

College of Agricultural Sciences and Natural Resources

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Science, technology, business, education, research, production and the environment are key elements in America's largest industry. In order to feed and clothe the five billion people of the world, the agricultural industry needs human capital—scientists and specialists with essential skills in molecular genetics, human nutrition, soil and water sciences, international marketing, systems analysis, biosystems and agricultural engineering and other specialities.

The diverse careers available in agriculture and natural resources offer many choices. Graduates are qualified to fill a wide variety of jobs in scientific research, marketing, financial services, and the processing of information, as well as in traditional crop, animal, range, and forest production, the management of natural resources, and the protection of soil and water quality. OSU graduates can be a part of the modern agricultural technologies that will bring new discoveries and techniques to the world.

The College of Agricultural Sciences and Natural Resources prepares students to analyze information, think critically, problem solve, and assume leadership roles in their respective fields of study. Students also receive a solid general education in communications, humanities and social sciences. In the new agriculture, the graduate will have a rewarding career that will last as long as food is consumed, fiber is grown and soil, water and wildlife resources are valued.

Accreditation

Agricultural Sciences and Natural Resources include broad and diverse professions and do not have a single accrediting society as do some other professions. Programs in agricultural education, agricultural engineering, forestry, landscape contracting, and land-



scape architecture are accredited by their professional organizations.

In addition, each department's program is reviewed approximately once every five years by a panel of scientists and other professionals with national or international reputation for excellence in that respective discipline.

Academic Programs

Undergraduate Programs. The *Bachelor of Science in Agricultural Sciences and Natural Resources* degree is offered in the following major fields of study: agribusiness, agricultural communications, agricultural economics, agricultural education, animal science, biochemistry and molecular biology, entomology, environmental science, forestry, horticulture and landscape architecture, plant and soil sciences, and pre-veterinary science. The *Bachelor of Landscape Architecture* is also offered in the College of Agricultural Sciences and Natural Resources.

Graduate Programs. Graduate study is available in all academic departments in the College. In addition to the *Master of Agriculture* and *Master of Science* degrees that may be obtained through several departments, the *Doctor of Philosophy* degree (Ph.D.) may be earned in the following areas: agricultural economics, agricultural education, biosystems engineering, animal breeding, animal nutrition, biochemistry and molecular biology, crop science, entomology, food

science, plant pathology, soil science, and in forestry and horticulture through interdisciplinary programs in crop science, environmental science, and plant science.

High School Preparation and Admission Requirements

The high school preparation and admission requirements for the College are the same as the general University requirements. A solid background in English, algebra, and natural science is important preparation for the many academic programs in the various agricultural disciplines.

Transfer Students

Students who transfer from an accredited college or two-year college must meet the general University admission requirements. All transferred courses are recorded on the OSU transcript; however, no more than 65 hours from a two-year college will be used to meet the College's degree requirements. Specific departmental requirements needed for graduation are determined by the department in which the student plans to earn his or her degree.

Scholarships

Students enrolled and entering the College of Agricultural Sciences and Natural Resources were awarded \$785,000 in scholarships by the College and its departments for the 2003-2004 academic year. The following areas will be considered in the awarding of scholarships: scholastic standing in high school or college; leadership qualities which have been shown in school, church, community or youth groups; financial need; sincere interest in the various agricultural disciplines.

Applications and additional information may be obtained from the Office of the Associate Dean, College of Agricultural Sciences and Natural Resources, Oklahoma State University, 136 Agricultural Hall, Stillwater, OK 74078. Applications for new students may also be obtained from local high schools. Applications are available beginning November 15.

Academic Advising

All students in the College have the advantage of being advised by a faculty member working in the individual student's academic discipline. Such advisers are readily available to students and work closely with the students throughout their academic careers.

Special Academic Programs

Honors Program. The Honors College through the College of Agricultural Sciences and Natural Resources is designed to provide outstanding students with opportunities to pursue new challenges and academic excellence. Honors courses, seminars, and special honors contracts provide for discussions and independent thought by students who have the desire and ability to explore academic subjects beyond the normal class work material. Honors awards available in the College are:

1. General Education Honors.
2. Departmental Honors.
3. The bachelor's degree, with honors.

Awards (1) and (2) may each be earned independently of the other. Award (3) is earned by satisfying the requirements of both (1) and (2). The completion of each award is noted on the student's transcript. Students who complete all three receive the bachelor's degree with honors diploma.

