)

Secondary education students must also complete the following courses:

R C I 415—Senior Seminar
3 C I 426—Principles of Secondary Education

All students must satisfactorily complete at least one credit of pre-student teaching laboratory experience. This requirement may be met through a pre-student teaching course (e.g. C I 280) or, in certain subject areas, a course designated to provide an equivalent experience.

Professional Courses in Areas of Specialization

AgEdS—AgEds 211, 310, 410, 411, 417

Biology—C I 280M, 347, 392, 468J, 468K, 492, C I/LAS 417D

Chemistry—LAS 417B, 492

Earth Sciences—C I 280M, 347, 392, 468J, 468K, 492, C I/LAS 417J

English—C I 395; Engl 392, 394, 494; LAS 417E

Family and Consumer Sciences Education, Home Economics Education option—FCEDS 206, 206L, 306, 318, 403, 413, 417A, 417B, 420

Foreign Languages—F Lng 487, LAS 417G

General Science—C I 280M, 347, 392, 468J, 468K, 492, C I/LAS 417B

Health Education—H S 375, 417

Mathematics—LAS 417C, 480C, Math 497, 542

Music—LAS 417K and/or 417L, Music 266, 366, 466, Vocal: 358A, 360, 367, 465, Instrumental: 350, 351, 352, 353, 354, 355, 356, 358B, 368 or 369, 464

Physical Education—Ex Sp 375, 417, 418, 475

Physical Sciences—C I 280M, 347, 392, 468J, 468K, 492, C I/LAS 417B

Physics—C I 280M, 347, 392, 468J, 468K, 492, C I/LAS 417B

History and Social Sciences—LAS 417A, 480A, 493

Speech Communication—LAS 417F, Sp Cm 495A, 495B

The Requirements for Areas of Specialization in Teacher Education

A teacher must also be competent in the area of a teaching specialization. For instance, certain competencies are required of those who would teach at the prekindergarten-kindergarten or the elementary level. Those preparing to teach at the secondary level must develop a depth of understanding in one or more subject matter areas.

For full-time teaching in secondary schools an approved subject matter concentration of at least 30 semester hours is required. Additional subject matter areas, usually consisting of 24 semester hours each, are possible but not required. Students interested in adding a second subject area should consult with the coordinator of the area.

The additional courses required by specific teaching areas are:

Agricultural Sciences and Agribusiness

See *Curriculum, Agricultural Education.*

Art

See *Curriculum, Art Education, Department of Art and Design, B.F.A.*

Biology

Coordinator: Warren Dolphin

Students seeking approval to teach biology must earn 13 credits in chemistry, 8 in physics, and at least 6 in mathematics, and take the following biological courses: Biol 201, 201L, 202, 202L, 301, 301L, 302, 303, 302L, and 312.

Bot 306
Micro 202
Zool 355

Seven additional credits at the 300 level or above in a basic biological science. A course emphasizing concepts in biotechnology is recommended, but not required.

Students who have begun their biological science program under earlier catalogs need to see the science teaching adviser if they have questions.

Chemistry

Coordinator: Thomas Greenbowe

Students seeking approval to teach chemistry must earn credits in the following courses:

General chemistry 177, 177L, 178,

Analytical chemistry 210 or 211, 211L, 316, and 316L

Organic chemistry 331, 331L, 332, 332L

Inorganic chemistry 301

Physical chemistry 321, 321L, 322

Math 165, 166

Phys 221 and 222 or 111 and 112

A minimum of one course in biology is required. The recommended course is Biol 201, 201L.

Students with an endorsement in a natural science who seek approval to teach chemistry as an additional area must earn credits in the courses below (15 minimum credits):

Chem 177, 177L, 178, 178L, 211, 211L, 331, 331L, 332, 332L

or

Chem 163, 163L, 164, 164L, 211, 211L, 231, 231L

Students with no natural science endorsement who seek approval to teach chemistry as an additional area must complete one of the two sets of courses listed above plus sufficient additional courses to total 24 chemistry credits, chosen from:

Chem 316, 316L, 301, 321, 322, 321L

or

BBMB 301, 320, 311, 451

In addition, students are required to take the physical science teaching methods course LAS 492.

Coaching Interscholastic Athletics

Coordinator: Rich Engelhorn

Students seeking approval for the Iowa State University endorsement to coach interscholastic athletics must:

a. Satisfy the professional teacher education requirements of the College of Education.

b. Satisfy the requirements of a teaching specialization area.

c. Earn credits in the following: Zool 155; EX SP 220, 258, 355 (Prereq: Phys 106 or 111), 315, 358 (Prereq: Zool 156), 365.

Curriculum and Instruction

Early Childhood Education. See *Curriculum, Curriculum and Instruction or Human Development and Family Studies.*

Elementary Education. See *Curriculum, Curriculum and Instruction.*

Earth Sciences

Coordinator: Kenneth Windom

Students seeking approval to teach earth sciences must earn credits in the following courses:

Geol 100, 100L, 102, 102L, 302, 305, 311, 356, 365, 368, 480
Mteor 206
Astro 120, 150
Chem 177, 177L, 178, 178L
Phys 111, 112; or 221, 222
Math 151 or 160 or 165
Com S 107
and one course in biology.

Students with an endorsement in a natural science who seek approval to teach earth sciences as an additional area must earn credits in the following courses:
Geol 100, 100L, 102
Mteor 206
Astro 120, 150
Courses 300 or above—3 credits

Students with no other natural science endorsement, but who seek endorsement in this area, must take the listed courses plus additional credits in this area to give a total of 24. See area coordinator for approval prior to taking courses.

English

Coordinator: Robert Tremmel

Students seeking endorsement to teach English (7-12) must earn 58 credits in the following courses:

Distributed Requirements:

12 English Studies: 199 (required, but no credit); 219; 260; 310; 339 or 350

3 Advanced writing (selected from 302, 303, 304, 305, 306, 307, 309, 314, 315, 316)

3 Classical Studies: Cl St 353

6 British literature (selected from 370, 373, 374, 375, 376, 377, 378, 379)

6 American literature (selected from 360, 361, 362, 363, 364)

3 Any literature course

3 Women's and/or minority literature (selected from 340, 345, 346, 347, 348, 349, 460) (or 301, 366, 389, 461, 489 when appropriate)

22 English Education: 220; 394; 420; 392 (C I 280 for 2 cr. must be taken concurrently with 392); 494 (C I 280 for 2 cr. must be taken con currently with 494); C I 395

Students seeking to add English as an additional endorsement area must earn 43 credits in the following courses:

3 Advanced writing (selected from 302, 303, 304, 305, 306, 307, 309, 314, 315, 316)

9 English Studies: 220, 260, and 310

3 British literature (selected from 370, 373, 374, 375, 376, 377, 378, 379)

6 American literature (selected from 360, 361, 362, 363, 364)

3 Any literature course

3 World, women's, or minority litera ture (selected from 340, 345, 346, 347, 348, 349, 353, 354);

16 English education 394; 392 (C I 280 for 2 cr. must be taken concurrently with 392), 494 (C I 280 for 2 crs. must be taken concurrently with 494); C I 395

English as a Second Language

Coordinator: Roberta Vann

To add a K-12 teaching endorsement in English as a Second Language, students must fulfill the certification requirements in a major subject area and complete twenty-four semester hours in ESL.

Those twenty-four hours must include Engl 518 and 588. In addition, students must take at least one course in each of the following areas. In some cases, relevant special topics courses or experimental courses may be substituted. Some courses have prerequisites.
Teaching ESL: Engl/Ling 524, 525, 528
Applied Linguistics: Engl/LIng 220, 419/516, 519, 526
Language in Culture: ComSt 310; Anthr/Ling 309, 500; Engl 344, 349, 549, Span 320.
Bilingual Education: Engl/Ling 514
Nature of Language: Engl/Ling 219, 420, 511, 512, 527
Process in Language Acquisition: Engl/Ling 425, 517

Family and Consumer Sciences

Coordinator: Donna Cowan

See *Curriculum, Family and Consumer Sciences Education, Teacher Licensure option.*

Foreign Languages and Literatures

Coordinator: Linda Quinn Allen

Students seeking approval to teach a foreign language must earn at least 34 credits in that one foreign language which must include the courses indicated below for that language. Licensure, full or restricted, also requires Foreign Language 487.

French: 301, 302, 305, 321 or 331, 322 or 332, 401.

German: 301, 302, 305, 330, 340, 4 credits from 471 or 472.

Spanish: 301, 303, 314, 320 or 326, 401, 403; 6 credits from 321, 322, 330, 331, 332.

Latin: 306 (2 cr.); 6 cr. each in 441, 442; 5 cr. arranged; Hist (Cl St) 403.

Russian: 301, 302, 321, 322, 401, 402.

The Department of Foreign Languages and Literatures requires that all students seeking approval to teach a modern language demonstrate adequate speaking proficiency in that language.

Students seeking approval to teach one of the above foreign languages as an additional area must earn 25 credits in that language; 9 of these credits must be at the 300 level or above with 6 of these credits in composition and conversation at the 300 or 400 level. In Latin 10 credits must be at the 300 or 400 level and Hist 403 (Cl St 403) is required. F Lng 487 is also required for this licensure.

Students seeking approval to teach Greek or Portuguese as an additional language must take 25 credits in the language; 9 of these credits must be 300 level courses or above. Endorsement in Greek also requires History 402. F Lng 487 is also required for this licensure.

General Science

Coordinators: Thomas Greenbowe, David Meltzer

Students seeking approval to teach general science must earn credits in the following courses:
Biol 201, 201L, 202, 202L
Chem 163, 163L, 164, 164L, 231, 231L
Geol 100, 100L
Phys 111, 112; or 221, 222
Math 151 or 160 or 165

At least 6 credits from courses numbered 300 or above in astronomy and astrophysics, biochemistry and biophysics, biology, botany, chemistry, genetics, geology, meteorology, microbiology, physics, and zoology.

Health Education

Coordinator: Frank Schabel

Students seeking approval to teach health education must earn credit in the following courses: EX SP 258; H S 110, 215, 305, 310, 350, 375, 390; FS HN 167, HD FS 276, 373 or 377; Zool 155, 156.

Students seeking approval for health education as an additional subject area must earn credits in the following courses: FS HN 167; HD FS 276; H S 110, 215, 305, 310, 350, 375, 390; Zool 155, 156.

History and Social Sciences

Coordinator: Clair Keller

Students seeking certification in any of the social studies areas must complete 15 credits from the following courses listed in each of at least two approval areas plus (a) 15 credits distributed among any of the remaining areas, or (b) 15 credits taken from a single additional area. For each additional area of certification, students must complete 15 credits from courses listed.

Courses applicable in specific areas

Anthropology: Anthr 201, 202, 306 or 309, 307 or 308, and any other Anthr course.

Economics: Econ 101 and 102, and credits as needed from 301 or 302, 312, 320, 321, 344, 353, 355, 370, 376, 415.

Geography: Select one course from each group: 1) Intro to Geog* or Anthr 306; 2) Political Geog* or Anthr 201; 3) Anthr 202; 4) Urban Geog* or Anthr 311 or 323 or 325 or 326; 5) EnSci 101 or 330 (*Geography courses are not available at ISU - see history/social science coordinator for available options).

Political Science: Credits as needed from: Pol S 215, 230, 241, 251, 305, 306, 310, 311, 320, 344, 357, 358, 359, 360, 361, 371, 381, 385, 405, 406, 410, 413, 420, 421, 433, 453, 464, 471.

Psychology: 101, 301, 440 and six additional credits except Psych 230 and 333.

Sociology: Soc 130 or 134 and credits as needed from 201, 235, 302, 305, 310, 327, 330, 331, 340, 345, 377, 380, 381, 401, 411, 415, 420, 425, 435, 461, 473, 484, 485.

United States History Credits as needed with at least two courses from groups 1 and 2 and one course from group 3.

Group 1: 221, 351, 450, 451, 454, 455, 462, 464, 465, 467.

Group 2: 222, 307, 352, 457, 458, 459, 463, 464, 467, 470, 471.

Group 3: 353, 354, 365, 366, 370, 375, 382, 386, 460, 461, 472, 488, 489.

World History Credits as needed with at least one course from each group.

Group 1: 201, 304, 325, 401, 402, 403, 404, 405, 406, 408.

Group 2: 202, 305, 326, 381, 410, 411, 412, 414, 417, 419, 421, 422, 424, 426, 430, 431.

Group 3: 207, 208, 310, 311, 336, 337, 338, 340, 341, 441.

Students who have approval in other subjects and who wish additional approval to teach a specific area of the social studies must take LAS 493 and complete 24 semester credits in the area of approval or 15 semester credits in an approval area plus 15 semester credits from one additional area or distributed from other social studies areas.

Human Development and Family Studies

Early Childhood Education. See *Curriculum, Human Development and Family Studies or Curriculum and Instruction*.

Mathematics

Coordinator: Janet Sharp

Students majoring in mathematics and seeking approval to teach mathematics as a primary endorsement must take the following:

One of the following sequences: Math 165, 166, 201; or 175, 176.

Math 265, 266 or 267, 301, 302 or 307 or 317, 304 or 341, 365, 414, 435, 436, 489, 497.

Com S 107 or 207 or 227.

Students wishing to add mathematics as an additional endorsement area or as a non-mathematics major seeking a license to teach mathematics must take the following:

One of the following sequences: Math 165, 166, 201; or 175, 176.

Math 266 or 267, 301, 304 or 341, 302 or 307 or 317, 414, 435, 436, 489, 497.

Com S 107 or 207 or 227.

Music

Coordinator: Sylvia Munsen

Students seeking approval to teach music must earn credits in the following courses:

Music 119, 120, 219, 230, 231, 232, 248, 266, 319, 331, 332, 337, 338, 361, 362, 366, 419, 466, 3 credits of advanced music history, and 3 credits of advanced music theory.

Music 327, 358A, 360, 367 and 465, and 3 credits of music theater or opera studio are required for students planning to teach vocal music.

Music 350, 351, 352, 353, 354, 355, 356, 358B, 464, and either 368 or 369 are required for students planning to teach instrumental music.

Physical Education

See *Curriculum, Exercise and Sport Science, Physical Education Licensure*.

Physical Sciences

Coordinators: Thomas Greenbowe, David Meltzer

Students seeking approval to teach physical sciences must earn credits in the following courses:

Astro 120, 150; or 342, 346
Chem 163, 163L, 231, 231L
Geol 100, 100L
Mteor 206
Phys 111, 112; or 221, 222
Biology: one course
Math 151 or 160 or 165

Three credits from courses numbered 300 and above in astronomy and astrophysics, chemistry, meteorology, physics, and geology.

Students with an endorsement in a natural science who seek approval to teach physical sciences as an additional area must earn credits in the courses listed below. Students with no other science endorsement, but who seek an endorsement in this area, must take the listed courses plus additional credits in the area to yield a total of at least 24. See area coordinator for approval prior to taking additional courses.
Astro 120 or 150 or 342 or 346
Chem 163, 163L
Geol 100, 100L
Mteor 206
Phys 111, 112; or 221, 222

Physics

Coordinator: David Meltzer

Students seeking approval to teach physics must earn credits in the following courses:

Phys 221, 222, 311T, 399 (2 cr), 321 or 324, and at least 12 credits from Phys 302, 304, 306, 310, 321L, 322, 322L, 361, 364, 365, 396; Astro 342, 344L, 346; Chem 321, 322; E E 205, 235, 441; E M 274, 301, 345, 378; M E 330, 331.

Students with an endorsement in a natural science who seek approval to teach physics as an additional area must complete one of the following sets of courses:

Phys 221, 222, 311T, 321, 321L, 399 (2 cr.); or Phys 111, 112, 302, 311T, 399 (2 cr.)

Students with no other natural science endorsement who seek approval to teach physics as an additional area must complete one of the two sets of courses listed above plus sufficient additional credits from the following list of courses to total 24 credits:

Phys 221, 222, 271, 272, 302, 304, 306, 310, 321, 321L, 322, 322L, 324; Astro 342, 344L, 346; Chem 321, 322; E E 205, 235, 441; E M 274, 301, 345, 378; M E 330, 331.

Reading (K-6; 7-12)

Coordinator: Donna Merkley

Students seeking endorsement to teach reading (7-12) as an additional area must earn credits in the following courses: Engl 219, 394; Engl 302 or 304 or 305 or 306 or 404 or 405; C I 378, 395, 396, 478. Students seeking reading approval for grades K-6, see elementary education adviser.

Speech Communication

Students seeking approval to teach speech must earn credits in the following courses:

CmDis 275; ComSt 102; Sp Cm 110, 212, 305, 313, 322, 412, 495A, 495B; Thtre 255 or 360, 358, 455; Jl MC 101.

Advisers for Areas of Specialization in Teacher Education

Persons interested in teaching in one of the following areas should consult with the appropriate individual. Details of each area will be found in the appropriate departmental section.

Community College—Larry Ebbers (Arts and Sciences), John Van Ast (Applied Science and Technology/Vocational-Technical)

Elementary Education—Al Campbell, Kate Shafer, Denise Zumbach

Early Childhood Education—Al Campbell (College of Education), Patricia Walsh (College of Family and Consumer Sciences)

Special Education—Geoffrey Abelson

Talented and Gifted—Gary Phye

Secondary Education

Agricultural Sciences/Agribusiness Education—Gregory S. Miller

Art—Dennis Dake

Biology—Warren Dolphin, Mike Clough

Chemistry—Thomas Greenbowe

Coaching Interscholastic Athletics—Rich Engelhorn

Earth Sciences—David Meltzer, Mike Clough

English—Robert Tremmel

English as a Second Language—Roberta Vann

Family and Consumer Sciences Education and Studies—Mary Gregoire

Foreign Languages—Linda Quinn Allen

General Science—Michael Clough, Thomas Greenbowe

Health Education—Frank Schabel

History and Social Sciences (economics, sociology, government, geography, and history)—Clair Keller

Mathematics—Janet Sharp, Richard Tondra

Music—Sylvia Munsen

Physical Education— Katherine Thomas

Physical Sciences—Mike Clough, Thomas Greenbowe, David Meltzer

Physics—David Meltzer

Reading—Donna Merkley

Speech Communication—

Technology and Social Change

Advisory Committee: Eric Abbott, coordinator; Karl Gwiasda, undergraduate coordinator; Robert Mazur, graduate coordinator.

Undergraduate Study

Technology and social change is a cross-disciplinary program examining the relationships between technologies and the social and cultural environments in which they operate. The program has a national and international perspective, with courses addressing the interrelationships, policies, and impacts created by the international exchange of technologies. Through T SC, students will better understand the institutional and sociocultural consequences of technological change from differing perspectives and will become sensitive to the issues attending the use of technology to improve people's lives. Work in the program can also serve as preparation for advanced study in this field.

The program requirement for a minor in technology and social change is a minimum of 15 credit hours. One of the courses must be T SC 341. An additional 3 credits must be taken from T SC cross-listed courses. The remaining 9 may be selected from T SC cross-listed courses or from the list of T SC approved courses. At least 9 of the 15 credits must be in courses numbered 300 or above. Because technology and social change is an interdisciplinary study, minor programs must include coursework in at least two departments. Students seeking a minor should develop a specific program of courses either with the T SC faculty representative in their department or with the T SC undergraduate coordinator. The student's minor program must be approved by the T SC program coordinator.

T SC courses are listed below. The list of T SC approved courses is available from the program coordinators. Through the program coordinator, students may petition for approval of courses not on the approved list that address matters relevant to technology and social change.

Graduate Study

The graduate minor in technology and social change is a cross-disciplinary program that enables students to study the interactions between technologies and their users, on both societal and individual levels. The minor strengthens the ability of students to apply differing perspectives in understanding the effects of the global exchange of technologies and to heighten their sensitivity to the institutional and sociocultural issues attending the use of technology to improve people's lives.

Students choosing to minor in technology and social change will pursue a degree program in the major department. In consultation with their major professor, students are to identify a T SC Faculty member to serve on the committee guiding their program of study. This T SC Faculty member must be on the Graduate faculty and must be from a discipline outside the major field of study. With the agreement of the POS committee, the student declaring a minor in T SC will select a group of courses from the list of T SC approved courses available through the program coordinators. For the master's degree, this group should be at least 9 credit hours; for a doctoral degree, the group should be at least 15 credit hours. In either case, T SC/Soc 541 is required. Students may not include in their minor any courses from their own major. All programs of study that include a T SC minor must be approved by the T SC Program coordinator.

Courses open for nonmajor graduate credit: 342, 343.

Courses Primarily for Undergraduate Students

T SC 341. Technology: International, Social, and Human Issues. (3-0) Cr. 3. F. *Prereq: Junior classification.* An interdisciplinary study of the international significance of technology and of the societal and human issues attending its development and adoption.

T SC 342. World Food Issues: Past and Present. (Same as Agron 342.) See *Agronomy.* Nonmajor graduate credit.

T SC 343. Philosophy of Technology. (Same as Phil 343.) See *Philosophy.* Nonmajor graduate credit.

T SC 474. Communication Technology and Social Change. (Same as Jl MC 474.) See *Journalism and Mass Communication.*

T SC 490. Independent Study. Cr. var. *Prereq: 341, permission of instructor and of T SC coordinator.*

Courses Primarily for Graduate Students, Open To Qualified Undergraduate Students.

T SC 541. Technological Innovation, Social Change, and Development. (Same as Soc 541.) See *Sociology*.

T SC 574. Communication Technologies and Societies. (Same as Jl MC 574.) See *Journalism and Mass Communication.*

T SC 590F. Special Topics: Technology and Social Change. (Same as U St 590F.) Cr. var. *Prereq: 541, permission of instructor and of T SC coordinator.* Individual study of topics concerning global and local implications of technological change.

Courses for Graduate Students

T SC 640. Seminar in Technology and Social Change. (Same as U St 640.) Cr. var. *Prereq: 541.* Consideration of global issues and consequences arising from technological change. Specific topics vary each time offered.

Textiles and Clothing

Mary Gregoire, Chair of Department

University Professors: *Farrell-Beck*

Professors: *Gregoire, Littrell, Stone*

Distinguished Professors (Emeritus): *Winakor*

Professors (Emeritus): *Burnet, Danielson*

Associate Professors: *Damhorst, Fiore, Kadolph, Kunz, Miller*

Associate Professors (Emeritus): *Brackelsberg, Kundel*

Assistant Professors: *Campbell, Parsons*

Assistant Professors (Adjunct): *Glock*

Instructors (Adjunct): *Fratzke*

Undergraduate Study

The department offers study for the degree bachelor of science with a major in apparel merchandising, design, and production. The program offers students a broad understanding of textile and apparel products, merchandising and marketing strategies, design and production processes, and business practices leading to a wide range of careers at state, national, and international levels in business and industry. Courses in the department provide scientific, technical, and humanistic knowledge about textiles, apparel, and related products basic to career preparation. Courses also provide knowledge applicable to the development and use of apparel and textile products by individuals, families, and institutions. The program can be used as a foundation for graduate study. Graduates understand the production, distribution, and use of textiles and apparel, with special attention to human concerns for protection and comfort, health and safety, aesthetic expression, and communication. They are prepared to plan, develop, and present textile and apparel products to meet the needs of consumers. They understand the issues involved in textile and apparel production and marketing, both nationally and internationally. Graduates appreciate the interdependence of nations and cultures as producers and consumers of textile products.

The major in apparel merchandising, design, and production (AMDP) provides a broad-based program of study with flexibility in creating an individualized program option. Courses are required in the following groups: general education, family and consumer sciences core, and the AMDP core. To complete the program, a student combines structured clusters of courses to form an option in merchandising, design, or production.

An option in merchandising prepares students for the planning, development, and presentation of market-oriented product lines. Career opportunities are in product development, buying, promotion, and management in both manufacturing and retailing sectors of the textile and apparel industry.

An option in apparel design is appropriate for those interested in the aesthetic, creative, and technical aspects of design, product or line development, or promotion of textiles and apparel.

An option in production prepares students for positions related to apparel engineering, plant management, quality assurance, costing, product development, sourcing, and buying piece goods or trim for apparel manufacturing or retailing firms.

In addition, a student selects a secondary option from the other primary options or from business, consumer behavior/marketing, creative design, history/theatre costume, human relations/communications, international trade quality assurance, or technical design. The combinations of primary and secondary options allow students to individualize their programs.

The department offers a minor in apparel merchandising, design, and production. The minor can be earned by taking T C 131 or 165; 204; 225, 231, or 245; 6 credits at the 300-400 level; for a total of 15 to 17 credits. Also available is an apparel merchandising, design, and production designated area of concentration combined with a major in journalism and mass communication in the College of Liberal Arts and Sciences; see department for details.

Grade point requirement: All students majoring in apparel merchandising, design, and production are required to earn a C– or better in all TC courses applied toward the degree, including transfer credits.

English proficiency: Undergraduate English proficiency is certified when the student has received a grade of C– or better in English 104 and 105. Students who receive a D+, D, or D– in English 104 or 105 may take English 302, 309, 314 instead of repeating the lower level course.

Graduate Study

The department offers the degrees master of science and doctor of philosophy with a major in textiles and clothing. The department also participates in the Master of Family and Consumer Sciences degree by offering a specialization within that program. For all programs the field of study is highly interdisciplinary; programs of study are tailored to students' background and interests.

Graduates understand how textiles and apparel are essential in meeting individual and societal needs and understand the interdependence of nations and cultures as producers and consumers. Graduates understand diverse philosophies of scholarship and apply multiple methods to research and teaching. Strong writing and oral communication skills help graduates disseminate scholarship and compete successfully for awards and grants.

Graduates accept positions relevant to their academic experience. All doctoral graduates have teaching experience. Masters and doctoral graduates have experience working in team-oriented and interactive environments. Graduates are prepared to adapt to future changes in their professions and to provide leadership in professional and public practice. They bring a strong sense of ethics to research, teaching, and business endeavors.

Program emphases for graduate study include consumer behavior; entrepreneurship; craft marketing; merchandising and marketing aspects of textiles and clothing; acquisition and use of textiles and apparel within cultures; U.S. costume and textiles of the 19th and 20th centuries; textiles; social/psychological aspects of dress; aesthetics; product quality and development; textile conservation; and computer-aided design.

The department participates in the interdepartmental minor programs of gerontology and housing.

Courses open for nonmajor graduate credit: 354.

Courses Primarily for Undergraduate Students

T C 121. Apparel Assembly Processes. (1-4) Cr. 3. F.S. Principles of garment assembly. Use of mass production equipment and methods to develop and assemble garments.

T C 131. Introduction to Apparel Product Development. (2-2) Cr. 3. F.S. Concepts related to and issues in the development of apparel products for consumers. Basics of computer-aided design for product development.

T C 165. Appearance in Society. (3-0) Cr. 3. F.S. Social science approaches to understanding clothing and appearance in contemporary U.S. society. Examination of diversity among consumers and forecasting future trends in consumer behavior.

T C 204. Textile Science I. (3-3) Cr. 3 or 4. 4 credits for majors; 3 credits for non-majors. F.S., WWW lectures. *Prereq: Sophomore standing.* Textile fibers, yarns, fabrication, coloration, and finishes. Quality and performance evaluation of apparel, furnishing, and industrial textiles.

T C 225. Patternmaking I. (2-4) Cr. 4. F.S. *Prereq: 121, 131; 204 recommended.* Basic flat pattern and draping methods for women's, men's and children's wear. Pattern drafting; pattern making by computer.

T C 231. Apparel Manufacturing. (3-2) Cr. 4. F.S. *Prereq: 204, 131.* Analysis of apparel manufacturing processes, product development, sourcing, and production. Focus on specifications relative to quality, performance, and cost.

T C 245. Aesthetics of Apparel. (2-0) Cr. 2. F.S. *Prereq: 131, 165.* Analysis of multisensory aesthetic aspects of apparel products and promotional settings affecting the consumer.

T C 245L. Aesthetics of Apparel Laboratory. (0-2) Cr. 1. F.S. *Prereq: 131, 165, 245 or concurrent enrollment.* Computer-aided design applied to analysis, development, and presentation of textiles and apparel.

T C 257. Introduction to Museums. (Same as Anthr 257.) (3-0) Cr. 3. F. *Prereq: Sophomore standing.* History and theory of museums. Overview of museums in modern society, careers in museums , and future needs.

T C 278. Fashion Illustration. (0-6) Cr. 3. F.S. *Prereq: 131, 245, Art 108 or 130.* Drawing the fashion figure and apparel using mixed media and computer aided design. Studies and compositions appropriate to advertising, fashion presentation, and portfolio development. Survey of historical and contemporary fashion artists.

T C 305. Quality Assurance of Textiles and Apparel. (Dual-listed with 505.) (2-2) Cr. 3. Alt. F.,S. offered 2003. *Prereq: 231, one course from the natural sciences select from list; Stat 101, 227, or 401.* Principles of product and materials evaluation and quality assurance. Developing specifications and using standard practices for evaluating materials, product characteristics, performance, and quality.

T C 321. Computer Integrated Textile and Fashion Design. (0-6) Cr. 3. F. *Prereq: 225, 231, 245; Com S 103.* Analysis and advanced use of industry specific software for textile and fashion design. .

T C 325. Patternmaking II. (Dual-listed with 525.) (2-4) Cr. 3. S., Alt. F., offered 2002. *Prereq: 204, 225, 278.* Principles of advanced patternmaking by flat pattern and draping techniques. Interaction of fabric characteristics with style features. Analysis of fit; problem solving.

T C 326. Experimental Design and Presentation. (2-2) Cr. 3. Alt. F., offered 2001. *Prereq: 225, 278; 325 recommended.* Use of traditional, non-traditional, and recycled materials to create innovative garments. Emphasis on collection concepts.

T C 331. Apparel Engineering and Management. (2-3) Cr. 3. S. *Prereq: 231; Com S 103; T C 121 recommended.* Procedures and experiences related to method analysis, work measurement, costing, and production planning; resource management, technology applications, and quality assurance.

T C 342. Aesthetics of Everyday Experience. (3-0) Cr. 3. S. Design principles, aesthetic concepts, and philosophies applied to everyday living. Influence of individual differences and cultural patterns on aesthetic preferences.

T C 354. History of European and North American Costume. (3-0) Cr. 3. Offered F. 2001; S. 2003. *Prereq: 3 credits chosen from Hist or Art H.* Clothing and adornment of women, men, and children in the Ancient Near East, Egypt, Europe, and the United States, from prehistoric times to present; social, economic, technological, and cultural context of costume. Nonmajor graduate credit.

T C 355. History of Asian Costume. (Dual-listed with 555.) (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 204; 3 credits from Hist or Art H.* Clothing and adornment of men, women, and children in selected countries of Asia, from antiquity to the early 20th century; includes Turkey, Iran, China, Japan, Korea, and Indonesia.

T C 362. Cultural Perspectives in Clothing and Textiles. (3-0) Cr. 3. S. *Prereq: 165 or 3 credits in anthropology, psychology, or sociology.* Analysis of multiple factors related to clothing and textiles in selected societies, including technology, aesthetics, social organization, ritual, stability and change. Applications to apparel business.

T C 375. Merchandising. (Dual-listed with 575.) (3-0) Cr. 3. F.S. *Prereq: 165; Com S 103, 3 credits in Math; junior classification.* Principles of merchandising as applied in manufacturing and retailing business organizations. Study of planning and development of primarily apparel and related product lines.

T C 375L. Merchandising Analysis. (1-0) Cr. 1. F.S. *Prereq: Credit or concurrent enrollment in 375.* Interpretation of financial results of merchandising decisions based on computer simulation.

T C 376. Merchandise Planning and Control. (3-0) Cr. 3. S. *Prereq: 375.* Theories and procedures in planning, sourcing, and controlling retail inventories for the profitable management and operation of apparel and related product lines. Computer applications in strategic retail management.

T C 377. Merchandise Presentation. (1-2) Cr. 2. Alt. SS 2002; S 2003. *Prereq: 245 and 375.* Merchandise presentation and promotion at wholesale and retail levels as related to image, sales, and aesthetics. Group project presentations of apparel and related products to diverse markets.

T C 380. Field Study. Cr. 2. May be repeated. F.S.SS. *Prereq: 9 credits in textiles and clothing, junior classification. Permission by application.* Study of and tours to textile mills, apparel manufacturers, design studios, showrooms, markets, retailers, museums, testing laboratories, trade seminars and exhibitions and other areas of interest within the textile and apparel industry.

T C 381. International Field Study. Cr. 2. May be repeated. Alt. S., offered 2003 and Alt. SS., offered 2002 *Prereq: 9 credits in textiles and clothing, junior classification.* Permission by application. Study of and tours to textile mills, apparel manufacturing, design studios, showrooms, markets, retailers, museums, testing laboratories, trade seminars and exhibitions and other areas of interest within the textile and apparel industry. Countries vary.

T C 398. Cooperative Education. Cr. R. F. S. SS. *Prereq: Permission of department executive officer; junior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

T C 404. Textile Science II. (Dual-listed with 504.) (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 204, 245; one course in natural sciences select from group.* Theories and principles of textile science; emphasis on fiber, dye, and detergency chemistry. Examination of product failure, current research, and environmental impact.

T C 410. Synthesis of Merchandising, Design, and Production. (2-3) Cr. 3. F.S. *Prereq: Senior classification; permission by application; 165, 231, 245, 375.* Multi-functional team approach to creative problem solving and development of apparel; integration, application, and presentation of facts and concepts.

T C 411. Seminar on Current Issues. Cr. 1 to 3 each time taken. *Prereq: Senior classification, 12 credits in textiles and clothing.* Trends and issues in textiles and apparel.

T C 467. Consumer Behavior and Apparel. (Dual-listed with 567.) (2-2) Cr. 3. F. *Prereq: Stat 101 or 227; T C 165 or 3 credits in marketing, psychology, or sociology.* Application of concepts and theories from the social sciences to the study of consumer behavior toward apparel and adornment. Experience in conducting research.

T C 470. Supervised Experience. Cr. 2 to 6. F.S.SS. *Prereq: Minimum 2.0 GPA; permission by application; junior or senior classification.* Supervised work experience with a cooperating firm in merchandising, design, manufacturing, product development or quality assurance.

A. Textile Industry. *Prereq: 305.*
B. Historic Textiles and Clothing. *Prereq: 6 credits from 354, 355, 362; 3 credits in anthropology recommended.*
C. Apparel Design. *Prereq: 225, 231, 245, 278.*
I. Merchandising. Cr. 4 or 6. *Prereq: 375.*
J. Extension. *Prereq: 6 credits in textiles and clothing.*
M. Museum. Cr. 2 to 6. *Prereq: 257.*
N. Apparel Production Management. *Prereq: 331.*
O. Product Development. *Prereq: 231, 225, 245, or 305.*
Q. Quality Assurance. *Prereq: 305.*
T. Public Relations. *Prereq: T C 375 and Jl MC 330.*

T C 472. Global Issues in Textiles and Apparel. (Dual-listed with 572.) (3-0) Cr. 3. F. *Prereq: 375, Econ 101.* Evaluation of key issues facing textiles and apparel businesses in global markets considering ethical, economic, political, social, and professional implications.

T C 474. Entrepreneurship in Family and Consumer Sciences. (Dual-listed with 574; same as HD FS 474.) (3-0) Cr. 3. S. *Prereq: 6 credits in T C at 300-level or above.* Explores entrepreneurship for family and consumer sciences related businesses. Includes family, home-based, rural, and women-owned businesses. Development of a feasibility analysis. Guest speakers.

T C 490. Independent Study. Cr. arr. May be repeated. F.S. *Prereq: 6 credits in textiles and clothing, permission of the instructor, adviser, and department executive officer.*

A. Textile Science
B. History of Textiles
C. Textile and Apparel Design
D. Aesthetics
E. History of Costume
F. Sociological and Psychological Aspects of Clothing and Textiles
G. Consumer Behavior
H. Honors
I. Merchandising
K. Cultural Analysis
M. Museums
N. Apparel Production Management
O. Product Development
Q. Quality Assurance
R. Functional Design
S. Small Business Entrepreneurship in Apparel

T C 495. Advanced Apparel Design. (1-5) Cr. 3. S. *Prereq: 225, 278, 325 recommended, senior classification.* Creation of a line of apparel from concept through completion. Development of portfolio using manual and computer-aided techniques. Line must be submitted to a local regional or national competition.

T C 498. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of department executive officer; senior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

T C 499. Undergraduate Research. Cr. 1 to 3 each time taken. F.S.SS. *Prereq: Senior classification, 15 credits in textiles and clothing, permission of instructor, adviser, and department executive officer.* Research experience in textiles and clothing with application to a selected problem.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

T C 504. Textile Science II. (Dual-listed with 404.) (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 204, 245; one course in natural sciences select from group.* Theories and principles of textile science; emphasis on fiber, dye, and detergency chemistry. Examination of product failure, current research, and environmental impact.

T C 505. Quality Assurance of Textiles and Apparel. (Dual-listed with 305.) (2-3) Cr. 3. Alt. F., offered 2001. *Prereq: 231, 375; Stat 101, 227 or 401; one course from the natural sciences select from list.* Principles of product and materials evaluation and quality assurance. Developing specifications and using standard practices for evaluating materials, product characteristics, performance, and quality. Proposal and research project.

T C 510. Foundation of Scholarship in Textiles and Clothing. (2-0) Cr. 2. F. *Prereq: Graduate classification.* Overview of research in textiles and clothing with emphasis on current and future directions and interdisciplinary nature of the field. Introduction to theory and model building.

T C 525. Patternmaking II. (Dual-listed with 325.) (2-4) Cr. 3. Alt. F., offered 2002. *Prereq: 204, 225, 278.* Principles of advanced patternmaking by flat pattern and draping techniques. Interaction of fabric characteristics with style features. Analysis of fit; problem solving.

T C 545. Interdisciplinary Approach to Aesthetics of Textiles and Clothing. (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: Undergraduate course in design elements and principles.* Examination of aesthetics theory from an interdisciplinary perspective. Emphasis on theory from disciplines outside textiles and clothing. Discussion of implications for development and promotion of apparel products and promotional settings.

T C 555. History of Asian Costume. (Dual-listed with 355.) (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 3 credits from Hist or Art H.* Clothing and adornment of men, women, and children, in selected countries of Asia, from antiquity to the early 20th century; includes Turkey, Iran, China, Japan, Korea, and Indonesia.

T C 557. Conservation of Textiles and Costume. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 204; 354 or 355.* Preventive and interventive approaches to textile conservation. Focus on understanding textiles and costume and factors related to aging, storage, and exhibition; research methods.

T C 562. Dress and Culture. (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 362 or 6 credits in social science or cultural anthropology.* Analysis of dress as artifact, behavior, and symbol in selected cultures.

T C 564. Clothing Consumption. (3-0) Cr. 3. *Prereq: Econ 101, Stat 101 or 227.* Theories of clothing consumption; factors affecting family expenditures and levels and standards of consumption for clothing and household textiles.

T C 567. Consumer Behavior and Apparel. (Dual-listed with 467.) (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: Stat 101, T C 165 or 3 credits in marketing, psychology or sociology.* Application of concepts and theories from the social sciences to the study of consumer behavior involving apparel and adornment. Experience in conducting research; grant proposal and manuscript writing.

T C 570. Practicum in Textiles and Clothing. Cr. 1 to 3. F.S.SS. *Prereq: 7 graduate credits in textiles and clothing, permission by application.* Supervised experience related to career objective. Proposal must be approved semester before placement.

T C 572. Global Issues in Textiles and Apparel. (Dual-listed with 472.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 375 or 575, Econ 101.* Evaluation of key issues facing textile and apparel businesses in global markets considering ethical, economic, political, social, and professional implications. Theoretical foundations of sourcing.

T C 574. Entrepreneurship in Family and Consumer Sciences. (Dual-listed with 474.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 6 credits in T C at 300-level or above.* Explores entrepreneurship for family and consumer sciences related businesses. Includes family, home-based, rural and women-owned businesses. Development of a feasibility analysis. Guest speakers.

T C 575. Merchandising. (Dual-listing with 375.) (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: 165; Com S 103 and 3 credits of Math.* Principles of merchandising as applied in manufacturing and retailing business organizations. Study of planning and development of primarily apparel and related product lines. Computer applications and theoretical foundations in merchandising.

T C 581. International Study. Cr. var. Alt. S., offered 2003 and Alt. SS., offered 2002. *Prereq: 9 credits in textiles and clothing, permission by application.* Study abroad of apparel and textile design, merchandising, production, distribution, and consumption; textiles in museums. Countries vary. May be repeated.

T C 590. Special Topics. Cr. arr. *Prereq: Permission of department executive officer and instructor(s).* Individually designed textile and clothing related projects that reflect the special interests of the student.

A. Textile Science
B. History of Textiles
C. Textile and Apparel Design
D. Aesthetics
E. History of Costume
F. Sociological and Psychological Aspects
G. Consumer Behavior
I. Merchandising
J. Extension
K. Cultural Analysis
L. Conservation
M. Museums
N. Apparel Production Management
O. Product Development
P. Interdisciplinary
Q. Quality Assurance
R. Functional Design
S. Small Business/Entrepreneurship in Apparel

T C 593. Workshop. Cr. arr. SS.

Courses for Graduate Students

T C 610. Philosophical Issues of Textiles and Clothing Scholarship. (2-0) Cr. 2. Alt. S., offered 2002. *Prereq: FCEdS 511 or Resev 550, 6 graduate credits in textiles and clothing.* Models, theory, methods, alternative philosophies, and ethics of science as applied in textiles and clothing scholarship.

T C 611. Seminar. Cr. 1 to 3 each time taken. *Prereq: 6 graduate credits in textiles and clothing, permission of instructor.* Discussion of scholarship and current issues. Topics vary.

T C 650. Advanced History of Costume and Textiles. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 204; 354 or 355.* Philosophy and techniques of history-based research applied to clothing and textiles; inter-relationship of artifacts and documents; individual and group projects.

T C 665. Social and Psychological Theories of Appearance. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: 467 or 6 credits in sociology or psychology.* Analysis of social science theories and concepts applicable to clothing and appearance research.

T C 690. Advanced Topics. Cr. arr. *Prereq: Enrollment in doctoral program, permission of instructor, and approval of department executive officer.*

T C 699. Research.

Theatre and Performing Arts

www.theatre.iastate.edu

(Administered by the Department of Music)

Undergraduate Study

Students interested in theatre as a major area of concentration declare a major in Performing Arts and select an emphasis in Theatrical Design or Acting/Directing. Students implement the theories and principles explored in the classroom by participating in production work. During the academic year, Iowa State University Theatre presents up to ten mainstage and second stage productions in Fisher Theater, and works in close collaboration with ISU Music and Dance.

The major in Performing Arts offers the undergraduate student a cross-disciplinary concentration in Music, Dance and Theatre. The core curriculum consists of 25 credit hours in the three areas. Students elect a 24 credit hour emphasis in either Dance, Theatrical Design or Acting/Directing. In addition to coursework, all Performing Arts majors and minors participate in concert (Orchesis, Footfalls), workshop (Opera Studio, Minority Theatre Workshop) and production (Barchje, Stars Over Veishea, ISU Theatre/Music Theatre/Second Stage and Studio) experiences.