All entering freshmen who have ACT composite scores of 27-29 and a high school GPA of 3.75 or better, or an ACT composite score of 30 or higher and a high school GPA of 3.50, are eligible to become a part of The Honors College. Sophomores, juniors, and seniors, with minimum cumulative grade-point averages of 3.25, 3.37, and 3.50, respectively, may enroll in The Honors College.

Additional information may be obtained from the director of The Honors College, 510 Library.

Pre-veterinary Medicine Curriculum.

The program in pre-veterinary medicine as offered in the College of Agricultural Sciences and Natural Resources includes all courses required for admission to the College of Veterinary Medicine.

Applicants must have completed at least 60 semester hours and have a minimum grade-point average of 2.80 in the required courses listed below (applicants must have satisfied all academic requirements by the last day of the spring term of the year in which admission is desired):

English composition (6 hours minimum): ENGL 1113 and 1213; or 1313 and 1413.

Technical report writing or English elective (3 hours minimum).

Inorganic chemistry and lab (8 hours minimum): CHEM 1314 and 1515.

Organic chemistry and lab (5 hours minimum): CHEM 3015 (or 3053, 3153, and 3112).

Biochemistry (3 hours minimum): BIOC 3653.

Mathematics (3 hours minimum): MATH 1513 (or any higher level mathematics).

Physics (4 hours minimum): PHYS 1014; or 1114 and 1214.

Animal nutrition (3 hours minimum): ANSI 3543.

Biological science (8 hours minimum): BIOL 1114 and 1604.

Microbiology and Lab (5 hours minimum): MICR 2125.

Genetics (minimum 3 hours): ANSI 3423 or PLNT 3554 or BIOL 3024.

Humanities/Social Sciences (6 hours minimum).

Although these course requirements may be completed within two years, most pre-veterinary medicine students complete at least three years of preparatory course work or a bachelor's degree. For more information on application requirements, refer to the "College of Veterinary Medicine" section in the *Catalog* and the current brochure, *OSU Veterinary Medicine Admission Requirements*. Students are also encouraged to contact the Office of the Assistant Dean for Academic Programs in the College of Agricultural Sciences and Natural Resources.

Pre-veterinary Science Degree. A Bachelor of Science in Agricultural Sciences and Natural Resources degree with a major in pre-veterinary science may be obtained after the completion of one year in the College of Veterinary Medicine. General education and other requirements for graduation in the College of Agricultural Sciences and Natural Resources must be met. Specific plans of study may be obtained from the Office of the Assistant Dean for Academic Programs, 136 Agricultural Hall.

General Education Requirements

The College of Agricultural Sciences and Natural Resources is committed to providing graduates both a depth of knowledge in their chosen field of study as well as breadth of knowledge outside their major. General education requirements are the same as those of the general University. Specific course offerings are given in the respective plans of study.

Graduation Requirements

General University requirements for graduation are stated elsewhere in the *Catalog*. In addition, specific requirements must be met for the Bachelor of Science in Agricultural Sciences and Natural Resources and Bachelor of Landscape Architecture degrees. For the B.S. degree, the required total semester credit hours varies by department, major and option. A minimum of 40 semester credit hours and 100 grade-points must be earned in courses numbered 3000 or above. The Bachelor of Landscape Architecture is a five-year program requiring 160 credit hours.