Performing Arts students, in addition to a solid theoretical and experiential background in the areas of performance, theatrical design, dance and music, are prepared to meet the challenges of the work force or graduate school with their strengths in collaboration, creative problem solving, meeting deadlines and processing diverse input to yield cohesive output. Two required professional internships prior to graduation are vital to the student's appreciation and practical understanding of the rigors of the field.

The theatre area offers a wide variety of courses. Students may select from a core of courses in acting, design (costume, scenic, lighting/sound), make-up, stage direction, stage management, and theatre history. Independent study and special topics courses supplement formal course offerings to provide opportunities to intensify study in a particular aspect of theatre.

Auditions for ISU Theatre productions are open to all students irrespective of academic major. Similarly, participation in areas of production other than acting is open to both majors and nonmajors. Qualified students also present experimental, laboratory, and Minority Theatre Workshop productions. Student actors, directors, designers, and technical crew heads are required to maintain a grade point average of at least 2.0 to participate in productions.

Theatre scholarships are awarded on a yearly basis to students who make significant contributions to Iowa State University Theatre.

Bachelor of Arts - Performing Arts Major (Perf)

The Core for the Performing Arts Major (25 cr)

(for individual Dance and Music course descriptions, see *Index* for individual department listing.)

Music 100, 102, 127
Dance 120–Modern Dance I, 130–Ballet I, 220–Modern Dance Composition
Dance 270–Dance Appreciation
Thtre 255, 263, 365
Perf 105–(six semesters), Perf 310 (2), Perf 401

Emphasis in Theatrical Design (24 cr)
Thtre 250 (2 cr), 360, 366, 455, 461, 465, 466, Music 133
Emphasis in Dance (24 cr)
Art 292, Music 133, Ex Sp 355
Dance 222, 224 (2 cr), 232, 360, 370
Select 2 credits from: Dance 140, 150, 160, 170, 211 (instead of 160, 170)
Select 2 credits from: Dance 223, 233, 242, 243, 262
Select 3 credits from: Dance 320, 384, 385, 386
All students enrolled in the Dance Emphasis must register for one dance technique course every semester of residence up to a total of 8 credits and must complete one computer course (Com S 103, 107, 207, C I 201).
Emphasis in Acting/Directing (24 cr)
Thtre 151, 250 (2 cr), 251, 351, 451, 455, 465, 466
Music 133

Minor in Performing Arts (21 cr)
Perf 105 (three semesters)
Music 100, 102
Dance 120 or 130, 270
Thtre 255, 263 or 251
plus six credits 300+ in Dance, Thtre or Perf

English proficiency requirement: Select one course from "Advanced Writing" Engl 302, 303, 304, 305, 306, 307, 309, 314, 315, 316, 366, 370.

Graduate Study

The department offers graduate courses as supporting work in other fields.

Courses open for nonmajor graduate credit: Thtre 316, 465, 466; Perf 401.

Performing Arts

Courses Primarily for Undergraduate Students

Perf 105. Issues in the Performing Arts. (1-0) Cr. R. F.S. Cross-disciplinary analysis and discussion of topics in the performing arts. Six semesters required of performing arts majors.

Perf 310. Performing Arts Internship. Cr. R. F.S.SS. Required of performing arts majors. A job or internship with a professional or semi-professional performing arts organization.

Perf 401. Performing Arts Seminar. (2-0) Cr. 2. Alt. S., offered 2003. Intensive collaborative study and practice of topics in music, dance and theatre. Required of performing arts majors. Nonmajor graduate credit.

Theatre

Courses Primarily for Undergraduate Students

Thtre 106. Introduction to the Performing Arts. (3-0) Cr. 3. F.S.SS. An audience oriented, broad-based, team-taught survey of the performing arts which emphasizes theatre and includes segments on television, radio, film, dance, and music.

Thtre 110. Theatre and Society. (3-0) Cr. 3. F.S.SS. An introduction to Theatre focusing on its impact on society from the Greeks to modern times. Particular emphasis on the contemporary world theatre.

Thtre 151. The Actor's Voice. (3-0) Cr. 3. S. Study and practice of fundamentals of vocal production: breathing, quality, articulation, projection, and expressiveness for the performing artist.

Thtre 224. Concert and Theatre Dance. (Same as Dance 224.) See *Health and Human Performance, Dance.*

Thtre 250. Theatre Practicum. Cr. 1 or 2 each time taken, maximum of 6 credits. F.S. *Prereq: Permission of instructor.* Practice in various aspects of technical theatre production. Offered on a satisfactory-fail grading basis only.

Thtre 251. Acting I. (3-0) Cr. 3. F.S. Theory and practice in fundamentals of acting.

Thtre 252. African American Theatre Production. (Same as Af Am 252.) (3-0) Cr. 3. F.S. An exploration of African American Theatre in production; aesthetic foundations, history and contributions to American Theatre.

Thtre 255. Introduction to Theatrical Production. (3-3) Cr. 4. F.S. Standard structure and procedures, historical overview of performing arts production including the design and creation of scenery, costumes and lighting.

Thtre 263. Script Analysis. (3-0) Cr. 3. F.S. Theory and analysis of scripts for production.

Thtre 290. Special Projects. Cr. 1 to 3 each time taken, maximum of 6 credits. F.S.SS. *Prereq: 3 credits in theatre; permission of instructor; approval of written proposal.*

Thtre 316. Creative Writing—Playwriting. (Same as Engl 316.) (3-0) Cr. 3. S. *Prereq: Engl 105, not open to freshmen.* Progresses from production of scenes to fully developed one-act plays. Emphasis on action, staging, writing, analytical reading, workshop criticism, and individual conferences. Nonmajor graduate credit.

Thtre 351. Acting II. (3-0) Cr. 3. S. *Prereq: 251, Dance 120 recommended.* Theory and practice of techniques of acting with emphasis on character and scene analysis.

Thtre 352. Stage Combat. (1-2) Cr. 2. Alt. S., offered 2002. *Prereq: 351.* Theory, history, and practice of theatrical combat. Includes tumbling, hand-to-hand, quarterstaff, broadsword, rapier, and dagger.

Thtre 354. Musical Theatre I. (2-2) Cr. 3. *Prereq: 251 or Music 236 or 3 credits in Dance.* Theory, history and practice of musical theatre techniques. Designed to develop the musical theatre performance skills of singers, dancers, and actors.

Thtre 355. Musical Theatre II. (2-2) Cr. 3. *Prereq: 354.* Theory, history and practice of musical theatre techniques. Designed to develop the musical theatre performance skills of singers, dancers, and actors.

Thtre 357. Stage Make-up. (1-2) Cr. 2. F. Theory and practice of make-up and hair-styling techniques for the performing arts: Theatre, Opera, Dance, Television and Film. Lab required.

Thtre 358. Oral Interpretation. (3-0) Cr. 3. F. Principles of oral interpretation: practice in analysis, in reading aloud of literary selections, and in reader's theatre.

Thtre 359. Theatre for Children and Youth. (3-0) Cr. 3. S. Study and practice of directing, acting, and the production of theatre for children and youth.

Thtre 360. Stagecraft. (3-2) Cr. 4. S. *Prereq: 255.* Tools, materials, and techniques of planning, constructing and painting of performing arts scenography. Basic principles of lighting technology. Technical drawing for performing arts production.

Thtre 365. Theatrical Design I. (2-2) Cr. 3. F. *Prereq: 255.* An exploration of the elements, principles and art of theatrical design.

Thtre 366. Theatrical Design II. (2-2) Cr. 3. S. *Prereq: 365.* Intensive application of the principles introduced in 365. In-depth study and practice of the graphic skills of rendering and drafting.

Thtre 367. Stage Management. (3-0) Cr. 3. F. *Prereq: 255.* The responsibilities and techniques of stage management for the performing arts.

Thtre 393. Workshop. Cr. 3 each time taken, maximum of 9. F.S.SS. *Prereq: 3 credits in theatre.* Offered to explore special topics.

A. Minority Theatre
B. Repertory
C. Children's Theatre
D. Musical Theatre
E. Creative Dramatics
F. International Storytelling

Thtre 451. Acting III. (3-0) Cr. 3. F. *Prereq: 351 and permission of instructor.* Analysis and practice of period scenes.

Thtre 455. Directing I. (3-0) Cr. 3. F. *Prereq: 255; 263; 251 recommended.* Theory, techniques, and practice of directing.

Thtre 456. Directing II. (2-2) Cr. 3. S. *Prereq: 455.* Practical and theoretical experience in directing the stage play.

Thtre 461. Theatrical Design Studio. (3-2) Cr. 4 each time taken, maximum of 12. F.S. *Prereq: Permission of instructor.* Focuses on the art and craft of specific areas of theatrical design. Each semester the student will focus on one or two of the following: scenic, costume, or lighting design.

Thtre 465. History of Theatre I. (3-0) Cr. 3. F. *Prereq: Hist 201 or equivalent.* Theatre history from ancient times to 1800. Nonmajor graduate credit.

Thtre 466. History of Theatre II. (3-0) Cr. 3. S. *Prereq: 465.* Theatre history from 1800 to present. Nonmajor graduate credit.

Thtre 469. Advanced Theatre Practicum. Cr. 1 to 3 each time taken, maximum of 3 credits per semester, maximum of 6 credits total. F.S.SS. *Prereq: 9 credits in theatre courses; junior classification.* Practicum in production with ISU Theatre, with opportunities for specialization within various areas. Required: Approval of written proposal.

Thtre 490. Independent Study. Cr. 1 to 3 each time taken. F.S.SS. *Prereq: 9 credits in theatre, approved written proposal, junior classification.* Only one independent study enrollment within the department is permitted per semester; no more than 9 credits in Thtre 490 may be counted toward graduation.

Thtre 497. Senior Seminar. (3-0) Cr. 3. S. *Prereq: 15 credits in theatre courses; senior classification.* Directed study of a theatre issue or problem identified by each student. Students synthesize relevant theory and research culminating in senior project or paper.

Thtre 499. Theatre Internship. Cr. var. 1 to 8 each time taken, maximum of 8. F.S.SS. *Prereq: 18 credits in theatre, other courses deemed appropriate by faculty adviser; 2nd semester junior or senior standing; cumulative GPA of at least 2.5 overall and 3.0 in theatre courses.* Supervised application of theatre in professional settings.

Courses Primarily for Graduate Students, open to qualified undergraduates

Thtre 504. Seminar. Cr. 1 to 3 each time taken. F.S.SS. *Prereq: 9 credits in theatre.* Topics may include the following:

A. Musical Theatre
B. Acting Techniques
C. Acting Styles
D. Design and Technical Theatre
E. Arts Management

Thtre 590. Special Topics. Cr. 1 to 4 each time taken, maximum of 12 credits. *Prereq: Approved written proposal.*

Toxicology

www.molebio.iastate.edu~L-wild/tox-home.htm

toxic@iastate.edu

(Interdepartmental Graduate Major)

Supervisory Committee: G. Munkvold, Chair; J. Beetham, J. Coats, W. Hyde, A. Kanthasamy

Work is offered for the degrees master of science and doctor of philosophy with major in toxicology in various cooperating departments: Agricultural and Biosystems Engineering; Animal Ecology; Animal Science; Biochemistry, Biophysics and Molecular Biology; Biomedical Sciences; Botany; Chemistry; Entomology; Food Science and Human Nutrition; Geological and Atmospheric Sciences; Microbiology; Plant Pathology; Veterinary Diagnostic and Production Animal Medicine; Veterinary Pathology; and Zoology and Genetics.

The prerequisites for entrance into the graduate toxicology major include an undergraduate degree in a relevant area of study; for example, chemical engineering, biology, biochemistry, chemistry, ecology, entomology, food science and technology, microbiology, nutritional science, zoology, or veterinary medicine. Minimum undergraduate coursework should include the following or their equivalent: 1 year of college mathematics, including calculus; 1 year of inorganic chemistry with quantitative analysis; 1 course in physics; 1 year of organic chemistry; 2 years of biological sciences including 1 course in physiology.

Other courses that are considered desirable in the undergraduate preparation include: biochemistry, physical chemistry, qualitative analysis, and some specialized courses such as histology or advanced physiology. Prospective students not meeting these requirements may be admitted on a provisional basis with approval of the admissions committee and the program of study committee.

Facilities and faculty are available in these departments for fundamental research in such areas as aquatic toxicology, environmental fate and effects of chemicals, food safety, neurotoxicology, nutritional toxicology, pesticides, and veterinary toxicology.

Students majoring in toxicology will be affiliated with a cooperating department and choose a major professor from the participating faculty in that department. All Ph.D. students take a core curriculum consisting of Tox 501 and 502, 2 credits of Tox 500 (Toxicology Seminar), 7 additional credits in toxicology, 8 credits in biochemistry (from BBMB 404, 405, 420, 451, 511, 542), 3 graduate credits in physiology, histology, or pathology; Stat 401 and 402. M.S. students take a core of Toxicology 501 and 502, 1 credit of Toxicology 500 Seminar, 3 additional credits in toxicology, BBMB 404 and 405, Stat 401. Additional coursework is selected to meet departmental requirements and to satisfy individual student research interests; toxicology courses may be chosen from those listed below. The foreign language requirement is determined by the student's major department.

Graduates of the Toxicology major will be able to carefully design, execute and analyze experiments that extend the knowledge of toxicology and closely related sciences. They will be able to clearly communicate research findings, and thoroughly evaluate the literature of toxicology, contributing significantly to the advancement of the field.

A graduate minor in toxicology is available for students enrolled in other majors. A minor for an M.S. degree includes Tox 500 and 501 and 6 credits in other toxicology courses. A minor at the Ph.D. level includes Tox 500, 501, and 9 credits in other toxicology course work. One member of the student's program of study committee will be a member of the toxicology faculty.

Courses open for nonmajor graduate credit: 419, 420.

Courses Primarily for Undergraduate Students

Tox 419. Foodborne Hazards. (Same as FS HN 419.) See *Food Science and Human Nutrition. Nonmajor graduate credit.*

Tox 420. Food Microbiology. (Same as Micro 420.) See *Microbiology.* Nonmajor graduate credit.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

Tox 501. Principles of Toxicology. (Same as VDPAM 501, Zool 501.) (3-0) Cr. 3. S. *Prereq: BBMB 404 or equivalent.* Principles of toxicology governing entry, fate, and effects of toxicants on living systems. Includes toxicokinetics and foreign compound metabolism relative to toxification or detoxification. Fundamentals of foreign compound effects on metabolism, physiology, and morphology of different cell types, tissues, and organ systems.

Tox 502. Toxicology Methods. (Same as VDPAM 502, Zool 502.) (0-6) Cr. 3. Alt. F., offered 2001. *Prereq: 501.* Provides demonstrations or laboratory experience in the application of methods used in toxicology, including safety procedures, calculation and data analysis, teratologic and morphologic evaluation, electrophysiologic measures, in vitro enzyme induction/biotransformation, neural and behavioral toxicology testing.

Tox 504. Toxicology Seminar. (Same as VDPAM 504.) (1-0) Cr. 1 each time taken. F.S. *Prereq: Permission of instructor.* Presentation of a seminar about a current topic in toxicology as part of a weekly series of seminars by graduate students, faculty, and guest lecturers from off campus.

Tox 513. Ecological Toxicology. (Same as A Ecl 513.) See *Animal Ecology.*

Tox 519. Food Toxicology. (Same as FS HN 519.) See *Food Science and Human Nutrition.*

Tox 526. Veterinary Toxicology. (Same as VDPAM 526.) (3-0) Cr. 3. S. *Prereq: Permission of instructor.* A study of disease processes in animals caused by toxicants and the use of differential diagnostic and therapeutic procedures.

Tox 535. Methods of Biostatistics. (Same as Stat 535.) See *Statistics.*

Tox 544. Aquatic Toxicology. (Same as A Ecl 544.) See *Animal Ecology.*

Tox 546. Clinical and Diagnostic Toxicology. (Same as VDPAM 546.) (0-3 to 0-9) Cr. 1 to 3 each time taken. F.S.SS. *Prereq: VDPAM 526 or DVM degree.* Advanced study of current problems and issues in toxicology. Emphasis on problem solving utilizing clinical, epidemiological, and laboratory resources.

Tox 550. Pesticides in the Environment. (Same as Ent 550.) See *Entomology.*

Tox 554. General Pharmacology. (Same as B M S 554). See *Biomedical Sciences.*

Tox 555. Neurobehavioral Toxicology. (Same as VDPAM 555.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: VDPAM 501.* Advanced study of neurotoxicology and behavior. Emphasis on methods in neurobehavioral toxicology and the effects of a broad spectrum of neurotoxic agents.

Tox 590. Special Topics.

Courses for Graduate Students

Tox 626. Advanced Food Microbiology (Same as FS HN 626.) See *Food Science and Human Nutrition.*

Tox 643. Natural Toxins. (Same as VDPAM 643.) (1-6) Cr. 3. Alt. F., offered 2002. *Prereq: Courses in biochemistry and physiology.* Naturally occurring toxins in foods and feeds, poisonous plants and venoms.

Tox 645. Agricultural and Environmental Analytical Toxicology. (Same as VDPAM 645.) (1-3) Cr. 2. F. *Prereq: Chem 211, 322,* Analysis and interpretation of toxicant residues in animal tissues, foods, water, soil, and other environmental specimens.

Tox 675. Insecticide Toxicology. (Same as Ent 675.) (2-3) Cr. 3. Alt. F., offered 2001. *Prereq: Ent 555 or Tox 501.* Coats. Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides.

Tox 699. Research.

Transportation

(Interdepartmental Graduate Major)

Supervisory Committee: R. R. Souleyrette, Chair; M. R. Crum, R. G. Mahayani

Work is offered for the degree master of science (thesis option only) with a major in transportation under a cooperative arrangement with various departments including Civil and Construction Engineering (CCE), Community and Regional Planning (CRP), and Logistics, Operations and Management Information Systems (LOMIS). Opportunities are afforded for research in such areas as modeling and performance of transportation systems, techniques for urban and regional transportation system planning, environmental and social policy analysis of transportation systems, transportation policy analysis, analysis of transportation technologies, commodity distribution, public administration of the transportation planning process, regional development and transportation system interrelationships, transportation economics and finance, and planning for logistics management.

Students majoring in transportation will develop a program of study under the guidance of a committee nominated by the administrative department head, approved by the departmental transportation supervisory committee representative, and appointed by the dean of the Graduate College. For administrative purposes, the student's home department will be the department originally admitting the student. A major professor may be selected from any of the three participating departments. A student must designate at least one member of the POS committee from his or her home department, and at least one member from outside the home department.

A student must complete at least 36 credit hours of acceptable work including preparation of a thesis. A structured minor requires 12 credits of approved transportation courses and a thesis on a transportation related topic.

A required core includes C E 551, Trans 691, Stat 401 and at least one course from all three cooperating departments (CRP. CCE and LOMIS). Detailed requirements are available from the chair of the supervisory committee.

Graduate students pursuing a major in any of the cooperating departments who have an interest in transportation are encouraged to consider a formal declared minor in transportation. Students considering a declared minor should consult with the chair of the supervisory committee about the requirements for it.

Students typically focus their program of study to support a career in one of four areas: regional and statewide transportation planning, transportation service operations and transportation management, transportation policy and economic analysis, and transportation planning and operation for local and state governments. Graduates will have specific knowledge in one or more of these focus areas and the skills to conduct research and analysis of transportation issues. These skills allow graduates to be productive immediately in positions related to a focus area or to continue in more advanced transportation graduate work.

Courses Primarily for Graduate Students

Trans 555. Economic Analysis of Transportation Investments. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: C E 350 or 353 or 354 or 355.* Application of economic analysis methodologies to evaluate transportation projects. Multi-modal approaches to evaluate impacts of transportation investments and maximize economic efficiency while considering equity and other social issues related to investment options.

Trans 691. Seminar in Transportation Planning. Cr. 1 to 3. S. Provide an overview of current transportation issues; lecturers provide seminars of a variety of timely transportation topics.

Trans 699. Research.

Transportation and Logistics

(Administered by the Department of Logistics, Operations, and Management Information Systems)

Michael R. Crum, Chair of Department

Distinguished Professors: Allen, Baumel

Professors: Crum, Poist, Wacker

Professors (Emeritus): Thompson, Voorhees

Associate Professors: Hendrickson, Lummus, Mennecke, Nilakanta, Norris, Premkumar, Walter

Assistant Professors: Hackbarth, Johnson, Montabon, Ruben, Strader, Suzuki, Zhu

Instructors (Adjunct): Blanshan, Choobineh, Clayton

Undergraduate Study

For the undergraduate curriculum in business, major in transportation and logistics, see *College of Business, Curricula.*

Transportation and logistics management is a discipline concerned with the efficient flow of materials through our industrial and economic system. Transportation management deals with the management of the domestic and international modes of transportation in today's rapidly changing economic environment. Logistics management assumes the systems approach to the management of a wide variety of activities such as inventory control, warehousing, traffic management, location analysis, packaging, materials handling, and customer service.

The study of transportation and logistics serves as a specialized program for those who plan careers in transportation or logistics with shippers, carriers, and government agencies. It is a broad-based educational program which emphasizes the managerial aspects of transportation and logistics systems and concepts.

The requirements for the transportation and logistics major are met by completion of the following courses: TrLog 460, 461, plus four of the following courses, two of which must be TrLog courses: TrLog 462, 463, 466, 468, 469, 490, POM 420, 422, 424, or MIS 439.

The department also offers a minor for College of Business students with a different major. They are required to take 15 credits from a list of approved courses, 9 credits of which may not be used to satisfy any other requirement.

Graduate Study

The department participates in two graduate degree programs: the M.S. in Business and the M.B.A. full-time day and part-time weekend programs. The M.S. degree in Business is a 30-credit curriculum culminating in a thesis. The M.B.A. program is a 48-credit, nonthesis, noncreative component curriculum. Twenty-four of the 48 credit hours are core courses and the remaining 24 are graduate electives. The department also participates in the interdepartmental transportation major.

Courses open for nonmajor graduate credit: 461, 462, 463, 466, 468, and 469.

Courses Primarily for Undergraduate Students

TrLog 360. Business Logistics. (3-0) Cr. 3. *Prereq: Econ 101.* Introduction and analysis of the logistics concept to include the management of transportation, inventory, packaging, warehousing, materials handling, order processing, facility location, and customer service.

TrLog 460. Advanced Logistics Management. (3-0) Cr. 3. *Prereq: 360 and Stat 227.* Development of logistics topics introduced in 360. Emphasis on managing inbound and outbound flows of products and associated information requirements in the logistics system.

TrLog 461. Transport Economics. (3-0) Cr. 3. *Prereq: Stat 227, Econ 101.* The role of transportation in the economy. The economic characteristics of the various modes of transportation, including the nature of transport demand and cost functions; economic dimensions of transport service; transport market structures; and transport pricing theory and practice. Emphasis on managerial implications of transport economic principles. Nonmajor graduate credit.

TrLog 462. Transportation Carrier Management. (3-0) Cr. 3. *Prereq: Credit or enrollment in 461.* Analysis of transport users' requirements. Carrier management problems involving ownership and mergers, routes, competition, labor, and other decision areas. Nonmajor graduate credit.

TrLog 463. Purchasing Management. (3-0) Cr. 3. *Prereq: 360.* Principles and policies in acquiring goods and services for the firm. Emphasis on purchasing as it relates to materials management. Nonmajor graduate credit.

TrLog 466. International Transportation and Logistics. (3-0) Cr. 3. *Prereq: 360.* Logistics systems and legal framework for the international movement of goods. Operational characteristics of providers of exporting and importing services. The effects of government trade policies on global logistics. Nonmajor graduate credit.

TrLog 468. Transportation and Public Policy. (3-0) Cr. 3. *Prereq: Credit or enrollment in 461.* Analysis of current policies affecting transportation providers and users. The roles of carrier and shipper organizations, government agencies, and other interest groups in policy development. Evaluation of impact of programs, policies, and legislation on various transportation constituencies. Nonmajor graduate credit.

TrLog 469. Transportation and Logistics Issues. (3-0) Cr. 3. *Prereq: 460, 461.* An integrative course designed to study contemporary problems and issues in transportation and logistics. Nonmajor graduate credit.

TrLog 490. Independent Study. Cr. 1-3 each time taken. *Prereq: 360, senior classification, permission of instructor.*

Courses Primarily for Graduate Students

TrLog 560. Business Logistics Strategies. (3-0) Cr. 3. *Prereq: Graduate classification.* Management of the logistics functions in the firm , including transportation, inventory control, warehousing, packaging, facility location, materials handling, and customer service. Includes both theoretical aspects and practical applications in logistics.

TrLog 561. Transportation Management and Policy. (3-0) Cr. 3. *Prereq: Graduate classification.* Analysis of contemporary issues and strategies in transportation management and policy. Emphasis on evaluation of the impacts of transportation policies, new technologies, and strategic carrier and shipper management practices on the freight transportation industry and logistics systems.

TrLog 590. Special Topics. Cr. 1 to 5 each time taken. *Prereq: Graduate classification and permission of instructor.* For students who wish to do individual research in a particular area of transportation or logistics.

University Studies

Howard Shapiro, Vice Provost for Undergraduate Programs

Certain interdisciplinary courses are offered through university studies, at the discretion of the vice provost for undergraduate programs upon the advice of the Faculty Senate Curriculum Committee. No major is available in university studies, but credit obtained through university studies offerings may be applied toward a degree in any of the colleges, consistent with the stipulations of the student's curriculum.

Requests to make use of U St 101, 290, 301, and 490 should be directed to the vice provost for undergraduate programs and should be accompanied by a positive recommendation from the department heads and deans of the instructors making the request. The vice provost will refer requests to the Faculty Senate Curriculum Committee which will make recommendations to the vice provost regarding their disposition after consultation with appropriate college and university committees.

The Graduate College sponsors U St 180 and 511 to help graduate students carry out instructional tasks as teaching assistants. Placement in 180 is determined by examination (SPEAK/TEACH tests).

Courses open for nonmajor graduate credit: 342.

Courses Primarily for Undergraduate Students

U St 101. Interdisciplinary Studies. Cr. var. Yr. Offered when demand warrants. Experimental interdisciplinary courses offered by an interdepartmental group. Intended primarily for freshman and sophomore offerings.

U St 105. Carver Academy Seminar. Cr. 1. F.S. *Prereq: Acceptance in Carver Academy Program.* Orientation to the university for Carver Academy students. Offered on a satisfactory-fail grading basis only.

U St 111. Hixson Scholars Seminar. (1-0) Cr. 1. F. *Prereq: Recipient of the Hixson Opportunity Award.* Orientation to Iowa State University and the Hixson Opportunity Awards Program. Offered on a satisfactory-fail grading basis only.

U St 120. Study Abroad Credit. (Same as IntSt 120.) See *International Studies.*

U St 131, 132. Early Success Seminar. (0-2) Cr. 1. F.S. Orientation to the university for students in the Early Success Program. Offered on a satisfactory-fail grading basis only.

U St 150. Dialogues on Diversity. Cr. 1. F.S. An exploration of diversity within the context of the Iowa State University community through understanding human relations issues.

U St 180. Communication Skills for International Teaching Assistants. (Same as Engl 180.) F.S. Placement based upon SPEAK/TEACH test results. Persons whose native language is English cannot take 180 for credit. No more than one section of 180 may be taken per semester; up to two sections total. Credit does not apply toward graduation. Offered on a satisfactory-fail grading basis only.

A. Speaking Skills. Cr. 3. Emphasis on pronunciation improvement and greater fluency in spoken English for teaching purposes.

B. Intermediate Spoken English. Cr. 3. Interactive speaking and response to questions is emphasized.

C. Advanced Spoken English. Cr. 3. For students who have completed 180A or 180B but have not

reached the passing level on the SPEAK/TEACH test.

D. Presentation Skills. Cr. 3. Developing explanations, leading discussions and handling questions in a teaching environment.

E. Supervised Independent Study. Cr. 1. Seminar with individual observation and consultation.

U St 220. Study Abroad Credit. (Same as IntSt 220.) See *International Studies.*

U St 235. Introduction to International Studies. (Same as IntSt 235.) See *International Studies.*

U St 240. Predeparture Orientation for China Study Abroad. Cr. 1. An examination of the culture, language, history, economics, and agriculture of China in preparation for participating in the ISU Study Abroad Program. Offered on a satisfactory-fail grading basis only.

U St 290. Special Problems. Cr. var. *Prereq: Permission of the vice provost for undergraduate programs.* Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores.

U St 298. Federal Cooperative Education Program. Cr. R. F.S.SS. *Prereq: Permission of director, ISU Career Planning and Placement Services; sophomore classification.* Required of all Federal Cooperative Education students. Students must register for this course prior to commencing each work period with the Federal Government.

U St 301. Interdisciplinary Studies. Cr. var. Yr. Offered when demand warrants. Experimental interdisciplinary courses offered by an interdepartmental group. Intended primarily for junior and senior offerings.

U St 311. Hixson Leadership Seminar. Sanborn. Cr. 2. *Prereq: 111; selection as leader of Hixson Seminar.* For students serving as leaders of Hixcon Seminars, under faculty supervision. Development of teaching and leadership skills. Offered on a satisfactory-fail grading basis only.

U St 320. Study Abroad Credit. (Same as IntSt 320.) See *International Studies.*

U St 336. International Perspectives in Career Development. Cr. 3. The course will give a student the opportunity to study career related issues of career planning, careers and work issues in career exploration, the job search, and cultural differences from international points of view. The course will prepare the student to seek career related employment outside the United States for up to six months. Offered on a satisfactory-fail grading basis only.

U St 342. World Food Issues: Past and Present. (Same as Agron 342.) See *Agronomy.* Nonmajor graduate credit.

U St 385. The Holocaust. (2-0) Cr. 2 or (3-0) Cr.3. F. An examination of the religious, social, scientific, and historical contexts for the Nazi destruction of European Jewry. Topics covered include anti-Semitism, German volkish philosophy, eugenics, World War II, the Final Solution, rescuers, and contemporary issues. Optional third credit requires a term paper.

U St 398. Federal Cooperative Education Program. Cr. R. F.S.SS. *Prereq: Permission of director, ISU Career Planning and Placement Services; junior classification.* Required of all Federal Cooperative Education students. Students must register for this course prior to commencing each work period with the Federal Government.

U St 420. Study Abroad Credit. (Same as IntSt 420.) See *International Studies.*

U St 430. Seminar in International Studies. (Same as IntSt 430.) See *International Studies.*

U St 471. Tones of Florence. (Same as Music 471.) See *Music.*

U St 490. Independent Study. Cr. var. *Prereq: Permission of the vice provost for undergraduate programs.* Independent study on topics of an interdisciplinary nature. Intended primarily for juniors and seniors.

I. International Studies

U St 498. Federal Cooperative Education Program. Cr. R. F.S.SS. *Prereq: Permission of director, ISU Career Planning and Placement Services; senior classification.* Required of all Federal Cooperative Education students. Students must register for this course prior to commencing each work period with the Federal Government.

Courses Primarily for Graduate Students, Open To Qualified Undergraduate Students

U St 541. Technological Innovation, Social Change, and Development. (Same as Soc 541.) See *Sociology.*

U St 590. Special Topics. Independent study on topics of an interdisciplinary nature. Intended primarily for graduate students.

F. Technology and Social Change. (Same as T SC 590F.)

Courses for Graduate Students

U St 640. Seminar in Technology and Social Change. (Same as T SC 640.) See *Technology and Social Change.*

Veterinary Clinical Sciences

Christopher M. Brown, Chair of Department

Professors: *Betts, Brown, Evans, Grier, Hoefle, Hopkins, Jackson, Merkley, Noxon, D. Riedesel, Ware*

Professors (Collaborators): *Carpenter*

Professors (Emeritus): *Carithers, Clark, Eness, Pearson*

Associate Professors: *Baldwin, Booth, Jergens, Miles, Nieves, Obrien, Reinertson, E. Riedesel, Wagner*

Assistant Professors: *Conzemius, Hopper, Kline, McClure, Whelan*

Instructors (Adjunct): *Aquino, Grewal, Hunter, Langer, Lauer, Little, Loenser, Morrison, Pendry, Ridgway, Schreiner, Sponseller, Wilke*

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see *Veterinary Medicine, Curriculum.*

The study of medicine and surgery expands the training previously received in anatomy, physiology, pharmacology, pathology, and microbiology.

The department presents coursework in animal reproduction concerning interferences with parturition, diseases of the newborn, and infertility.

The teaching of radiology emphasizes the production and interpretation of radiographs and the dangers of ionizing radiation to humans and animals. Alternate imaging modalities, including ultrasonography and nuclear medicine are also taught.

Hospital assignments during the fourth year provide the student an opportunity to participate in the application of clinical skills and knowledge.

Graduate Study

The department offers work for the degree master of science with major in veterinary clinical science, and minor work for students majoring in other departments. Within the veterinary clinical sciences major, the student may specialize in veterinary medicine, swine production medicine, surgery, or theriogenology. The D.V.M. degree or equivalent is prerequisite to a major graduate work.

Both thesis and nonthesis options are available and require the completion of a minimum of 30 graduate credits and a final examination.

Foreign language requirements may be established by the student's program of study committee.

Courses Primarily for Professional Curriculum Students

V C S 385. Seminar. (Same as VDPAM 385.) (1-0) Cr. R each time taken. F.S. *Prereq: Classification in veterinary medicine.* Seminars and case discussions on selected clinical subjects by staff and fourth-year students of the College of Veterinary Medicine. Offered on a satisfactory-fail grading basis only.

V C S 391. Radiology. (2-0) Cr. 1. S. 8 weeks. *Prereq: First-year classification in veterinary medicine.* Essentials of radiology and radiobiology with special emphasis on radiation safety. Introduction to diagnostic imaging methods, image interpretation, and radiation therapy.

V C S 397. Principles of Surgery (6-0) Cr. 6. S. *Prereq: Second-year classification in veterinary medicine.* General principles of surgery of domestic animals.

V C S 398. Anesthesiology. (1-0) Cr. 1. S. *Prereq: Second-year classification in veterinary medicine.* Anesthetic equipment, agents, and procedures for domestic animals.

V C S 399. Ophthalmology. (1-0) Cr. 1. S. *Prereq: Third year classification in veterinary medicine.* Principles and techniques of medical and surgical ophthalmology.

V C S 401. Advanced Small Animal Orthopedics. (1-0) Cr. 1. S. *Prereq: Third or Fourth-year classification in veterinary medicine.* Elective course in advanced small animal orthopedics.

V C S 402. Electrocardiology. (1-0) Cr. 1. Alt. S., offered 2002. *Prereq: V C S 444.* Elective course in electrocardiology.

V C S 405. Pet Bird and Exotic Species Medicine. (1-3) Cr. 2. S. *Prereq: Classification in veterinary medicine.* Elective course in management and diseases of pet birds and exotic species.

V C S 407. Feline Internal Medicine. (1-0) Cr. 1. F. *Prereq: Third-year classification in veterinary medicine.* Elective course in feline internal medicine.

V C S 414. Companion Animal Nutrition. (1-0) Cr. 1. S. *Prereq: Third or Fourth -year classification in veterinary medicine.* Elective course in small animal and equine nutrition.

V C S 415. Advanced Small Animal Dermatology. (1-0) Cr. 1. Alt. S., offered 2002. *Prereq: Third or Fourth-year classification in veterinary medicine.* Elective course in dermatology.

V C S 419. Preceptorship in Veterinary Medical Practice. Cr. 1 to 6 each time taken. F.S.SS. *Prereq: Fourth-year classification in veterinary medicine, permission of department chair.* Elective course in veterinary practice under the guidance of veterinarians in approved practice settings.

V C S 420. Animal Welfare. (2-0) Cr. 1. Alt. F., offered 2001, first 8 weeks. Guest speakers discuss topics pertaining to animal welfare.

V C S 421. Husbandry and Diseases of Non-traditional Species. (2-0) Cr. 1. Alt. F., offered 2002. *Prereq: Second-, third-, or fourth-year classification in veterinary medicine.* Husbandry, management, and common diseases of rabbits, guinea pigs, hamsters, gerbils, rats, and mice.

V C S 440. Introduction to Clinics. (Same as VDPAM 440.) (0-4) Cr. R. F. 8 weeks. *Prereq: Third-year classification in veterinary medicine.*

V C S 443. Equine Lameness. (1-0) Cr. 1. F.S. *Prereq: Third-year classification in veterinary medicine.* Orthopedic diseases of the equine.

V C S 444. Clinical Medicine I. (5-0) Cr. 5. F. *Prereq: Third-year classification in veterinary medicine.* Clinical diagnostic methods and consideration of diseases of domestic animals.

V C S 445. Clinical Medicine II. (Same as VDPAM 445.) (5-0) Cr. 5. S. *Prereq: Third-year classification in veterinary medicine.* Clinical diagnosis and treatment of diseases of equine, swine, beef, dairy, and sheep.

V C S 446. Clinical Neurology. (0-40) Cr. 2. *Prereq: Fourth year classification in veterinary medicine.* Forty hour per week. Clinical rotation in neurology with an emphasis on neurolocalization, disease processes, use of diagnostics in medical and surgical neurology and treatment options. Exposure to neurosurgical techniques.

V C S 448. Radiology. (2-0) Cr. 2. S. *Prereq: Third-year classification in veterinary medicine.* Essentials of diagnostic imaging and radiobiology with emphasis on diagnostic interpretation and protection from radiation.

V C S 449. Surgery Laboratory. (1-4) Cr. 3. F. *Prereq: Third-year classification in veterinary medicine.* Pre-laboratory presentations and laboratories introducing the student to appropriate companion animal surgical methods and techniques.

V C S 450. Disturbances of Reproduction. (Same as VDPAM 450.) (4-0) Cr. 4. F. *Prereq: Third-year classification in veterinary medicine.* General principles of diseases causing disturbances in reproduction.

V C S 451. Advanced Small Animal Soft Tissue Surgical Laboratory. (1-6) Cr. 2. *Prereq: VCS 397, 398, 399, 449.* Advanced small animal soft tissue surgical procedures involving the abdominal cavity. Less emphasis will be placed on the thoracic cavity and head and neck injury.

V C S 452. Clinical Dermatology. Cr. 2. *Prereq: Fourth-year classification in veterinary medicine, small animal option.* Study of clinical dermatological problems via computer-aided instruction, case simulations, and/or lectures. Clinical management of cases presented to Veterinary Teaching Hospital.

V C S 453. Small Animal Medicine I. Cr. 2 each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Clinical assignment in small animal medicine.

V C S 454. Small Animal Medicine II. Cr. 2 each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Clinical assignment in small animal medicine.

V C S 455. Small Animal Soft Tissue Surgery. Cr. 2 each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Clinical assignment in soft tissue surgery.

V C S 456. Small Animal Orthopedic Surgery. Cr. 2 each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Clinical assignment in orthopedic surgery.

V C S 457. Equine Medicine. Cr. 3 each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Clinical assignment in equine medicine.

V C S 458. Equine Surgery. Cr. 3 each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Clinical assignment in equine surgery.

V C S 460. Radiology. Cr. 3. *Prereq: Fourth-year classification in veterinary medicine.* Clinical assignment in veterinary radiology.

V C S 463. Community Practice. (0-40) Cr. 2 each time taken. *Prereq: Fourth year classification in veterinary medicine.* Forty hours per week. Clinical experience in hospital based general practice.

V C S 466. Anesthesiology. Cr. 3. *Prereq: Fourth-year classification in veterinary medicine.* Clinical assignment in small animal and large animal anesthesiology.

V C S 468. Intensive Care. Cr. 4. *Prereq: Fourth-year classification in veterinary medicine.* Clinical assignment to provide supervision of hospital cases requiring intensive care and including emergency cases.

V C S 469. Special Senses. Cr. 2 each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Clinical assignment in ophthalmology.

V C S 470. Radiology. Cr. var each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Elective clinical assignment in veterinary radiology.

V C S 471. Animal Reproduction. Cr. var each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Elective clinical assignment in animal reproduction. Equine and small animal reproduction only.

V C S 472. Small Animal Medicine. Cr. var each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Elective clinical assignment in small animal medicine.

V C S 473. Small Animal Surgery. Cr. var each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Elective clinical assignment in small animal surgery.

V C S 474. Equine Medicine and Surgery. Cr. var each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Elective clinical assignment in equine medicine and surgery.

V C S 476. Anesthesiology. Cr. var each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Elective clinical assignment in small animal and large animal anesthesiology.

V C S 478. Intensive Care. Cr. var each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Elective clinical assignment in intensive care.

V C S 479. Special Senses. Cr. var each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Elective clinical assignment in ophthalmology.

V C S 480. Veterinary Dentistry. Cr. 1. Alt. F., offered 2002. *Prereq: Third or Fourth-year classification in veterinary medicine.* All aspects of veterinary dentistry, prophylaxis, endodontics, and orthodontics.

V C S 484. Advanced Pet Bird Medicine. (1-0) Cr. 1. Alt. F., offered 2001. Elective course emphasizing diagnostic and therapeutic techniques and infectious and non-infectious disease in pet birds.

V C S 490. Independent Study. Cr. 1 to 5. *Prereq: Permission of instructor and department chair.*

V C S 495. Seminar. (Same as VDPAM 495.) Cr. R. S. *Prereq: Fourth-year classification in veterinary medicine.* Seminars and case discussions on selected subjects by staff of the College of Veterinary Medicine and others, including student presentations. Offered on a satisfactory-fail grading basis only.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

V C S 590. Special Topics. Cr. 1 to 3. *Prereq: Permission of instructor.*
- A. Medicine
- B. Surgery
- C. Theriogenology
- D. Radiology
- E. Anesthesiology

V C S 599. Creative Component. Cr. var. *Prereq: Enrollment in nonthesis master's degree program.*

Courses for Graduate Students

V C S 604. Seminar. Cr. 1 each time taken. F.S.

V C S 640. Advanced Radiology. (2-0) Cr. 2. Alt. F., offered 2001. P*rereq: 448.* Detailed principles of clinical radiology with particular reference to radiographic interpretation.

V C S 644. Advanced Animal Reproduction. (1-3) Cr. 2. Alt. S., offered 2002. *Prereq: 447, 450.* A detailed study of reproductive diseases of the male animal.

V C S 645. Advanced Animal Reproduction. (1-3) Cr. 2. Alt. S., offered 2003. *Prereq: 447, 450.* A detailed study of reproductive diseases of the female animal.

V C S 671. Advanced General Surgery. (1-3) Cr. 2. Alt. S., offered 2002. *Prereq: 441.* An advanced course designed to investigate and discuss the responses of the body to surgical and anesthetic procedures.

V C S 672. Advanced Special Surgery. (1-3) Cr. 2. Alt. S., offered 2003. *Prereq: 449.* Advanced procedures in both clinical and research techniques in abdominal, thoracic, orthopedic, cardiovascular, and neurological surgery.

V C S 676. Advanced Medicine. (2-0) Cr. 2. Alt. F., offered 2001. *Prereq: 445.* Principles of general medicine. A study in depth of factors that contribute to the development of clinical signs as related to the pathogenesis of disease.