College and Departmental Clubs, Organizations and Honor Societies

Ag Communicators of Tomorrow
Aggie-X Club (agricultural economics)
Agriculture Ambassadors
Agriculture Student Council
Agronomy Club
Alpha Zeta (college honor society)
American Society of Agricultural Engineers
American Society of Landscape Architects
Associated Landscape Contractors of America
Biochemistry Club
Block and Bridle Club (animal science)
Collegiate Farm Bureau
Collegiate 4-H
Collegiate FFA (agricultural education)
Cowboys for Christ
Dairy Science Club
Environmental Science Club
Food Industry Club
Forestry Club
Golf Course Superintendent's Assoc. of America
Horticulture Club
National Agri-marketing Association
Oklahoma Collegiate Cattlewomen
Horseman's Association
Pi Alpha Xi
Pre-veterinary Medicine Club
Rodeo Association
Sanborn Entomology Club
Sigma Alpha
Sigma Lambda Alpha (horticulture and landscape architecture)
Society of American Foresters
Society of Range Management
Soil and Water Conservation Society
Turf Club
Xi Sigma Pi (forestry honor society)

Agricultural Communications

Professor and Head James G. Leising, Ph.D.

Modern agriculture, with its diversity and specialization, requires accurate communication between industry leaders and the general public. Education in agriculture and journalism trains the agricultural communications student to provide the necessary communications link.

By majoring in agricultural communications, a student may choose a special-interest area such as advertising, public relations, radio and television broadcasting, photography, reporting and news writing, or research report writing. Opportunities are also available for the student to develop a double-major program with other departments in the College of Agricultural Sciences and Natural Resources.

For the graduate with a bachelor's degree and a major in agricultural communications, career opportunities are abundant in the agricultural production industry, and service organizations as well as with publishing firms, broadcast stations or other media.

Agricultural Economics

Professor and Head James N. Trapp, Ph.D.

The Department of Agricultural Economics at Oklahoma State University offers programs of study leading to the B.S., M.S., M.Ag. and Ph.D. degrees in agricultural economics and the B.S. degree in agribusiness. Agricultural economics and agribusiness curricula study the economic relationships among individuals, firms and service agencies in agriculture and between the agricultural sector and other sectors of the economy. The department's courses emphasize the economic issues and concepts associated with producing, processing, marketing, and consuming agricultural goods and services and those used in the industry.

Undergraduate programs in agricultural economics and agribusiness combine instruction in technical agricultural sciences with education in the application of economic and business management principles and tools. The agricultural economist or agribusiness person

draws upon the physical and social sciences to outline, understand, and solve economic problems created by agriculture's dynamic operating environment. Curricula in the Department of Agricultural Economics emphasize the decision-making and problem-solving skills used in the management of agricultural production and marketing firms.

Study in agricultural economics or agribusiness prepares students to excel in many challenging careers. Many graduates work to improve food production and processing throughout the world. Other graduates work with government policies that affect the food and fiber sector. Others assist rural communities to adjust and thrive in the rapidly changing world. Graduates also help protect and maintain natural resources and the environment for the greatest benefit of society. Many graduates chose career paths that lead them far from the farm.

Agricultural Economics

The agricultural economics B.S. degree trains students to analyze problems and make decisions using a solid framework of economic and business principles. Study plans may be tailored to a wide variety of career interests. In addition to a base agricultural economics B.S. degree plan, the agricultural economics student can choose from four degree options: international agricultural marketing, a double major with accounting, a double major with agricultural education, and a double major with computer science. In addition, the base agricultural economics degree plan offers specializations in quantitative studies, environmental and natural resources, and community and regional analysis. Each of the study plans in agricultural economics equips students for a variety of employment opportunities at competitive salaries in private industry and government agencies.

Agribusiness

Like the agricultural economics degree the agribusiness B.S. degree trains students to analyze problems and make decisions using a solid framework of economic and business principles. In addition, the agribusiness degree targets the skills needed for careers in agribusiness firms, including all areas of food and fiber production, processing, and marketing. In addition to the base agribusiness degree plan, students may choose from six degree options: farm

and ranch management, agribusiness management, agribusiness marketing, agribusiness finance, pre-law, or pre-veterinary business management. Agribusiness students also may develop a minor area of study or a double major by selecting various course electives. Employment opportunities for agribusiness graduates are widely diverse, including jobs with farms, agricultural advisors, processing firms, wholesalers and retailers of food and fiber products, farm input supply firms, banks and other financial services firms, utilities and educational institutions.

Graduate Programs

The department offers graduate work leading to the Master of Science, the Master of Agriculture and the Doctor of Philosophy degrees. Both thesis and non-thesis options are available at the M.S. level. Ph.D. students complete a teaching practicum in addition to the research thesis as a part of the degree requirements.