V C S 677. Advanced Medicine. (2-0) Cr. 2. Alt. F., offered 2002. *Prereq: 445.* An advanced study of metabolic diseases.

V C S 699. Research.
- A. Medicine
- B. Surgery
- C. Theriogenology
- E. Anesthesiology

Veterinary Diagnostic and Production Animal Medicine

Robert E. Holland, Chair of Department

University Professors: McKean

Professors: Carson, Evans, Harris, Hartwig, Hoffman, Holland, Hopkins, Hopper, Hyde, Kunesh, Oswelier, Trampel

Professors (Emeritus): Kunesh, Stahr, Wass

Associate Professors: Halbur, Janke, Kersting, Larson, Thacker, Thompson, Uhlenhopp, Yaeger, Zimmerman

Assistant Professors: Apley, Carr, O'Connor, Sorden, Yoon, Zhou

Assistant Professors (Adjunct): Harmon, Imerman, Kinyon, Kozak, Schwartz

Instructors (Adjunct): Ensley, Harms, Meyer, Pogranichnyy, Robbe, Swalla, Villar, Wagner

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see *Veterinary Medicine, Curriculum.*

The study of veterinary diagnostic and production animal medicine provides the student with basic and advanced skills in diagnostics, reproduction, medicine, surgery, production, and health management of the major livestock species. Students in the fourth year of the curriculum in veterinary medicine may elect to take advanced courses in beef, dairy, swine, poultry or sheep production medicine. Elective courses may include preceptorships in private practices, other veterinary schools, research and disease control laboratories.

Production animal medicine emphasizes the integration of veterinary medicine with nutrition, genetics, economics, food safety, and other disciplines, enabling graduates to use a broad knowledge base to support the health and production of food and fiber animals.

Graduate Study

The department offers graduate courses for students pursuing graduate work in other departments. The D.V.M. degree or equivalent is prerequisite to enrollment in these courses.

Courses Primarily for Professional Curriculum Students

VDPAM 385. Seminar. (Same as V C S 385.) (1-0) Cr. R each time taken. F.S. *Prereq: Classification in veterinary medicine.* Seminars and case discussions on selected clinical subjects by staff and fourth-year students of the College of Veterinary Medicine. Offered on a satisfactory-fail grading basis only.

VDPAM 408. Poultry Medicine and Disease Prevention. (Dual-listed with VDPAM 508.) Cr. 2. S. *Prereq: Enrollment in College of Veterinary Medicine.* Bacterial, viral, parasitic, and nutritional diseases of domestic poultry and gamebirds; biosecurity, immunization, and management procedures to prevent poultry diseases.

VDPAM 411. Production Animal Medicine. Cr. 4 each time taken. F.S.SS. *Prereq: Fourth-year classification in veterinary medicine.* Seasonal enrollment limit. Clinical assignment in food animal production medicine and service. Emphasis on diagnosis, medicine, surgery, theriogenology, and treatment skills.

VDPAM 416. Bovine Reproduction Evaluation Laboratory. (0-3) Cr. 1. F.S. *Prereq: Third year classification in veterinary medicine. 10 students per section.* Bovine rectal palpation techniques will be repetitively taught in three-hour sessions. Students will learn techniques of epidural anesthesia, artificial insemination, and ultrasonic imaging. University-owned cattle will be used.

VDPAM 420. Preceptorship in Veterinary Medical Practice. Cr. 1 to 6 each time taken. F.S.SS. *Prereq: Fourth-year classification in veterinary medicine, permission of department chair.* Elective course in veterinary practice under the guidance of veterinarians in approved practice settings.

VDPAM 426. Veterinary Toxicology. (Dual-listed with 526.) Cr. 3. S. *Prereq: Third-year classification in veterinary medicine.* A study of the disease processes in animals caused by toxicants and the use of differential diagnostic and therapeutic procedures.

VDPAM 436. Beef Records Analysis. Cr. 1 per semester. S. *Prereq: Classification in Veterinary Medicine.* Students will learn to conduct and critically assess production and financial data using Standardized Performance Analysis (SPA) in beef herds. Students will be matched with individual herds and work with producers to identify areas for improving profitability, health, and sustainability. Enrolling in the class for multiple semesters will be encouraged.

VDPAM 437. Investigational Techniques in Dairy Production Medicine: Dairy Herd Problem Identification. (7-33) Cr. 2. F.S.SS. *Prereq: Fourth-year classification in veterinary medicine.* Seven hours recitation/discussion and 33 hours clinical experience per week. Course taken for two weeks at University of Wisconsin, Madison on a space-available basis. Identify equipment, facilities and management characteristics of dairy farms. Understand dairy herd records and use to examine health and productivity. Prioritize herd health and production problems and evaluate adequacy of ventilation and housing systems.

VDPAM 438. Milk Quality in Dairy Production Medicine: Mastitis/Milk Quality. (9-31) Cr. 2. F.S.SS. *Prereq: Fourth-year classification in veterinary medicine.* Nine hours recitation/discussion and 31 hours clinical experience per week. Course taken for two weeks at University of Wisconsin, Madison on a space-available basis. Analysis of somatic cell counts. Bulk tank milk cultures, individual cow microbiology. Milking system analysis and milking management. Evaluate milking practices, assess dairy environment and partial budget techniques.

VDPAM 439. Nutrition in Dairy Production Medicine: Applied Dairy Nutrition. (3-37) Cr. 2. F.S.SS. *Prereq: Fourth-year classification in veterinary medicine.* Three hours lecture, 37 hours clinical experience per week. Course taken for two weeks at University of Wisconsin, Madison on a space-available basis. Production and metabolic disease problems. Evaluate feeding management. Forage and feedstuff analysis, dry matter determinations. Ration analysis using trilogic computer programs.

VDPAM 440. Introduction to Clinics. (Same as V C S 440.) (0-4) Cr. R. F. 8 weeks. *Prereq: Third-year classification in veterinary medicine.*

VDPAM 445. Clinical Medicine. (Same as V C S 445.) (5-0) Cr. 5. S. *Prereq: Third year classification in veterinary medicine.* Clinical diagnosis and treatment of diseases of equine, swine, beef, dairy, and sheep.

VDPAM 450. Disturbances of Reproduction. (Same as V C S 450.) (4-0) Cr. 4. F. *Prereq: Third-year classification in veterinary medicine.* General principles of diseases causing disturbance in reproduction.

VDPAM 455. Diagnostic Laboratory Practicum. Cr. 2 each time taken. F.S. *Prereq: Fourth-year classification in veterinary medicine.* Practical experience in diagnosis of field cases.

VDPAM 477. Food Animal Medicine and Surgery. Cr. var. each time taken. Seasonal enrollment. *Prereq: Fourth-year classification in veterinary medicine.* Elective clinical assignment in food animal medicine and surgery.

VDPAM 478. Introduction to Swine Production Medicine. (15-20) Cr. 2. F.S.SS. *Prereq: Fourth-year classification in veterinary medicine.* Two week introductory topics in swine production medicine with emphasis on monitoring disease, disease prevention, and production economics. Fifteen hours recitation/discussion and 20 hours clinical experience per week.

VDPAM 479. Swine Production Medicine Preceptorship. (0-40) Cr. 1-6 each time taken. F.S.SS. *Prereq: 478.* Two week advanced course in swine production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit.

VDPAM 480. Advanced Swine Production Medicine. (15-20) Cr. 2. F.S.SS. *Prereq: 478.* Two week advanced clinical rotation in swine production medicine. Fifteen hours recitation/discussion and 20 hours clinical experience per week. The instructor will lead field trips as well as problem solving exercises where the student will apply concepts of herd management, production analysis, and disease prevention.

VDPAM 481. Introduction to Beef Production Medicine. (15-20) Cr. 2. SS. *Prereq: Fourth-year classification in veterinary medicine.* Two week introductory topics in beef production medicine with emphasis on monitoring disease, disease prevention, and production economics. Fifteen hours recitation/discussion and 20 hours clinical experience per week.

VDPAM 482. Beef Production Medicine Preceptorship. (0-40) Cr. 1-6 each time taken. F.S.SS. *Prereq: 481.* Two week advanced course in beef production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit.

VDPAM 483. Advanced Beef Production Medicine. (15-20) Cr. 2. F.S. *Prereq: 481.* Two week advanced clinical rotation in beef production medicine. Fifteen hours recitation/discussion and 20 hours clinical experience per week. The instructor will lead field trips as well as problem solving exercises where the student will apply concepts of herd management, production analysis, and disease prevention.

VDPAM 484. Introduction to Dairy Production Medicine. (15-20) Cr. 2. SS. *Prereq: Fourth-year classification in veterinary medicine.* Two week introductory topics in dairy production medicine with emphasis on monitoring disease, disease prevention, and production economics. Fifteen hours recitation/discussion and 20 hours clinical experience per week.

VDPAM 485. Dairy Production Medicine Preceptorship. (0-40) Cr. 1-6 each time taken. F.S.SS. *Prereq: VDPAM 484.* Two week advanced course in dairy production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit.

VDPAM 486. Introduction to Small Ruminant Production Medicine. (15-20) Cr. 2. SS. *Prereq: Fourth-year classification in veterinary medicine.* Two week introductory topics in small ruminant production medicine with emphasis on monitoring disease, disease prevention, and production economics. Fifteen hours recitation/discussion and 20 hours clinical experience per week.

VDPAM 487. Livestock Disease Prevention. (3-0) Cr. 3. F. A survey of diseases of large domestic animals, including discussion of causes, transmission, and control. Designed for students majoring in agricultural sciences.

VDPAM 488. Laboratory in Clinical Microbiology. Cr. 1 each time taken. F.S.SS. *Prereq: Fourth-year classification in veterinary medicine.* Application of microbiological and immunological procedures to the diagnosis of infectious and immunologically mediated diseases.

VDPAM 490. Independent Study. Cr. 1 to 5. F.S.SS. *Prereq: Permission of department chair.*

VDPAM 495. Seminar. (Same as V C S 495.) Cr. R. S. *Prereq: Fourth-year classification in veterinary medicine.* Seminars and case discussions on selected subjects by staff of the College of Veterinary Medicine and others, including student presentations. Offered on a satisfactory-fail grading basis only.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

VDPAM 501. Principles of Toxicology. (Same as Tox 501, Zool 501.) (3-0) Cr. 3. S. *Prereq: BBMB 404 or equivalent.* Principles of toxicology governing entry, fate, and effects of toxicants on living systems. Includes toxicokinetics and foreign compound metabolism relative to toxification or detoxification. Fundamentals of foreign compound effects on metabolism, physiology, and morphology of different cell types, tissues, and organ systems.

VDPAM 502. Toxicology Methods. (Same as Tox 502, Zool 502.) (0-6) Cr. 3. Alt. F., offered 2001. *Prereq: 501.* Provides demonstrations or laboratory experience in the applications of methods used in toxicology, including safety procedures, calculation and data analysis, mutagenicity tests, cell culture, residue analysis, teratologic and morphologic evaluation, electrophysiologic measures, in vitro enzyme induction/biotransformation, neural and behavioral toxicology testing.

VDPAM 504. Toxicology Seminar. (Same as Tox 504.) (1-0) Cr. 1 each time taken. F.S. *Prereq: Permission of instructor.* Presentation of a seminar about a current topic in toxicology as part of a weekly series of seminars by graduate students, faculty, and guest lecturers from off campus.

VDPAM 508. Poultry Medicine and Disease Prevention. (Dual-listed with VDPAM 408.) Cr. 2. S. *Prereq: Graduate student status in Vet Med, Animal Science, Animal Ecology, or Biology.* Bacterial, viral, parasitic, and nutritional diseases of domestic poultry and gamebirds; biosecurity, immunization, and management procedures to prevent poultry diseases.

VDPAM 522. Principles of Epidemiology. (Same as V MPM 522.) (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: Micro 310.* Epidemiology and ecology of disease in populations. Disease causality and epidemiologic investigation. Issues in disease prevention, control, and eradication.

VDPAM 526. Veterinary Toxicology. (Dual-listed with 426; Same as Tox 526.) (3-0) Cr. 3. S. *Prereq: Permission of instructor.* A study of the disease processes in animals caused by toxicants and the use of differential diagnostic and therapeutic procedures.

VDPAM 546. Clinical and Diagnostic Toxicology. (Same as Tox 546.) (0-3 or 0-9) Cr. 1 to 3 each time taken. F.S.SS. *Prereq: D.V.M. degree or 526.* Advanced study of current problems and issues in toxicology. Emphasis on problem solving utilizing clinical, epidemiological, and laboratory resources.

VDPAM 555. Neurobehavioral Toxicology. (Same as Tox 555.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 501.* Advanced study of neurotoxicology and behavior. Emphasis on methods in neurobehavioral toxicology and the effects of a broad spectrum of neurotoxic agents.

VDPAM 590. Special Topics. Cr. 1 to 3. *Prereq: Permission of instructor. T*opics in medicine, surgery, theriogenology; beef, swine, dairy, or sheep production medicine.

Courses for Graduate Students

VDPAM 643. Natural Toxins. (Same as Tox 643.) (1-6) Cr. 3. Alt. F., offered 2002. *Prereq: Courses in biochemistry and physiology.* Naturally occurring toxins in foods and fees; poisonous plants and venoms.

VDPAM 645. Agricultural and Environmental Analytical Toxicology. (Same as Tox 645.) (1-3) Cr. 2. F. *Prereq: Chem 211, 322.* Analysis and interpretation of toxicant residues in animal tissues, feeds, water, soil, and other environmental specimens.

VDPAM 650. Swine Diagnostic Medicine. Cr. 1-4. SS. *Prereq: DVM degree. Permission of instructor.* A detailed study of swine diseases emphasizing the pathogenesis and diagnosis of swine respiratory, enteric, reproduction, metabolic, and septicemic diseases.

VDPAM 651. Disease Dynamics in Swine Production Medicine. Cr. 2. F. *Prereq: DVM degree, permission of instructor.* A detailed study of disease dynamics, prevention and control in food producing animal populations, emphasis on swine epidemiological issues pertinent to production medicine.

VDPAM 652. Analytical Methods in Swine Production Medicine. Cr. 2. S. *Prereq: DVM degree, permission of instructor.* An overview of experimental and observational study designs, analytical techniques and data interpretation, emphasis on methodologies pertinent to swine production medicine.

VDPAM 653. Clinical Trials in Production Medicine. Cr. 1. SS. *Prereq: DVM degree, permission of instructor.* Application of clinical trials in production medicine. Study design and execution and data analysis, interpretation, and reporting.

VDPAM 654. Comparative Antimicrobial Clinical Pharmacology. Cr. 2. Alt. S., offered in 2002. *Prereq: Graduate student, resident, or intern in College of Veterinary* Medicine. Initial antimicrobial selection for infectious diseases of domestic animals. The antimicrobial drug groups will be examined, stressing pharmacokinetics, minimal inhibitory concentrations, and the use of these parameters to select appropriate compounds and dosages for maximum efficacy.

VDPAM 655. Advanced Swine Production Medicine. Cr. 1-4. S. *Prereq: DVM degree and permission of instructor.* Detailed overview of applied techniques used in swine production medicine; production modeling and record analysis, production economics and financial analysis, therapeutic and vaccination strategies, quality control procedures and food safety.

Veterinary Medicine

Norman F. Cheville, Interim Dean

Eldon K. Uhlenhopp, Associate Dean

Donald L. Reynolds, Associate Dean

Courses Primarily for Professional Curriculum Students

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see *Veterinary Medicine, Curriculum*.

V Med 301. Professional Orientation. (1-0) Cr. R. F. 8 weeks. *Prereq: First-year classification in veterinary medicine.* An orientation to the College of Veterinary Medicine at ISU and the veterinary medicine profession.

V Med 302. Clinical Communications and Listening Skills. (2-0) Cr. 1. S. 8 weeks. *Prereq: Classification in veterinary medicine.* Topics to be covered include attending and observation, interviewing, listening and paraphrasing, empathy, resistance and confrontation, enhancement of compliance, and integration.

V Med 303. Ethical Issues in Veterinary Medicine. (1-3) Cr. 2. F. *Prereq: Second year classification in Veterinary Medicine.* Selected topics on moral, ethical, and legal issues affecting the practice of veterinary medicine.

V Med 401. Introductory Aquatic Animal Health and Medicine. (Same as A Ecl 401.) (1-2) Cr. 1. F. 8 weeks. Introductory course with focus on fin fish production, health, and medicine. Course content will help define future roles for veterinarians, procedures, and service providers. Emphasis will be placed on anatomy, pathology, infectious diseases, nutrition, regulatory constraints in production, food safety, and current research. Field trip to aquaculture facility.

V Med 402. Seminar in International Veterinary Medicine. (2-0) Cr. 1. S. 8 weeks. *Prereq: Third-year classification in veterinary medicine.* Selected topics on international perspectives of veterinary medicine.

V Med 403. International Preceptorship. (0-40) Cr. 1-12 each time taken. F.S.SS. *Prereq: Second-year classification in veterinary medicine.* International preceptorships and Study Abroad Group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities.

V Med 404. Orientation for International Experience. (2-0) Cr. 1. S. 8 weeks. *Prereq: Classification in veterinary medicine.* Predeparture orientation for group study abroad. Cultural considerations for the study abroad experience and a conversational language introduction. Out of class work will be assigned.

V Med 409. Management Pathways in Veterinary Medicine. (3-15) Cr. 4. F. 7 weeks. *Prereq: Classification in veterinary medicine.* Introduction to veterinary operations management and marketing. Skills development related to being a valued practice associate. Self development to assist the student in successfully balancing elements of fiscal responsibility and personal and professional success. Out of class work will be assigned.

V Med 414. Veterinary Practice Entrepreneurship. (2-0) Cr. 2. *Prereq: Classification in veterinary medicine.* A formal exposure to the skills needed for purchase and successful ownership of a veterinary practice. The course incorporates the fundamental business skills of accounting, finance, management, marketing, strategic planning, organizational structure, human resource management, operations management, and statistical quality control.

V Med 490. Independent Study. Cr. 1 to 3. *Prereq: Classification in veterinary medicine.* Independent or small group study of a specific area for which no course is available in an existing department.
H. Honors

V Med 503. International Preceptorship. (0-40) Cr. 1-12 each time taken. F.S.SS. *Prereq: Admission to the Graduate College.* International preceptorships and Study Abroad Group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities.

Veterinary Microbiology & Preventive Medicine

Charles O. Thoen, Chair of Department

Distinguished Professors: Kaeberle, Ross, Roth

Professors: Carpenter, Cheville, Moon, Paul, Platt, Reynolds, Rosenbusch, Thoen

Professors (Collaborators): Donham, Larsen, Mengeling, Nystrom-Dean, O'Berry, Schmerr, Schultz, Tabatabai

Distinguished Professors (Emeritus): Beran, Packer, Switzer

Professors (Emeritus): Hogle, Jensen, Kramer

Associate Professors: Abou-Gabal, Dickson, Griffith, Holland, Minion, B. Thacker, Uhlenhopp, Wannemuehler, Zimmerman

Associate Professors (Collaborators): Frey, Harp, Panigrahy, Zuerner

Assistant Professors: Cornick, E. Thacker, Yoon

Assistant Professors (Adjunct): Davis, Flaming

Assistant Professors (Collaborators): Anderson, Currier, Halling, Hurd, Sacco, Stabel, Stanton, Waters, Wesley

Instructors (Adjunct): Frana, Qual

Instructors (Collaborators): Schlater

The Department of Veterinary Microbiology and Preventive Medicine offers instruction in the areas of bacteriology, mycology, virology, immunology, epidemiology and public health at the graduate level.

Microbiologic, immunologic, regulatory, and preventive medical aspects of infectious diseases of animals are emphasized in courses for students in the veterinary curriculum.

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see *Veterinary Medicine, Curriculum.*

The Department of Veterinary Microbiology and Preventive Medicine provides instruction on pathogenic bacteria, fungi, and viruses and their interaction with host animal species. Principles and applications of infectious diseases, immunity to disease, diagnostic methods for infectious diseases, and vaccinology are covered. Principles and applications of epidemiology, public health, preventive veterinary medicine, regulatory veterinary medicine and food safety are also emphasized.

Graduate Study

The department offers opportunities for the degree doctor of philosophy with a major in veterinary microbiology. A specialization in preventive medicine is an option for this degree. Graduates in the Veterinary Microbiology and Preventive Medicine programs have a broad understanding of the fundamental processes involved in infectious diseases, pathogenesis and immunology. They are able to effectively establish research programs, which involve complex biological systems and disease syndromes. They are also prepared to address microbial-based social, ethical and environmental problems. Graduates acquire effective written and oral communication skills which lead to successful research and teaching careers in the medical and veterinary sciences. The department also offers work towards the master of science with majors in veterinary microbiology, or veterinary preventive medicine. A non-thesis master's option is available for majors in preventive medicine. Courses are open for students majoring in other graduate programs.

Prerequisite to graduate study is completion of coursework in general microbiology, biology, biochemistry, mathematical sciences, and physics. Candidates for the majors in veterinary microbiology should possess an undergraduate degree in biomedical science with emphasis in medical microbiology or the D.V.M. degree. Candidates for the major in preventive medicine should possess the D.V.M. degree.

The department also participates in the interdepartmental majors and programs in genetics, immunobiology, and MCDB (molecular, cellular, and developmental biology; see *Index*).

Each graduate student must demonstrate proficiency in English composition within two semesters in residence.

Courses Primarily for Professional Curriculum Students

V MPM 378. Case Study IV. (0-4) Cr. 2. S. *Prereq: Second-year classification in veterinary medicine.* Clinical applications of basic sciences taught concurrently in the spring semester of the second year curriculum in veterinary medicine.

V MPM 380. Veterinary Immunology. (3-3) Cr. 2. S. 8 weeks. *Prereq: First-year classification in veterinary medicine.* Structure and function of the immune system in animals.

V MPM 386. Veterinary Microbiology. (3-5) Cr. 5. F. *Prereq: Second-year classification in veterinary medicine.* Bacteria and fungi of veterinary importance with emphasis on mechanisms of disease production and laboratory diagnostic procedures.

V MPM 387. Veterinary Virology. (3-0) Cr. 3. S. *Prereq: Second-year classification in veterinary medicine.* The nature and ecology of animal viruses. Pathogenesis of viral diseases. The role of the immune response in pathogenesis and immunity to viral diseases.

V MPM 388. Public Health. (3-0) Cr. 3. S. *Prereq: Second-year classification in veterinary medicine.* Principles and practice of epidemiology. Relationships of animals to human health and well-being including zoonotic diseases, safety of food products of animal origin, water safety, and handling of animal wastes.

V MPM 389. Clinical Mycology. (1-2) Cr. 2. F. *Prereq: Second-year classification in veterinary medicine or Micro 310.* Fungal pathogens, common mycotoxins and the associated diseases in animals and humans with emphasis on clinical laboratory diagnosis.

V MPM 390. Topics in Veterinary History. (2-0) Cr. 1. S. 8 weeks. Significant persons, noteworthy events, and pivotal scientific discoveries in the course of the development and advancement of veterinary medicine from ancient times to the present.

V MPM 403. The Human-Animal Bond. (1-0) Cr. 1. F. Prereq: *Enrollment in veterinary medicine.* Concepts of the human-animal bond including history, philosophy, and effects on individuals and society.

V MPM 409. Infectious Diseases of Captive Wild Animals. (1-0) Cr. 1. F. *Prereq: Third year classification in veterinary medicine.* Infectious diseases (bacterial, viral, and mycotic) of non-human primates, birds, ruminants, cold-blooded animals, marine mammals, and carnivores.

V MPM 436. Infectious Diseases and Preventive Medicine. (2-0) Cr. 2. F. *Prereq: Third-year classification in veterinary medicine.* Etiology, epidemiology, laboratory diagnosis, regulatory control and preventive medicine aspects of the infectious diseases of small domestic animals.

V MPM 437. Infectious Diseases and Preventive Medicine. (3-0) Cr. 3. S. *Prereq: Third-year classification in veterinary medicine.* Etiology, epidemiology, laboratory diagnosis, regulatory control and preventive medicine aspects of the infectious diseases of swine, sheep, goats, cattle and horses.

V MPM 486. Laboratory in Public Health. Cr. 1 each time taken. F.S. *Prereq: Fourth-year classification in veterinary medicine.* Laboratory exercises and field trips related to veterinary public health practices.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

V MPM 502. Microbial Genetics. (Same as Micro 502.) See *Microbiology*.

V MPM 504. Microbial Physiology. (Same as Micro 504.) See *Microbiology*.

V MPM 505. Poultry Diseases. (2-0) Cr. 1. S. 8 weeks. *Prereq: V MPM 386, 387, V Pth 342.* Avian diseases affecting poultry production. Techniques currently utilized for diagnosis of disease.

V MPM 520. Medical Immunology I. (4-0) Cr. 4. F. *Prereq: Micro 310 or V MPM 386, 3 credits in biochemistry.* Nature of the immune system and its role in health and disease. Credit for either 520 or 575, but not both may be applied toward graduation.

V MPM 522. Principles of Epidemiology. (Same as VDPAM 522.) (3-0) Cr. 3. Alt. S., offered 2003. *Prereq: Micro 310 or V MPM 380 and 386.* Epidemiology and ecology of disease in populations. Disease causality and epidemiologic investigation. Issues in disease prevention, control, and eradication.

V MPM 536. Zoonoses and Environmental Health. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: V MPM 522.* Epidemiology, prevention and management of zoonotic diseases. Factors influencing transmission and survival of pathogenic microorganisms in the environment. Application of environmental control measures.

V MPM 537. Infectious Diseases and Preventive Medicine. (3-3) Cr. 4. S. Prereq: *Permission of instructor.* Indepth study of the etiology, epidemiology, laboratory diagnosis, regulatory control and preventive medicine aspects of the infectious diseases of large domestic animals.

V MPM 540. Livestock Immunogenetics. (Same as An S 540.) See *Animal Science.*

V MPM 575. Immunology. (Same as Micro 575.) See *Microbiology.*

V MPM 586. Medical Bacteriology. (Same as Micro 586.) (4-0) Cr. 4. F. *Prereq: Permission of instructor.* Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses.

V MPM 586L. Medical Bacteriology Laboratory. (0-6) Cr. 2. F. *Prereq: credit or enrollment in 586 or 625.* Procedures used in isolation and identification of pathogenic bacteria, including molecular and genetic techniques used in research.

V MPM 587. Animal Virology. (4-0) Cr. 4. *Prereq: Permission of instructor.* The biology of animal viruses and pathgenic mechanisms in viral diseases.

V MPM 587L. Laboratory in Animal Virology. (0-3) Cr. 1. *Prereq: Permission of the instructor.* Basic laboratory techniques in virology.

V MPM 599. Creative Component. Cr. arr. *Prereq: Nonthesis M.S. Option only.* A written report based on laboratory research, library reading, or topics related to the student's area of specialization and approved by the student's advisory committee.

Courses for Graduate Students

V MPM 604. Seminar. (1-0) Cr. 1 each time taken. F.S. Offered on a satisfactory-fail grading basis only.

V MPM 608. Molecular Virology. (Same as Pl P 608.) (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: BBMB 405 or Gen 511.* Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis.

V MPM 615. Molecular Immunology. (Same as BBMB 615.) See *Biochemistry, Biophysics, and Molecular Biology.*

V MPM 625. Mechanisms of Bacterial Pathogenesis. (Same as Micro 625.) (4-0) Cr. 4. Alt. S., offered 2003. *Prereq: 386 and 520.* Advanced study of virulence mechanisms of bacteria and current knowledge of research on host defenses in the pathogenesis of bacterial infections.

V MPM 629. Medical Immunology II. (3-0) Cr. 3. S. *Prereq: 520 or 575.* Current concepts of the role of native and acquired immunity in health and disease.

V MPM 690. Current Topics. Cr. 1 to 3 each time elected. F.S.SS. *Prereq: Permission of instructor.* Colloquia or advanced study of specific topics in a specialized field.

A. Immunology
B. Infectious Diseases

V MPM 698. Seminar in Molecular, Cellular, and Developmental Biology. (Same as MCDB 698.) See *Molecular, Cellular, and Developmental Biology.*

V MPM 699. Research.

Veterinary Pathology

Claire B. Andreasen, Interim Chair of Department

University Professors (Emeritus): Kluge

Professors: Carson, Cheville, Haynes, Hopper, Hyde, Moon, Myers, Niyo, Osweiler

Professors (Collaborators): Meador, Murray

Professors (Emeritus): Daniels, Greve, Hagemoser, Holter, Jeska, Ledet, Miller, Seaton, Stahr

Associate Professors: Ackermann, Andreasen, Halbur, Janke, Jarvinen, Larson, Yaeger

Assistant Professors: Beetham, Brockus, Jones, Sorden, Williamson

Assistant Professors (Collaborators): Hutto, Rhyan

Instructors (Adjunct): Greenlee, Morgan, Thomsen

Assistant Professors (Temporary): Fales-Williams, Hostetter

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see *Veterinary Medicine, Curriculum.*

The Department of Veterinary Pathology offers a systematic study of basic disease mechanisms with emphasis on the changes in cells, tissues, organs, and body fluids associated with disease. The theory and practice of veterinary pathology, veterinary clinical pathology, veterinary parasitology, veterinary toxicology, and related disciplines provide the basis for accurate diagnosis and a rational approach to the treatment and prevention of animal diseases.

Graduate Study

The department offers work for the degree master of science and doctor of philosophy with a major in veterinary pathology. As an option, students within the veterinary pathology major may choose an area of specialization in cellular and molecular pathology, veterinary clinical pathology, veterinary toxicology, or veterinary parasitology. The master of science degree is available on a thesis or nonthesis basis in the veterinary pathology major with or without an area of specialization.

Graduates have a broad understanding of veterinary pathology and related disciplines. They are able to communicate with clinicians, other scientists, and other colleagues on scientific matters, and with the general public on science policy matters that relate to veterinary pathology.

Graduates are able to address complex problems facing the agricultural and biomedical sciences, and are able to make appropriate diagnoses and investigations of animal diseases. They consider ethical, social, legal and environmental issues, and are skilled at carrying out research, communicating research results, and writing concise and persuasive grant proposals.

A minor in veterinary pathology requires a minimum of 12 graduate credits at the Ph.D. level and 8 graduate credits at the M.S. level. Additionally, a faculty member from the department must be a member of the student's program of study committee.

A veterinary degree (doctor of veterinary medicine or equivalent) is required for the major in veterinary pathology and Veterinary Clinical Pathology. Other specializations do not required the veterinary degree. A minimum score of 550 is required on the TOEFL examination for students whose native language is not English. Scores on the standardized Graduate Record Examination (GRE) General Test are required of students not having a veterinary degree from the United States or Canada. The GRE General Test is strongly recommended for all other applicants. The foreign language requirement will be determined by the student's program of study committee with the approval of the departmental chair. The Graduate English Examination is a graduate college requirement for native English speakers.

The M.S. thesis degree in veterinary pathology, with or without an area of specialization, requires a minimum of 30 graduate credits. Following completion of all other requirements, a comprehensive final examination is administered covering all graduate work including the thesis. The examination is typically oral, but a written component may be specified by the program of study committee. The degree candidate must submit a thesis, including at least one manuscript suitable for publication, to the major professor at least one week prior to the final examination. The departmental requirement for graduate courses includes 3 credits of basic biological sciences (biochemistry, genetics, cell biology), 4 credits of statistics (Stat 401), 4 credits of systemic pathology (from V Pth 570 or 571), 1 credit of postmortem pathology (V Pth 551) 1 credit of seminar (V Pth 605), and a significant number of research credits (V Pth 699).

The M.S. nonthesis degree in veterinary pathology, with or without an area of specialization, requires a minimum of 40 graduate credits including at least 10 graduate credits earned outside the department. Every nonthesis master's degree program requires evidence of individual accomplishment demonstrated by completion of a creative component, special report, or scientific study. A minimum of 3 credits of such independent work (V Pth 599) and a practical diagnostic examination (V Pth 606) corresponding to the area of specialization are required on every program of study. The final examination is comprehensive and consists of written and oral questions. The departmental requirement for graduate courses includes those for the M.S. thesis degree plus additional courses corresponding to the area of degree emphasis of specialization. Contact the department for a more complete list of requirements and information on areas of specialization.

The Ph.D. degree in veterinary pathology, with or without an area of specialization, requires a minimum of 72 graduate credits including at least 12 graduate credits earned outside the department. A minor is encouraged, but not required. The preliminary examination, consisting of written and oral components, is comprehensive and not restricted to the content of graduate courses. The degree candidate must submit a dissertation, including at least two manuscripts suitable for publication, to the major professor at least one week prior to the final examination. The final examination is primarily a defense of the dissertation, but it may include questions on other areas of specialized knowledge. Contact the department for a more complete list of requirements for the Ph.D. degree and information on areas of specialization.

Minor work is recommended in other departments in the College of Veterinary Medicine or departments or programs in other colleges. The department participates in the interdepartmental program in immunobiology and the interdepartmental major in toxicology. (See *Index*.)

Courses open for nonmajor graduate credit: 478.

Courses Primarily for Professional Curriculum Students

V Pth 304. Introduction to Clinical Problem Solving. (0-4) Cr. 2. F. *Prereq: First year classification in veterinary medicine.* Application of knowledge in basic biomedical sciences to clinical problems using a small group, problem-based learning format.

V Pth 342. General Pathology. (Dual-listed with 542.) (3-2) Cr. 2. S.8 weeks. Offered second half semester only. *Prereq: First-year classification in veterinary medicine.* Basic pathology with emphasis on disease in animals.

V Pth 372. Systemic Pathology. (2-3) Cr. 3. F. *Prereq: 342.* Response to injury by each body system.

V Pth 376. Veterinary Parasitology. (Dual-listed with 576.) (3-3) Cr. 4. S. *Prereq: Second-year classification in veterinary medicine.* Parasitic diseases of domestic animals and their control.

V Pth 377. Case Study III. (0-4) Cr. 2. F. *Prereq: Second-year classification in veterinary medicine.* Clinical applications of the basic sciences taught concurrently in the fall semester of the second year curriculum in veterinary medicine.

V Pth 401. Basics of Medical Terminology. (1-0) Cr. 1. F. 8 weeks, offered second half semester only. Discussion of prefixes, suffixes, and roots (mostly from Latin and Greek) that comprise medical terms.

V Pth 406. Surgical Pathology. (1-0) Cr. 1. S. *Prereq: 372.* Biopsies and associated cases reviewed with students in a seminar format. Interpretation of histopathologic findings as an adjunct to diagnosis, prognosis, and management of clinical cases.

V Pth 407. Parasites of Laboratory and Exotic Animals. (1-0) Cr. 1. S. *Prereq: Third- or fourth-year classification in veterinary medicine.* Discussion of important parasitisms occurring as natural infections in laboratory animals and exotic pet animals. Rodents, primates, reptiles, and caged birds are examples of hosts discussed.

V Pth 408. Clinical Pathology Interpretation. (1-0) Cr. 1. S. *Prereq: 425.* Interpretation of laboratory data on a series of clinical cases supplemented by current literature review.

V Pth 409. Introduction to Veterinary Cytology. (1-0) Cr. 1. F.S. *Prereq: Second or third-year classification in veterinary medicine.* Description and interpretation of cellular preparations from tissues and body fluids.

V Pth 422. Special Pathology. (3-3) Cr. 4. S. *Prereq: 372.* Pathogenesis of diseases in domestic animals.

V Pth 425. Clinical Pathology. (1-4) Cr. 3. F. *Prereq: 372.* Principles of clinical hematology and clinical chemistry in domestic animals.

V Pth 456. Necropsy Laboratory Practicum. Cr. 1 each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Practicum in postmortem examination and diagnosis.

V Pth 457. Clinical Pathology Laboratory Practicum. Cr. 1 each time taken. *Prereq: Fourth-year classification in veterinary medicine.* Methodology in clinical chemistry, hematology and cytology; practice in interpretation of laboratory data.

V Pth 478. Global Protozoology - Molecular Biology of Protozoa. (Dual-listed with 578, same as Ent 478) (2-1) Cr. 3. F. *Prereq: Permission of instructor.* Analysis of cellular systems, molecules, and organelles of pathogenic protozoan parasites. Emphasis is placed on processes and systems that are unique to protozoa, are important to understanding vector-parasite-host biology/ecology, or are targets of disease prevention/treatment programs for international disease control. Nonmajor graduate credit.

V Pth 490. Independent Study. Cr. arr. *Prereq: Permission of instructor and department chair.*

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

V Pth 542. General Pathology. (Dual-listed with 342.) (3-2) Cr. 2. S. 8 weeks, offered second half semester only. *Prereq: Graduate classification and BMS 330, 332, or Zool 322; for graduate credit.* Basic pathology with emphasis on disease in animals.

V Pth 548. Diagnostic Parasitology Laboratory. (0-3 to 0-9) Cr. 1 to 3. F.S.SS. *Prereq: 376 or 576.* A laboratory experience in the technical and applied aspects of veterinary parasitology.

V Pth 549. Clinical Pathology Laboratory. (0-3) Cr. 1 each time taken. F.S.SS. *Prereq: 457.* Laboratory procedures and clinical interpretations with emphasis on hematology, cytology, and clinical chemistry. Offered on a satisfactory-fail grading basis only.

V Pth 550. Surgical Pathology Laboratory. (0-3 to 0-9) Cr. 1 to 3 each time taken. F.S.SS. *Prereq: 422, 570 or 571.* Diagnosis of lesions in biopsy specimens; classification of neoplasms. Course includes rotation through departmental biopsy service and review of selected cases from departmental archives. Offered on a satisfactory-fail grading basis only.

V Pth 551. Postmortem Pathology Laboratory. (0-3 to 0-9) Cr. 1 to 3 each time taken. F.S.SS. *Prereq: 542 or 422.* Necropsy techniques of animals with emphasis on gross and microscopic lesions and diagnosis. Offered on a satisfactory-fail grading basis only.
A. Veterinary Pathology
B. Veterinary Diagnostic Laboratory

V Pth 554. Ethics in Scientific Research and Writing. (1-0) Cr. 1. Alt. S., offered 2002. Prereq: Graduate classification. Ethical conduct in biomedical research, criticism, writing, and adherence to regulations. Offered on a satisfactory-fail grading basis only.

V Pth 570. Systemic Pathology I. (2-4) Cr. 1 to 4. Alt. F., offered 2001. *Prereq: 342 or 542.* Pathology of the respiratory, reproductive, endocrine, musculoskeletal, and cardiovascular systems. Emphasis on pathogenesis and anatomic pathology correlated with interpretive clinical pathology where appropriate.

V Pth 571. Systemic Pathology II. (2-4) Cr. 1 to 4. Alt. F., offered 2002. *Prereq: 342 or 542.* Pathology of the integumentary, urinary, digestive, lymphoid, and nervous systems and special senses. Emphasis on pathogenesis and anatomic pathology correlated with interpretive clinical pathology where appropriate.

V Pth 576. Veterinary Parasitology. (Dual-listed with 376.) (3-3) Cr. 4. F. *Prereq: Graduate classification and 542.* Parasitic diseases of domestic animals and their control.

V Pth 578. Global Protozoology - Molecular Biology of Protozoa. (Dual-listed with 478, same as Ent 578) (2-1) Cr. 3. F. *Prereq: Permission of instructor.* Analysis of cellular systems, molecules, and organelles of pathogenic protozoan parasites. Emphasis is placed on processes and systems that are unique to protozoa, are important to understanding vector-parasite-host biology/ecology, or are targets of disease prevention/treatment programs for international disease control.

V Pth 590. Special Topics. Cr. 1 to 4. F.S.SS. *Prereq: Permission of instructor.*
A. Veterinary Pathology
B. Veterinary Parasitology
C. Veterinary Toxicology
D. Veterinary Clinical Pathology

V Pth 599. Creative Component Research
A. Veterinary Pathology
B. Veterinary Parasitology
C. Veterinary Toxicology
D. Veterinary Clinical Pathology

Courses for Graduate Students

V Pth 604. Pathology Case Seminar. Cr. 1 to 2 each time taken. F.S. Description and interpretation of microscopic lesions and clinical pathology data collected from cases of natural and experimental disease. Offered on a satisfactory-fail grading basis only.

V Pth 605. Current Topics Seminar. Cr. 1 each time taken. F.S.

V Pth 606. Diagnostic Interpretation. Cr. R. F.S.SS. A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization.
A. Veterinary Pathology
B. Veterinary Parasitology
C. Veterinary Toxicology
D. Veterinary Clinical Pathology

V Pth 652. Pathologic Hematology. (2-2) Cr. 3. Alt. S., offered 2003. *Prereq: 425.* Pathologic changes in blood constituents of domestic animals.

V Pth 653. Research Methods in Pathobiology. (2-0) Cr. 2. Alt. F., offered 2001. *Prereq: Permission of instructor.* Introduction to laboratory techniques for study of pathologic changes in cells and tissues, including: microscopy, cytochemistry, and molecular pathology techniques. Offered on a satisfactory-fail grading basis only.

V Pth 655. Cellular and Molecular Pathology I. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: Graduate course in biochemistry, genetics, or cell biology.* Cellular and molecular mechanisms of cell injury, circulatory dysfunction, and the inflammatory response.

V Pth 656. Cellular and Molecular Pathology II. (3-0) Cr. 3. Alt. S., offered 2002. *Prereq: Graduate course in biochemistry, genetics, or cell biology.* Cellular and molecular mechanisms of neoplasia and toxicologic pathology.

V Pth 660. Pathology of Parasitic Diseases. (2-3) Cr. 3. Alt. SS., offered 2002. *Prereq: 372, 376.* Pathologic tissue changes caused by parasites and mechanisms of host response.

V Pth 663. Clinical Chemistry. (2-2) Cr. 3. Alt. S., offered 2002. *Prereq: 425.* The pathophysiology, methodology, and clinical application of laboratory medicine.

V Pth 679. Histopathology of Laboratory Animals. (0-4) Cr. 2. Alt. SS., offered 2002. *Prereq: 570 or 571.* Study of microscopic lesions in laboratory animals with emphasis on description, etiology, pathogenesis, and diagnosis.

V Pth 699. Research.
A. Veterinary Pathology
B. Veterinary Parasitology
C. Veterinary Toxicology
D. Veterinary Clinical Pathology

Water Resources

(Interdepartmental Graduate Major)

Supervisory Committee: R. Horton, Chair; T. Al Austin, J. L. Baker, J. A. Herriges, W. W. Simpkins

Water resources is a university-wide, interdisciplinary program involving biological, chemical, physical, and social sciences. Faculty from departments in the colleges of Agriculture, Engineering, and Liberal Arts and Sciences cooperate to offer courses and research opportunities leading to the M.S. and Ph.D. degrees with a major in water resources.

Although broadly trained, water resources majors specialize in some technical aspect of water resources, and applicants should have completed the equivalent of an undergraduate or masters degree in one of the biological, chemical, physical, or engineering sciences.