The graduate program stresses development of superior professional competence, suited to the demands of the modern business, academic, government and research environments. Advanced courses concentrate on economic analysis applied to problems of production, distribution and consumption of agricultural products. Courses in economic theory, econometrics, mathematical economics, statistics, and computer science are an integral part of the program. Problems of agricultural policy, natural resource use and rural area development and planning are also important topics. The faculty give direction and individual guidance to student research in marketing, production, management of agricultural enterprises, price analysis, land and water use and development, rural development and planning, agricultural finance, international trade, farm appraisal and agricultural policy. Specialization is achieved through course electives and research topics. An advisory committee guides each student in the preparation of the program of study to ensure that background or prerequisite work and the graduate plan will lead to the desired depth and breadth of proficiency.

Admission Requirements. Prerequisites to advanced training in agricultural economics are (1) the desire to understand and solve the complex and changing economic problems faced by agriculture and rural society, and (2) the desire and ability to learn methods of rigorous logical analysis.

In addition, differential calculus, three semester hours of statistical methods,

and 15 semester hours of agricultural economics and economics, including intermediate micro- and macroeconomic theory, constitute a minimum background for advanced study in agricultural economics. In certain cases, a part of this work can be taken after admission but will not count toward a graduate degree.

Acceptance by an adviser in the department is not required prior to official admittance to the departmental graduate program.

Agricultural Education

Professor and Head James G. Leising, Ph.D.

The programs of study offered in agricultural education are designed to provide both comprehensive and specialized training to prepare graduates for careers in a wide range of fields of agriculture. In addition to being prepared for licensure as teachers, graduates are professionally prepared for work in cooperative extension and other federal and state programs and services, as well as international education endeavors. Graduates also may find employment as educational directors and consultants with agribusiness firms and organizations. Studies may culminate in the B.S., M.Ag., M.S. or Ph.D. degrees.

The agricultural education major has two options – teaching, and leadership and service.

The undergraduate teaching option is designed to qualify the bachelor's degree recipient for the Oklahoma Agricultural Education Teaching License. This license is recognized as meeting requirements for initial employment as a teacher in most states. The leadership and service option is designed to focus on careers relating to education or service in agriculture, outside of the public school setting. Graduates look forward to careers ranging from cooperative extension educator to agricultural sales, marketing and production positions. Some students find it advantageous to elect a dual major, thus meeting requirements in both agricultural education and another major within the College of Agricultural Sciences and Natural Resources. The undergraduate options in agricultural education are structured to provide educational experiences in general education, agriculture and professional education.

Minor in Leadership Education. The minor is designed to prepare students to serve as leadership educators within the

context of their chosen major. Students explore career options in leadership education, develop an understanding of their own leadership style and philosophy, acquire knowledge about leadership theory, explore contemporary issues in leadership, evaluate current leadership research and learn to facilitate leadership training. Requirements of the minor include 14 hours of courses focused on leadership, as well as six hours of controlled electives.

Graduate Programs

Graduate programs in agricultural education are designed to (1) prepare students for entry into or advancement in teaching careers and (2) provide for further development of professional leadership skills for other educational careers in agriculture, agribusiness, government service, extension, or adult education. To meet needs of both international and domestic students plans of study are developed for academic excellence specific to students' career goals. The selection and organization of courses are made in consultation with the adviser and the student's advisory committee.

The Master of Agriculture is offered to further knowledge and skills of agriculture and education in preparation for and advancement in teaching, extension administration and other professional areas. Two options are offered in the Master of Agriculture program. The creative component option requires 36 approved semester credit hours of course work, including a two-credit-hour creative component, which may involve curriculum, teaching methods, literature or some similar area. The internship option requires 36 approved semester credit hours of course work, which include six hours of credit for a professional internship.

The Master of Science develops the theoretical and research foundation for further graduate studies in addition to further knowledge and skills in agriculture and education. It is designed primarily for those students interested in research. Two options are offered in the Master of Science program. The thesis option requires 30 approved credit hours of course work, which includes a six-credit-hour formal thesis following the graduate college format. The formal report option requires 32 approved semester hours of course work, which includes a two-credit hour formal report.

The Doctor of Philosophy program is designed to prepare graduates for careers in teacher education, supervision, administration, curriculum development and other areas of professional leadership in agriculture, agricultural extension

or vocational education. Within the minimum 60 credit hour requirement, 20 credit hours must be completed in agricultural education. In addition, 13 credit hours must be completed in an area of specialization such as agricultural extension, technical agriculture, educational administration, or other similar area. The additional hours include 12 hours of research design and statistics and 15 hours for the dissertation.

Admission Requirements. Students seeking admission to the master's degree program must have earned a bachelor's degree in agricultural education, agriculture or education. A student with background deficiencies must compensate for such deficiencies before completing the masters degree. Evidence of academic ability (2.80 GPA or above) in undergraduate course work is required. Three letters of reference and a statement of purpose are also required. Graduate Record Exam (GRE) scores are required for students seeking admission to the Master of Science degree program.

Admission to the doctoral degree program is based upon evidence that the applicant meets the general requirements of the Graduate College, has demonstrated superior achievement, and can successfully complete a doctoral program as evidenced by three letters of recommendation, GRE scores, a minimum of 2.80 undergraduate grade-point average and 3.00 graduate grade-point average, three years of successful professional experience, and a philosophy statement and goals. Alternative criteria may be considered by the graduate committee for those who submit ample supportive evidence of other exemplary qualifications.

Student fee waivers are available for qualifying master's degree candidates. A grant and loan program is available through the Office of Student Financial Aid. Doctoral degree candidates may qualify for teaching and research assistantships. In addition to the assistantships, doctoral candidates may qualify for fellowships and fee waivers.

Agriculture

Professor and Associate Dean
Edwin L. Miller, Ph.D.

Graduate Programs

The Master of Agriculture degree is designed for students interested in graduate professional training with a strongly applied research orientation. The degree is offered in the following areas of

emphasis: agricultural economics, agricultural education, animal science, entomology, forestry, horticulture and landscape architecture, plant and soil sciences, and plant pathology.

Purpose. The purpose of this degree is to provide a program which will give additional specialization in technical fields, as well as increased breadth of training. Students who are interested in working toward the Ph.D. degree should follow the regular Master of Science degree program.

Character of Program. This program will provide a greater breadth of study than the Master of Science program. Emphasis will be given to practical application of the technical aspects of the discipline as well as discipline interrelationships. The principal focus, however, is on an applied research concept and a broader program than is normally available with the specialized research degree.

Admission Requirements. A baccalaureate degree in agriculture or a related field is required for admission. The candidate must meet requirements for acceptance into the Graduate College and be recommended by the departmental graduate committee responsible for the program.

Degree Requirements. The requirements for this degree are the same as those listed in the *Catalog*, "Graduate College" section, under "The Master's Degree."

In addition, each candidate approved for study under this program will be assigned an adviser and advisory committee with whom he or she will develop a plan of study in accordance with guidelines established in the department. A preliminary plan of study must be approved by the Office of the Associate Dean for Academic Programs and must be filed in the Graduate College Office prior to enrollment for the 17th credit hour. Departmental comprehensive final examinations will be required of all Master of Agriculture candidates.

Degree Options. *Option A Requirements.* A total of 32 approved semester credit hours of work, including an approved report having a credit hour value of not more than two credit hours, is required.

Option B Requirements. A total of 36 approved semester credit hours of work is required and must contain a creative component. No report is required.

Option C Requirements. A total of 36 approved semester credit hours of work, including six hours of credit for a professional internship, is required. The internship includes professional practice and a report.

Animal Science

Professor and Head Donald G. Wagner, Ph.D.

The Department of Animal Science offers professional training at both the undergraduate and graduate levels. The undergraduate program leads to the Bachelor of Science in Agricultural Sciences and Natural Resources degree. Graduate studies culminate in the Master of Science, Master of Agriculture (emphasis in animal science) or the Doctor of Philosophy in nutrition, animal breeding and animal reproduction, or food science.