The water resources program emphasizes fundamental concepts and research, which at the same time address water resources issues having regional and national significance. The curriculum is designed to provide the interdisciplinary approach needed in water resources education and research. In addition to work in their chosen area of specialization, students may obtain a broad background in water resources encompassing physical, chemical, and biological aspects of water resources. Cooperating departments offer courses covering surface water and groundwater hydrology, meteorology, climatology, water quality, aquatic and wetland ecology, water resources engineering, and sociological, political, and economic aspects of water resources planning and management.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

W Res 583. Water Resources. (Same as Econ 583.) (3-0) Cr. 3. F. *Prereq: Graduate classification; not for economics majors.* Analysis of water resource management issues from economic, legal, political, and sociological perspectives. Topics include rational water allocation systems, market failure, investment, pollution control strategies, and resource management. Administered by Economics in cooperation with Political Science and Sociology.

W Res 590. Special Topics. Cr. var. *Prereq: Permission of major professor in water resources faculty.* Literature reviews and conference in accordance with needs and interest of the student.

W Res 599. Creative Component. Cr. var. *Prereq: Permission of major professor in water resources faculty.* Creative component for nonthesis master of science degree.

W Res 690. Seminar in Water Resources Management. (1-0) F.S.
A. Cr. 1. Presentation required.
B. Cr. R. Attendance only.

Women's Studies

www.public.iastate.edu/~womenstu/wsprogram.htm

(Interdepartmental Undergraduate Major)

Program Director: J. Bystydzienski

Undergraduate Study

Women's Studies in the College of Liberal Arts and Sciences is a cross-disciplinary program in which students may elect a minor or a major. Women's Studies provides an opportunity for students to examine women's roles, contributions, and status in social and cultural context and to investigate a variety of disciplines from feminist perspectives. Women's Studies creates an understanding that interrelated factors –e.g., race, ethnicity, class, age, disability, religions, national origin, and sexual orientation – inform knowledge of women's history, culture, and social roles. Women's Studies seeks to improve critical thinking and to provide students with the intellectual means to question prevailing assumptions. It encourages students to explore the contexts and ideological origins of knowledge and to examine the relationship between knowledge and power in society. It promotes social responsibility by examining the connections between personal experience and political activity, and validates student contributions and voices. Women's Studies graduates are skilled in critical thinking, research methods, and effective communication. Because they have developed a thorough understanding of gender, race, and class, they can understand and work effectively with employers, colleagues, and clients to analyze and address complex social problems. Women's Studies graduates acquire strong backgrounds for careers in such areas as counseling, education, human resources, public policy, politics, business, or law. The program includes at various times core courses in Women's Studies and cross-listed courses in anthropology, art history, classical studies, economics, English, foreign languages and literatures, history, health and human performance, political science, psychology, religious studies, sociology, speech communication, and zoology.

An undergraduate major requires 33 credits of core, cross-listed, and independent study courses. Women's Studies majors must satisfy the following requirements:

1. 18 credits selected from women's studies core courses (W S).

   A. Required core courses: W S 201, 301, and 401 or 402. Students must also choose between a thesis, W S 499 (3 cr.) or an internship, W S 491 (3 cr.)

   B. The remaining 6 credits should be chosen from the Women's Studies core courses (W S 450 and 301 may be taken more than once.)

   C. No more than 6 credits of W S 490 may be counted toward the W S major.

2. 15 credits selected from W S cross-listed courses or W S core courses.

Women's Studies majors must also declare either a minor or a second major in a different program or department.

English proficiency requirement: The Women's Studies major requires an average grade of C- or better in English 104 and 105 (or 105H) and successful completion of either English 305, English 314 or a foreign language 370 course (literature and culture in English translation).

Undergraduate students may minor in Women's Studies by taking 15 semester hours of Women's Studies classes, including W S 201, 301 and one 400 level core Women's Studies course, plus 6 additional credits of core or cross-listed courses.

Because course listings vary from year to year, any student interested in a minor or major in Women's Studies should contact the chair of the program committee for advising. (See *Index, Cross-Disciplinary Programs.*)

The following women's studies courses are applicable to the human relations requirement for teachers: 201, 327, 340, 345, 346, 370, 385, 386. (See *Index, Teacher Education Program.*)

Graduate Study

Courses open for nonmajor graduate credit: 301, 321, 323, 336, 340, 345, 350, 394, 401, 402, 422, and 450.

Courses Primarily for Undergraduate Students

W S 201. Introduction to Women's Studies. (3-0) Cr. 3. F.S. Introduction to the interdisciplinary field of Women's Studies. Contemporary status of women mainly in the United States from social, economic, historical, political, philosophical and literary perspectives. Analysis of intersection of gender, race, class, and sexuality. Topics include work, health, sexuality, violence, and sport. Background for the other courses in the program.

W S 203. Lesbian Cultures and Communities. (3-0) Cr. 3. S. An exploration of contemporary and historical lesbian cultures and communities in the United States, examining their roots, politics, populations, and conflicts from multiple perspectives.

W S 258. Human Reproduction. (Same as Zool 258.) See *Zoology.*

W S 301. International Perspectives on Women and Gender. (3-0) Cr. 3. May be repeated for up to 6 credits. F. *Prereq: 201 or 3 credits in Women's Studies at the 300 level or above.* Study of women in a range of cultures, depending on faculty expertise. Special emphasis on women in development seen in postcolonial context. Nonmajor graduate credit.

W S 321. Economics of Discrimination. (Same as Econ 321.) See *Economics.* Nonmajor graduate credit.

W S 323. Gender and Communication. (Same as Sp Cm 323.) See *Speech Communication.* Nonmajor graduate credit.

W S 327. Sex and Gender in Society. (Same as Soc 327.) See *Sociology.*

W S 328. Sociology of Masculinities and Manhood. (Same as Soc 328.) See *Sociology*.

W S 336. Women and Religion. (Same as Relig 336.) See *Religious Studies.* Nonmajor graduate credit.

W S 340. Survey of Women's Literature. (Same as Engl 340.) See *English.* Nonmajor graduate credit.

W S 345. Women and Literature: Selected Topics. (Same as Engl 345.) See *English.* Nonmajor graduate credit.

W S 346. Psychology of Women. (Same as Psych 346.) See *Psychology.*

W S 350. African American Women. (Same as Af Am 350.) (3-0) Cr. 3. S. *Prereq: 201 or Af Am 201 or 3 credits in Women's Studies or African American Studies at the 300 level or above.* Economic, social, political and cultural roles of African American women in the U.S. Includes literary, philosophical, and artistic expressions. Myths and realities explored. Nonmajor graduate credit.

W S 374. Women in Classical Antiquity. (Same as Cl St 374.) See *Classical Studies.*

W S 380. History of Women in Science, Technology, and Medicine. (Same as Hist 380.) See *History.*

W S 383. Women in Science and Engineering. (Same as Zool 383.) See *Zoology.*

W S 385. Women in Politics. (Same as Pol S 385.) See *Political Science.*

W S 386. History of Women in America. (Same as Hist 386.) See *History.*

W S 394. Women in Art. (Same as Art H 394.) See *Art History.* Nonmajor graduate credit.

W S 401. Feminist Theories. (3-0) Cr. 3. F. *Prereq: 201 or 3 credits in Women's Studies at the 300 level or above.* Current theories of feminism, the feminine and sexual difference. Problems in race, class, sexuality, ethnicity as they are developed in diverse feminisms. May include readings in lesbian, Black, postcolonial, psychoanalytic and postmodern thought. Nonmajor graduate credit.

W S 402. Feminist Research Methodologies and Scholarship. (3-0) Cr. 3. S. *Prereq: 201 and 301.* Introduction to feminist research methods and the history and influence of feminist research. Examination of scholarly works by U.S. and international feminists. Nonmajor graduate credit.

W S 422. Women, Men, and the English Language. (Same as Engl 422.) See *English.* Nonmajor graduate credit.

W S 450. Topics in Women's Studies. (3-0) Cr. 3 each time taken, maximum of 6. S. *Prereq: 201 or 3 credits in Women's Studies at the 300 level or above.* Special and/or experimental topics in a specific discipline, e.g., women and education, women and religion, women and the law, women and science. Nonmajor graduate credit.

W S 490. Independent Study. Cr. 1 to 3 each time taken, maximum of 6. *Prereq: Any two courses in Women's Studies, permission of instructor.* The director of the Women's Studies Program Committee must be consulted in advance.

W S 491. Senior Internship. (3-0) Cr. 3. F.S.SS. *Prereq: Senior classification.* Internship designed to provide an application of Women's Studies principles and methods in a workplace. To be arranged with an internal or external employer and conducted under the supervision of a member of the Women's Studies faculty.

W S 499. Senior Thesis. (3-0) Cr. 3. F.S.SS. *Prereq: Senior classification.* Senior thesis to be independently researched and written under the supervision of a member of the Women's Studies faculty.

Courses for Graduate Students, Open To Qualified Undergraduate Students

W S 523. Gender Roles and Sport. (Same as Ex Sp 523.) See *Health and Human Performance.*

W S 528. Sociology of Gender. (Same as Soc 528.) See *Sociology.*

W S 545. Women's Literature. (Same as Engl 545.) See *English.*

W S 590. Special Topics. Cr. var. *Prereq: Permission of Women's Studies Program Committee.* Independent study on a topic in Women's Studies.

W S 594. Women in Art. (Same as Art H 594.) See *Art History.*

Courses Offered by Other Departments

Engl 304. Creative Writing - Fiction. See *English*. Acceptable only when offered as a course on women's writing.

Frnch 370. French Studies in English. See *Foreign Languages and Literatures*. Acceptable only when offered as a course on women or feminism in French literature.

Ger 370. German Studies in English. See *Foreign Languages and Literatures*. Acceptable only when offered as a course on women or feminism in German literature.

Zoology and Genetics

www.mbb.iastate.edu/htm/index.html

M. Duane Enger, Chair of Department

University Professors: Dolphin

Professors: Ackerman, Atherly, Campbell, Drewes, Enger, Haydon, Henderson, Howell, J. Johansen, Lee, Mayfield, Myers, T. Peterson, Richmond, Schnable, Shen

Distinguished Professor (Emeritus): Ulmer

University Professor (Emeritus): Stadler

Professors (Collaborators): Palmer, Paradise, Shoemaker

Professors (Emeritus): Bishop, Brown, Buttrey, Hollander, Imsande, Jeska, Miller, Mutchmor, Pattee, Pollak, Redmond, Robertson, Welshons

Associate Professors: Ambrosio, Brendel, Buss, Dobbs, Emery, Farrar, Ford, Girton, Ingebritsen, Janzen, K. Johansen, McCloskey, Minion, T. Peterson, Powell, Sakaguchi, Viles, C. Vleck, Voytas

Associate Professors (Adjunct): D. Vleck, Wang

Associate Professors (Collaborators): Link, Mahajan, Tucker

Associate Professor (Emeritus): Shaw

Assistant Professors: Becraft, Chou, Gu, Naylor, Powell-Coffman

Assistant Professors (Adjunct): Coffman, Pleasants

Assistant Professor (Collaborators): Bricker

Instructors (Adjunct): Carlson, Leshem-Ackerman

Instructor (Collaborator): Bowman

Undergraduate Study

The department offers majors in genetics, zoology and co-administers biology. The zoology and genetics majors are available to students in both the College of Agriculture and the College of Liberal Arts and Sciences. The programs for these majors are listed below and under the Curricula in Agriculture. College requirements can be found under Curricula in Agriculture and Curriculum in Liberal Arts and Sciences. The department offers minors in both genetics and zoology. B.S./M.S. programs are available in which a student, with proper planning, can complete the requirements for both bachelor's and master's degrees in five years. Students interested in the B.S./M.S. program must apply during their sophomore year.

Training in genetics, zoology or biology may lead to employment in teaching, research, or any of a variety of health-related professions. In most cases, students should plan on continuing their education in graduate or professional school. Students with the B.S.degree may expect to find employment in the biotechnology, health, or food industries. Recent graduates have also developed careers in conservation biology, technical writing, science journalism, technical sales, business, and genetic counseling.

The required course work and associated electives are designed to provide students with knowledge of the basic biological sciences, mathematics, chemistry, and physics. This background is essential for professions involving modern biological sciences. As part of these courses, students develop skills in problem solving, critical thinking, writing, research-related activities and an introduction to biological professions.

The respective communications and English proficiency requirements of both colleges are met by an average of C or better in Engl 104, 105 or 105H, and an additional English writing course. The lowest grade acceptable in any of these courses is C-. Students in the College of Agriculture must also achieve a C or better in an oral communications course.

A grade of C– or better is required in all biological science courses within the majors with a cumulative GPA of at least 2.0.

Specific entrance requirements for medical and health-related professions are established by the professional schools. Students interested in fulfilling preprofessional requirements for such professions as cytotechnology, dental hygiene, dentistry, human medicine, medical technology, nursing, optometry, pharmacy, physical therapy, physicians assistant, and veterinary medicine can major in either genetics or zoology while fulfilling the preprofessional requirements. (See *Preprofessional Study*.)

Genetics

Genetics is the scientific study of heredity. The understanding of heredity is fundamental to all the biological sciences. The department offers a full range of instruction in all aspects of genetics from the molecular genetics of microorganisms to population genetics.

In addition to basic degree requirements listed in the Curricula in Agriculture or the Curriculum in Liberal Arts and Sciences, genetics majors must satisfy the following requirements:

1. Biol 201, 201L, 202, 202L, 301, 301L, 302, 302L, 303, and Micro 302.

2. Gen 110, 410, 411, 491, and either 462 or 563.

3. Eleven credits of calculus and statistics including at least one course in each.

4. Three years of chemistry and biochemistry.

5. One year of general college physics.

6. Nine credits for the degree in the College of Agriculture, and 6 credits for the degree in the College of Liberal Arts and Sciences, of support electives chosen from an approved list.

7. Majors in the College of Liberal Arts and Sciences must take one course that involves both humanities and biology such as history of science or bioethics. This course may also count toward a college group requirement. A list of acceptable courses is available from the departmental office.

8. Majors in the College of Agriculture must include Biol (A Ecl) 312 in their program.

The department offers a minor in genetics that may be earned by completing Biol 301, 301L, 302, 302L, Gen 410, 411 and 491. A Genetics major may not double major or minor in Biology.

Zoology

The study of zoology includes all aspects of animal life. The department offers instruction in a wide range of zoological subjects ranging from the structure and function of cells to the behavior of animals and their populations.

In addition to the basic degree requirements listed in the Curricula in Agriculture and the Curriculum in Liberal Arts and Sciences, zoology majors (including those preparing for professional programs in medical and other health-related fields) must complete satisfactorily the following requirements.

1. Zool 110, Biol 201, 201L, 202, 202L, 301, 301L, 302, 302L, and Zool 355.

2. Zoology electives: 17 credits in zoology at the 300 level or above are required including seven credits at the 400 level or above and two laboratory courses with at least one at the 400 level. Biol 312, 303, and Gen 462 are also acceptable electives. A maximum of 4 credits of 490R and no credits of 490S and 490U may be used toward the 17 credits; however, only 2 credits of 490R may be applied to the requirement of seven 400 or above credits and no 490R credits can be applied to the laboratory requirement. The 17 credits must also include at least one organismal course.

3. Two years of chemistry or biochemistry totaling 15 credits to include one year of general chemistry with laboratory and at least one semester of organic chemistry with laboratory.

4. Eleven credits of calculus and statistics including at least one course in each.

5. One year of general college physics.

6. Majors in the College of Liberal Arts and Sciences must take one course that involves both humanities and biology such as history of science or bioethics. This course may also count toward a college group requirement. A list of acceptable courses is available in the department office.

7. Majors in the College of Agriculture must take 6 credits of agricultural biology electives. This requirement is satisfied by passing six credits at the 300 level or above from the departments of Animal Ecology, Animal Science, or Entomology.

8. Majors in the College of Agriculture must include Biol (A Ecl) 312 in their program.

Majors are encouraged to take advantage of special opportunities available in summer courses at the Iowa Lakeside Laboratory at Lake Okoboji and at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. (See *Index*.). Generally, these credits may be applied toward the zoology elective requirement. Interested students should consult their advisers.

The department offers a minor in zoology which may be earned by receiving credit for Biol 301, 301L, 302, 302L, Zool 355, and 3 additional zoology credits taken at the 300 level or above. A Zoology major may not double major or minor in Biology.

Information of the faculty, programs, staff and course requirements for the genetics or zoology major can be found at the Zoology and Genetics web site:
www.mbb.iastate.edu/htm/index.html

Graduate Study

The department offers work for the master of science and doctor of philosophy degrees.

A student majoring in zoology may specialize in animal behavior, animal models of gene therapy, cell biology, comparative physiology, developmental biology, ecology, endocrinology, immunobiology, molecular biology, neurobiology, parasitology, or physiology.

Students entering any graduate major or program in the department need a sound background in the biological, physical, and mathematical sciences and must be committed to research. Applicants are required to submit Graduate Record Examination (GRE) scores for both the aptitude and the biology advanced tests.

Many of the graduate students in the department are in interdepartmental graduate majors or interdepartmental graduate programs, such as: Ecology and Evolutionary Biology; Immunobiology; Interdepartmental Genetics; Molecular, Cellular and Developmental Biology and Neuroscience.

The requirements for the genetics major can be found under *Genetics* in the separate interdepartmental listing.

Specific course requirements for advanced degrees depend largely upon previous training and experience in the major area of specialization. There is no foreign language requirement. Certification in the use of written English is required. All graduate students must acquire teaching experience, usually in laboratory courses, as part of their graduate program. All graduate students will participate in a 690 journal club seminar and a 696 research seminar in their area of interest each academic year. Students majoring in an interdepartmental program may substitute one semester of program seminar requirement for 690/696 departmental seminar.

Courses open for nonmajor graduate credit: Zool 355, 403l, 404l, 405, 415l, 419l, 420l, 428, 454, 456, 459, 462: Gen 410, 411, 462.

Genetics (Gen)

Courses Primarily for Undergraduate Students

Gen 110. Genetics Orientation. (1-0) Cr. 0.5. F. First 8 weeks. Orientation to the area of genetics. For students considering a major in genetics. Specializations and career opportunities. Offered on a satisfactory-fail grading basis only.

Gen 260. Human Heredity and Society. (3-0) Cr. 3. F. *Prereq: One semester of college biology or Anthr 202.* A survey course in genetics for non-biology majors interested in heredity and its importance, and implications to self and society. Not recommended for those intending to take advanced courses in genetics. Credit for graduation will not be allowed for more than one of the following: 260, 301, 320, Biol 301 and 301L and Agron 320.

Gen 298. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of department cooperative education coordinator; sophomore classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Gen 301. Principles of Genetics. (Same as Biol 301.) See *Biology.* Credit for graduation will not be allowed for more than one of the following: 260, 301, 320, Biol 301 and 301L and Agron 320.

Gen 301L. Principles of Genetics Laboratory. (Same as Biol 301L.) See *Biology.*

Gen 308. Biotechnology in Agriculture, Food, and Human Health. (Dual-listed with 508.) (3-0) Cr. 3. F. S. Prereq: Biol 201 and 202. Scientific principles and techniques in biotechnology. Products and applications in agriculture, food, and human health. Ethical, legal, and social implications of biotechnology. A research paper is required for graduate credit.

Gen 320. Genetics, Agriculture and Biotechnology. (Same as Agron 320.) (3-0) Cr. 3. F.S. *Prereq: Biol 202.* Transmission genetics with an emphasis on applications in agriculture, the structure and expression of the gene, how genes behave in populations and how recombinant DNA technology can be used to improve agriculture. Credit for graduation will not be allowed for more than one of the following: 260, 301, 320, Biol 301 and 301L and Agron 320.

Gen 340. Human Genetics. (3-0) Cr. 3. S. *Prereq: Biol 301 or Gen 301.* Fundamental concepts and current issues of human genetics. Human chromosome analysis, pedigree analysis, gene mapping, the human genome project, sex determination, genetics of the immune system, genetics of cancer, gene therapy, the genetic basis of human diversity, eugenics.

Gen 398. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of department cooperative education coordinator; junior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Gen 410. Transmission Genetics. (Dual-listed with 510.) (3-0) Cr. 3. F. *Prereq: Biol 301 or Gen 301.* The principles and practice of transmission genetics. The Mendelian concept of the gene, mutational analysis of gene function, linkage and gene mapping, genetic fine structure analysis, chromosomal aberrations, aneuploidy and polyploidy, extrachromosomal inheritance, analysis of genetic pathways, genetics of quantitative traits. Nonmajor graduate credit.

Gen 411. Molecular Genetics. (3-0) Cr. 3. S. *Prereq: Biol 302.* The principles of molecular genetics: gene structure and function at the molecular level, including regulation of gene expression, genetic rearrangement, and the organization of genetic information in prokaryotes and eukaryotes. Nonmajor graduate credit.

Gen 462. Evolutionary Genetics. (Dual-listed with 562; same as Zool 462.) (3-0) Cr. 3. S. *Prereq: Biol 303.* The genetic basis of evolutionary processes in higher organisms. The role of genetic variation in adaptation, natural selection, adaptive processes, and the influence of random processes on evolutionary change. Nonmajor graduate credit

Gen 490. Independent Study. Cr. arr. *Prereq: 301, junior or senior classification, permission of instructor.* Students in the College of Agriculture may use no more than 6 credits of Gen 490 toward the total of 128 credits required for graduation; students in the College of Liberal Arts and Sciences may use no more than 9 credits of Gen 490 toward graduation.

R. Genetics research. Cr. 1 to 5 each time taken.

S. Attendance and critique of genetics seminars. Cr. 1. Offered on a satisfactory-fail grading basis only.

U. Laboratory teaching experience. For students registering to be undergraduate laboratory assis tants. Cr. 1 to 2. Offered on a satisfactory-fail grad ing basis only.

Gen 491. Undergraduate Seminar. (1-0) Cr. 1. F. *Prereq: Junior classification.* The investigation of current issues in genetics. Graduate school and employment opportunities discussed. Practice in résumé writing and interview techniques. Required for majors in genetics.

Gen 495. Molecular Biology for Computational Scientists. (Same as BCB 495.) (3-0) Cr. 3. F. Dobbs. Survey of molecular cell biology and molecular genetics for non-biologists, especially those interested in bioinformatics/computational biology. Basic cell structure and function; principles of molecular genetics; biosynthesis, structure, and function of DNA, RNA, and proteins; regulation of gene expression; selected topics. Provides biological background for BCB/Gen/Com S/Math 594.

Gen 498. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of department cooperative education coordinator; senior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

Gen 508. Biotechnology in Agriculture, Food , and Human Health. (Dual-listed in 308.) (3-0) Cr. 3. F.S. *Prereq; Biol 201 and 202.* Scientific principles and techniques in biotechnology. Products and applications in agriculture, food, and human health. Ethical, legal, and social implications of biotechnology. A research paper is required for graduate credit.

Gen 510. Transmission Genetics. (Dual-listed with 410.) (3-0) Cr. 3. F. *Prereq: 301.* The principles and practice of transmission genetics. The Mendelian concept of the gene, mutational analysis of gene function, linkage and gene mapping, genetic fine structure analysis, chromosomal aberrations, aneuploidy and polyploidy, extrachromosomal inheritance, analysis of genetic pathways, genetics of quantitative traits.

Gen 511. Molecular Genetics. (Same as MCDB 511.) (3-0) Cr. 3. S. *Prereq: Biol 301 and BBMB 405.* The principles of molecular genetics: gene structure and function at the molecular level, including regulation of gene expression, genetic rearrangement, and the organization of genetic information in prokaryotes and eukaryotes.

Gen 512. Plant Growth and Development. (Same as Bot 512.) See *Botany.*

Gen 520. Genetic Engineering. (Same as BBMB 520, MCDB 520.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: 411 or BBMB 405.* Strategies and methods of gene cloning, restriction endonuclease mapping, southern hybridization, isolation and manipulation of plasmid DNA, and detection of specific genes in bacteria.

Gen 536. Genetic Statistics. (Same as Stat 536.) See *Statistics.*

Gen 537. Genetic Statistics. (Same as Stat 537.) See *Statistics.*

Gen 556. Computational Genomics and Evolution. (Same as BCB 556.) (3-0) Cr. 3. S. *Prereq: Biol 301.* Gu. Introduction to evolutionary sequence analysis at the genome level. Topics include sequence alignment, phylogenetic inference, molecular clock analysis, ancestral state inference, sequence/structure relation, functional divergence and prediction, evolutionary development, genome duplication, and comparative genomics. Focus will be on data analysis and biological interpretation.

Gen 562. Evolutionary Genetics. (Dual-listed with 462; same as Bot 562, Zool 562.) (3-0) Cr. 3. S. *Prereq: Biol 303.* Graduate study in conjunction with 462. The genetic basis of evolutionary processes in higher organisms. The role of genetic variation in adaptation, natural selection, adaptive processes, and the influence of random processes on evolutionary change.

Gen 563. Molecular Phylogenetics. (Same as Zool 563.) See *Zoology*.

Gen 566. Molecular Evolution. (Same as Bot 566.) See *Botany*.

Gen 590. Special Topics. Cr. 1 to 3. *Prereq: 301 or 320.*

Gen 594. Computational Molecular Biology. (Same as BCB 594, Com S 594, Math 594.) (3-0) Cr. 3. F.S. *Prereq: Biol 301 and 302 or Math 304 and 307 (Math 317 may be used in place of 307) or Com S 311 and 330 or equivalent courses.* Introduction to the biological background and the algorithms used in sequence comparison and data base search, fragment assembly and physical mapping of DNA, building of phylogenetic trees, analysis of genome rearrangement, and molecular structure prediction. Practice with some of the software commonly used for these problems.

Gen 596. Genomic Data Processing. (Same as BCB 596, Com S 596.) (3-0) Cr. 3. F. *Prereq: Com S 208 or 228, and Com S 311.* Chou. Introduction to major computational methods relevant to modern molecular biology research. Topics include database construction, search and update; data collection and dissipation through Internet; sequence alignment and comparison methods; structure recognition and prediction algorithms; shotgun assembly procedures and algorithms; and scripting languages for linking together an automatic biological data processing pipeline. Focus will be on the analysis and actual implementation of those algorithms.

Courses for Graduate Students

Gen 615. Molecular Immunology. (Same as BBMB 615.) See *Biochemistry, Biophysics and Molecular Biology*.

Gen 675. Nucleic Acid Structure and Function. (Same as BBMB 675.) See *Biochemistry, Biophysics and Molecular Biology.*

Gen 696. Seminar in Plant Physiology and Molecular Biology. (Same as Bot 696.) See *Botany.*

Gen 698. Seminar in Molecular, Cellular, and Developmental Biology. (Same as MCDB 698.) See *Molecular, Cellular, and Developmental Biology.*

Gen 699. Research.

Zoology (Zool)

Courses Primarily for Undergraduate Students

Zool 110. Zoology Orientation. (1-0) Cr. 0.5. F. First 8 weeks. Orientation to the area of zoology. For students considering a major in zoology. Specializations and career opportunities in the zoological sciences, including medically related professions. Offered on a satisfactory-fail grading basis only.

Zool 155. Basic Human Physiology and Anatomy. (3-0) Cr. 3. F.S.SS. *Prereq: H.S. biology and chemistry or Biol 109 or 201; Biol 109 or 201 recommended.* The structure and functions of human organ systems.

Zool 156. Laboratory in Human Physiology and Anatomy. (0-4) Cr. 2. F.S.SS. *Prereq: Credit or enrollment in 155.* Introduction to selected aspects of human anatomy and physiology through the use of models, specimens, and student conducted experiments.

Zool 255. Intermediate Physiology. (3-0) Cr. 3. F. *Prereq: Biol 201, 202.* Intermediate level human systems physiology.

Zool 258. Human Reproduction. (Same as W S 258.) (3-0) Cr. 3. Alt. F., offered 2002. *Prereq: 155 or Biol 109 or 201.* Anatomy and physiology of human reproductive systems, including fertility, pregnancy, and delivery.

Zool 298. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; sophomore classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Zool 301I. Iowa Natural History. (Same as Ia LL 301I.) See *Iowa Lakeside Laboratory.*

Zool 303. Biological Evolution. (Same as Biol 303.) See *Biology.*

Zool 304. Animal Behavior. (3-0) Cr. 3. F. *Prereq: Biol 202.* Ethological and sociobiological approaches to animal behavior. Genetic and developmental aspects of behavior, biological rhythms, orientation (including navigation, migration), communication, and social behavior (mating, aggression, parental care).

Zool 304L. Laboratory in Animal Behavior. (0-3) Cr. 1. F. *Prereq: Credit or enrollment in Zool 304.* Laboratory techniques for observation, description and analysis of animal activities; independent projects.

Zool 310. Brain and Behavior. (Same as Psych 310.) See *Psychology.*

Zool 311. Introduction to Parasitology. (Same as Micro 311.) (3-3) Cr. 4. F. *Prereq: Biol 202.* Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

Zool 312I. Ecology. (Same as Ia LL 312I.) See *Iowa Lakeside Laboratory.*

Zool 320. Comparative Chordate Anatomy. (3-4) Cr. 5. F. *Prereq: Biol 202, junior classification.* The evolution of chordates as reflected in the anatomy of extinct and living forms. Lecture topics include the history and diversity of chordates; comparisons of anatomic structures among major groups, the adaptive significance of anatomic structures. Laboratory involves dissection of representative species.

Zool 322. Vertebrate Histology. (3-3) Cr. 4. S. *Prereq: Biol 202.* Microscopic structure of vertebrate tissues and organs, with an introduction to histological techniques.

Zool 334. Embryology. (2-0) Cr. 2. S. *Prereq: Biol 202.* Basic principles and processes of development. Course will cover classical as well as current aspects of developmental biology. Emphasis will be on vertebrate model systems. Not acceptable for credit in the major for Genetics or Zoology majors.

Zool 334L. Embryology Laboratory. (0-3) Cr. 1. S. *Prereq: Credit or enrollment in 334.* Selected experiments demonstrating basic concepts in development. Mixture of live embryo experiments and vertebrate developmental anatomy.

Zool 355. Principles of Physiology. (3-4) Cr. 5. F.S. *Prereq: Biol 302.* Introduction to systemic functions with emphasis on mammals. Nonmajor graduate credit.

Zool 383. Women in Science and Engineering. (Same as W S 383.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: A 200 level course in science, engineering or women's studies; Engl 105.* The interrelationships of women and science and engineering examined from historical, sociological, philosophical, and biological perspectives. Factors contributing to under-representation; feminist critiques of science; examination of successful strategies.

Zool 398. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; junior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Zool 403I. Evolution. (Same as Ia LL 403I.) See *Iowa Lakeside Laboratory.* Nonmajor graduate credit.

Zool 404I. Behavioral Ecology. (Same as Ia LL 404I.) See *Iowa Lakeside Laboratory.* Nonmajor graduate credit.

Zool 405. Biology of Invertebrates. (Dual-listed with 505.) (3-0) Cr. 3 or (3-2) Cr. 4. F. *Prereq: Biol 302.* Emphasis on diversity, development, physiology and behavior of invertebrate organisms - the "spineless wonders" of the world. Laboratory emphasizes hands-on study and experimentation with living invertebrates. Nonmajor graduate credit.

Zool 415I. Freshwater Invertebrates. (Same as Ia LL 415I.) See *Iowa Lakeside Laboratory.* Nonmajor graduate credit.

Zool 419I. Vertebrate Ecology and Evolution. (Same as Ia LL 419I.) See *Iowa Lakeside Laboratory.* Nonmajor graduate credit.

Zool 420I. Amphibians and Reptiles. (Same as Ia LL 420I.) See *Iowa Lakeside Laboratory.* Nonmajor graduate credit.

Zool 428. Cell Biology. (3-0) Cr. 3. S. *Prereq: Biol 302.* Biological organization and function at the cellular level. Emphasis on biomembranes. Nonmajor graduate credit.

Zool 433. Developmental Biology. (Dual-listed with 533; same as Biol 433.) (3-0) Cr. 3. S. *Prereq: Biol 302.* Principles of multicellular development, from gametogenesis and fertilization through reproductive maturity. Emphasis is placed on understanding the underlying mechanisms that govern developmental processes.

Zool 433L. Developmental Biology Laboratory. (Same as Biol 433L.) (0-3) Cr. 1. S. *Prereq: Credit or enrollment in 433.* Experiments and explorations illustrating fundamental principles of multicellular development.

Zool 454. General and Comparative Endocrinology. (Dual-listed with 554.) (3-0) Cr. 3 or (3-3) Cr. 4. S. *Prereq: 355 and Biol 302.* Chemical integration of vertebrate organisms. The structure, development, and evolution of the endocrine glands and the function and structure of their hormones. Laboratory techniques for studying hormonal phenomena. Laboratory experiments require animal surgery and involvement outside of scheduled class time. Nonmajor graduate credit.

Zool 456. Neurobiology. (Dual-listed with 556.) (3-0) Cr. 3 or (3-3) Cr. 4. F. *Prereq: 310 or 355; physics recommended; permission of instructor to enroll in lab.* Integration, coding, plasticity, and development in nervous systems. Nonmajor graduate credit.

Zool 459. Environmental Physiology. (Dual-listed with 559.) (3-0) Cr. 3 or (3-3) Cr. 4. S. *Prereq: 355 or A Ecl 311; physics recommended.* Physiological adaptations to the environment with an emphasis on vertebrates. Nonmajor graduate credit.

Zool 462. Evolutionary Genetics. (Dual-listed with 562; same as Gen 462.) See *Genetics*. Nonmajor graduate credit.

Zool 490. Independent Study. *Prereq: 15 credits in zoological sciences; permission of instructor.* Students in the College of Agriculture may use no more than 6 credits of 490 toward the total of 128 credits required for graduation; students in the College of Liberal Arts and Sciences may use no more than 9 credits of 490 toward graduation.

I. Iowa Lakeside Laboratory.
R. Zoology research. Cr. 1 to 5 each time taken.
S. Attendance and critique of zoology seminars. Cr. 1. Offered on a satisfactory-fail grading basis only.
U. Laboratory teaching experience. Cr. 1 to 2. For students registering to be undergraduate laboratory assistants. Offered on a satisfactory-fail grading basis only.

Zool 498. Cooperative Education. Cr. R. F.S.SS. *Prereq: Permission of the department cooperative education coordinator; senior classification.* Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses Primarily for Graduate Students, Open to Qualified Undergraduate Students

Zool 501. Principles of Toxicology. (Same as Tox 501, VDPAM 501.) See *Toxicology* or *Veterinary Diagnostic and Production Animal Medicine*.

Zool 502. Methods of Toxicology. (Same as Tox 502, VDPAM 502.) See *Toxicology* or *Veterinary Diagnostic and Production Animal Medicine.*

Zool 505. Biology of Invertebrates. (Dual-listed with 405.) (3-0) Cr. 3 or (3-2) Cr. 4. *Prereq: Biol 302.* Emphasis on diversity, development, physiology and behavior of invertebrate organisms - the "spineless wonders" of the world. Laboratory emphasizes hands-on study and experimentation with living invertebrates.

Zool 507. Advanced Animal Behavior. (2-0) Cr. 2. S. *Prereq: 304; permission of instructor.* Analysis of current research in animal behavior with emphasis on physiological or endocrine control mechanisms.

Zool 510. Histology and Pathology of Fish Diseases. (Same as A Ecl 510.) (2-3) Cr. 3. Alt. S., offered 2002. *Prereq: A course in vertebrate histology or ichthyology.* Histology of teleost fishes; pathogen biology and analysis of cell and tissue changes in the major teleost diseases.

Zool 511I. Field Parasitology. (Same as Ia LL 511I.) See *Iowa Lakeside Laboratory*.

Zool 515. Ecology of Freshwater Invertebrates. (Same as A Ecl 515.) See *Animal Ecology.*

Zool 528. Cellular Growth and Regulation. (Same as MCDB 528.) (3-0) Cr. 3. F. *Prereq: Courses in cell biology and biochemistry.* Cell cycle, regulation of cell growth, cell division, membranes, transport processes, and regulation of cellular activities.

Zool 533. Principles of Developmental Biology. (Same as MCDB 533.) (3-0) Cr. 3. Alt. F., offered 2001. *Prereq: Biol 302.* Fundamental principles in multicellular development. Emphasis on understanding evolutionary conserved cellular and molecular regulatory processes as illustrated in classical studies and current literature.

Zool 540. Signal Transduction. (Same as BBMB 540, MCDB 540.) (3-0) Cr. 3. S. *Prereq: 528, BBMB 404.* Mechanisms and components of cellular signal transduction including receptors, G-proteins, second messengers, protein phosphorylation, other post-translational protein modifications, and transcriptional regulation.

Zool 542. Introduction to Molecular Biology Techniques. (Same as BBMB 542, Bot 542, FS HN 542, BMS 542.) Cr. 1 per module. F.S.SS. *Prereq: Graduate classification.* Workshops in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail grading basis only.

A. DNA Techniques. Includes genetic engineering procedures, sequencing, PCR, and genotyping.

B. Protein Technique. Includes fermentation, protein isolation and analysis, NMR and monoclonal antibody production.

C. Cell Techniques. Includes cell immobilization, ELISA, flow cytometry, karyotyping and image analysis.

D. Plant Transformation. Includes Agrobacterium and particle gun transformation, and analysis of transformants (enzyme assay, PCR, Southern blot).

Zool 554. General and Comparative Endocrinology. (Dual-listed with 454.) (3-0) Cr. 3 or (3-3) Cr. 4. S. *Prereq: 355 and Biol 302.* Graduate study in conjunction with 454. Chemical integration of vertebrate organisms. The structure, development, and evolution of the endocrine glands and the function and structure of their hormones. Laboratory techniques for studying hormonal phenomena. Laboratory experiments require animal surgery and involvement outside of scheduled class time.

Zool 556. Neurobiology. (Dual-listed with 456; same as Neuro 556.) (3-0) Cr. 3 or (3-3) Cr. 4. F. *Prereq: 355 or 310; physics recommended; permission of instructor to enroll in lab.* Graduate study in conjunction with 456. Integration, coding, plasticity, and development in nervous systems.

Zool 557. Advanced Neuroscience Techniques. (Same as Neuro 557.) See *Neuroscience.*

Zool 559. Environmental Physiology. (Dual-listed with 459.) (3-0) Cr. 3 or (3-3) Cr. 4. F. *Prereq: 355 or A Ecl 311, physics recommended.* Graduate study in conjunction with 459. Physiological adaptations to the environment with emphasis on vertebrates.

Zool 562. Evolutionary Genetics. (Dual-listed with 462; same as Gen 562.) See *Genetics.*

Zool 563. Molecular Phylogenetics. (Same as Gen 563, Bot 563.) (2-3) Cr. 3. F. *Prereq: Biol 303 and 301.* Estimation of phylogenetic trees from DNA sequence data. Course provides an overview of uses for phylogenetic trees in bioinformatnics, genomics, molecular genetic, and systematics and explores the relationship between data, models of molecular evolution and patterns of biological diversification.

Zool 566. Molecular Evolution. (Same as Bot 566.) See *Botany*.

Zool 568. Advanced Systematics. (Same as Ent 568.) See *Entomology*.

Zool 569. Biogeography. (Same as Bot 579.) see *Botany*.

Zool 590. Special Topics. (Same as Ia LL 590I.) Cr. 1 to 5 each time taken. *Prereq: Permission of instructor*.

Zool 590I. Graduate Independent Study. (Same as Ia LL 590I.) See *Iowa Lakeside Laboratory.*

Courses for Graduate Students

Zool 632. Current Topics in Signal Transduction. Cr. 2 to 3 each time taken. *Prereq: Permission of instructor.* Selected topics in signal transduction events, their molecular mechanisms and their relation to cellular processes. Topics may include cell recognition, second messenger systems, information integration and transfer, cell cycle, cell differentiation, and pattern formation.

Zool 660. Current Topics in Neurobiology and Behavior. (Same as Neuro 660.) Cr. 2 to 3 each time taken. *Prereq: Permission of instructor.* Topics may include communication, hormones and behavior, neural integration, developmental neurobiology, neuroanatomy and ultrastructure, sensory biology, social behavior, techniques in neurobiology and behavior.

Zool 690. Seminar in Zoology. Cr. 1 each time taken. Journal article critique and discussion by faculty and graduate students. Offered on a satisfactory-fail grading basis only.

A. Cellular, Molecular, and Developmental Biology
B. Biology of Populations and Organisms
C. Neurobiology
D. Physiology
E. Evolution
F. Animal Models of Gene Therapy
G. Behavior
H. Bioinformatics

Zool 696. Research Seminar. Cr. 1 each time taken. Research seminars by faculty and graduate students. Offered on a satisfactory-fail grading basis only.

A. Cellular, Molecular, and Developmental Biology
B. Biology of Populations and Organisms
C. Neurobiology
D. Physiology
E. Evolution
F. Animal Models of Gene Therapy
G. Behavior
H. Bioinformatics

Zool 698. Seminar in Molecular, Cellular, and Developmental Biology. (Same as MCDB 698.) See *Molecular, Cellular, and Developmental Biology.*

Zool 699. Research.

I. Iowa Lakeside Laboratory. See *Iowa Lakeside Laboratory.*

Courses Offered at the Gulf Coast Research Laboratory (GCRL), Ocean Springs, Mississippi

The Gulf Coast Research Laboratory is affiliated with the University of Southern Mississippi. Iowa State students may register for the following University of Southern Mississippi/ GCRL courses and transfer them to their ISU degree programs. Written permission of the ISU coordinator for the GCRL, 201 Bessey, is required for this arrangement. Inquire at 201 Bessey for further information.

MAR 301. Marine Biology. Cr. 3. SS. *Prereq: 8 semester hours of biological sciences.* A general introduction to marine biology with emphasis on local fauna and flora.

MAR 301L. Marine Biology Lab. Cr. 2. SS. Lab to accompany 301 .

MAR 403. Marine Invertebrate Zoology. Cr. 3. SS. *Prereq: 16 credits in zoology, including an introductory course in invertebrate zoology.* Concentrated study of free-living, marine invertebrates of the Mississippi Sound and adjacent continental shelf of the northeastern Gulf of Mexico. Emphasis on structure, classification, phylogeny, larval development, and functional processes.

MAR 403L. Marine Invertebrate Zoology Lab. Cr. 3. SS. Lab to accompany 403.

MAR 404. Parasites of Marine Animals. Cr. 3. SS. *Prereq: 311.* Study of the parasites of marine and estuarine animals with emphasis on morphology, taxonomy, life histories, and host-parasite relationships.

MAR 404L. Parasites of Marine Animals Lab. Cr. 3. SS. Lab to accompany 404.

MAR 408. Marine Ichthyology. Cr. 3. SS. *Prereq: 16 credits in zoology, including comparative anatomy.* Principles involved in classification and taxonomy of marine and estuarine fishes.

MAR 408L. Marine Ichthyology Lab. Cr. 3. SS. Lab to accompany 408.

MAR 430. Comparative Histology of Marine Organisms. Cr. 3. SS. *Prereq: Permission of instructor.* Detailed study of the histological organization of representative marine organisms at the light and electron microscope levels.

MAR 430L. Comparative Histology of Marine Animals Lab. Cr. 3. SS. Lab to accompany 430.