Animal science is concerned with the science, art and business of the production of beef cattle, dairy cattle, horses, poultry, sheep and swine. An animal scientist is concerned with the application of the principles of the biological, physical and social sciences to the problems associated with livestock production and management.

Animal science is also concerned with the products of food animals: meat, dairy foods and eggs. The food industry is one of the largest and most important industries in the United States. Students can gain expertise in the processing, quality control and marketing of meat, dairy and poultry products.

Undergraduate students may elect an option in the areas of animal biotechnology, business, food industry, food science, international, livestock merchandising, pre-veterinary animal science, production, and ranch operations, or a double major with agricultural communications or with agricultural education. In addition, students have the opportunity to concentrate their studies on one of the animal groups (meat animals, dairy, horses or poultry). Internship programs providing three to six months of off-campus work experience are available in all options. Participation in undergraduate clubs (Block and Bridle, Dairy Science, Horsemen's Association, Food Industry, Oklahoma Collegiate Cattlewomen and Oklahoma State Collegiate Cattlemen's clubs) or judging teams (livestock, meat, horses, dairy cattle, or poultry) improves social, communication and leadership skills.

Students interested in veterinary medicine may complete the pre-veterinary medicine requirements at the same time they are working toward a B.S. degree in animal science. In addition, pre-vet students gain valuable insight into the care and management of animals throughout the animal science curriculum.

Undergraduate students follow a similar curriculum during the first two years

which includes basic courses in the physical, biological and social sciences, and a series of introductory courses in agriculture and business. Upper-class students take a basic core of advanced animal science courses including genetics, physiology, nutrition or food science. As seniors, students complete a series of advanced animal science courses which are designed to apply knowledge obtained in previous courses to livestock or food production systems. Every opportunity is taken in teaching to utilize the excellent herds, flocks and processing facilities owned or operated by the department.

Students completing a degree with a major in animal science have a wide choice of challenging careers including ownership or management of farms, ranches, feedlots; employment with state and federal agencies concerned with inspection, grading or regulation; sales and service positions with companies involved with feeds, pharmaceuticals or other livestock products; opportunities in agricultural extension or teaching; and work in the processing, distributing and merchandising of dairy, poultry and meat products. Students who earn the master's or doctorate can look forward to careers in teaching, research or extension with universities, the U.S. Department of Agriculture or private industry.

Graduate Programs

The Department of Animal Science offers graduate work leading to the Master of Science degree in animal science or food science. Research work at the M.S. level is available in the areas of animal breeding (genetics), animal nutrition, animal physiology or food science (meat or milk products). A Master of Agriculture degree in the emphasis area of animal science is also available. The department offers programs leading to the Doctor of Philosophy degree in animal breeding and reproduction, animal nutrition, and food science.

Prerequisites. Admission to the graduate program requires an undergraduate major in animal science, dairy science or poultry science, or in closely-related biological sciences or biochemistry. In addition, students with a major in dairy manufacturing, microbiology, human nutrition, food science, or food technology can qualify for the program in food science. A student enrolling in a degree program must have been accepted by an adviser prior to official admission. In all cases, the student's graduate adviser or committee may recognize specific undergraduate deficiencies and require measures to attain proficiency.

Biochemistry and Molecular Biology

Regents Professor and Interim Head
Margaret K. Essenberg, Ph.D.

Biochemistry, the central scientific discipline linking the chemical, physical and biological sciences, exerts a profound influence on the progress of medicine and agriculture. By applying concepts and methods of chemistry and physics to the fundamental problems of biology, biochemists have made great progress in their effort to understand the chemistry of living organisms. Major discoveries concerning the biochemistry of genetic material provide the tools of molecular biology that are essential to contemporary life sciences research.

Biochemists and molecular biologists are concerned with living things. They must acquire some knowledge of the biological sciences. Since a biochemist's tools are the physical sciences, he or she must receive sound education in mathematics, physics and chemistry.

Challenging positions for well-trained biochemists and molecular biologists are available in colleges and universities, state and federal laboratories, research institutes, medical centers and in an increasing number of industrial organizations, particularly the pharmaceutical and food industries. Biochemists are involved with research on the chemistry of processes occurring in plants, animals, and various microorganisms, and with the discovery and development of antibiotics, vitamins, hormones, enzymes, insecticides and molecular genetic techniques.

At the undergraduate level a major in biochemistry and molecular biology administered by the Department of Biochemistry and Molecular Biology is available through the College of Agricultural Sciences and Natural Resources. The department also offers a B.S. degree in biochemistry through the College of Arts and Sciences. An honors program is available. The curriculum provides a broad background in chemistry and biological science and permits flexibility in meeting particular interests of the student. Courses in biochemistry are based on general, organic and analytical chemistry. The biochemistry and molecular biology curriculum provides students with sufficient background in the basic sciences of mathematics, physics, chemistry and biology to meet the needs for graduate study in most fields of modern science related to agriculture or medi-

cine. The curriculum is excellent for preprofessional students of medicine, dentistry and veterinary medicine. The department's research activities provide opportunities for part-time employment of undergraduate majors to improve their professional competence.

Graduate Programs

Because many of the opportunities in biochemistry require advanced course work, a major part of the program in the Department of Biochemistry and Molecular Biology is concerned with its graduate program leading to the M.S. or Ph.D. degree. This graduate program is an integral part of extensive basic research activities in the Oklahoma Agricultural Experiment Station.

Prerequisites. Although the B.S. in chemistry or biochemistry is preferred, students with strong backgrounds in other biological or physical science disciplines are eligible. Individuals not having at least eight semester credit hours each of organic chemistry and calculus plus four credit hours each of analytical and physical chemistry must take appropriate undergraduate courses to make up deficiencies. The results of the three general GRE exams (verbal, quantitative, analytical) are required for entrance. An advanced GRE subject matter exam (biochemistry, chemistry or biology) is also recommended. A cumulative GRE score of 1500 is normally required.

Degree Requirements. A more detailed description of the graduate study program in biochemistry is available from the department upon request. The requirements listed below complement the general graduate requirements described in the "Graduate College" section of the *Catalog*. After the first semester, continuous attendance and participation in the departmental seminar is expected.

The Master of Science Degree. Twenty-four credit hours of formal graduate courses are required, including BIOC 5753, 5824, 5853, and 5930. In addition, a student must present an acceptable research thesis (six hours) and pass a final oral examination covering it and related material. Research advisers are selected at the end of the first semester.

A non-thesis Master of Science degree is also available. It does not require a research thesis, but requires a report and extensive technical training in the laboratory. The non-thesis M.S. is not recommended for students wishing to pursue a Ph.D. later.

The Doctor of Philosophy Degree. The course requirements are determined with the aid of the student's graduate advisory committee. Usually they follow these

guidelines: total of 30-40 credit hours of formal graduate course work which includes all the courses listed for the M.S. degree, at least four of the advanced graduate courses in biochemistry (6000 level) and two offerings of Special Topics (6820). Additional course requirements, appropriate to the student's interests, are determined by the advisory committee. The advisory committee is selected at the end of the second semester. Each student will take a series of cumulative examinations beginning in January of his or her first year. A more comprehensive qualifying examination is also given, usually during the fourth semester of graduate study.

One year of a foreign language at the college level is required. The student must present, and defend in a final oral examination, an acceptable research thesis which contains a substantial original contribution to the field of biochemistry. The department offers research experience in a variety of areas of biochemistry.

Biosystems and Agricultural Engineering

Professor and Head Ronald L. Elliott,
Ph.D., P.E.

The Department of Biosystems and Agricultural Engineering is administered jointly by the College of Agricultural Sciences and Natural Resources and the College of Engineering, Architecture and Technology.

Biosystems engineers are professionals who create and adapt engineering knowledge and technologies for the efficient and effective production, processing, storage, handling and distribution of food, feed, fiber and other biological products, while at the same time providing for a quality environment and preserving and protecting natural resources. Subject-matter specialization is provided through the following four undergraduate option areas: biomechanical, bioprocessing and biotechnology, environment and natural resources and food processing.

Biosystems engineering courses integrate engineering sciences, physical sciences, and biological sciences, and teach students to address real-world challenges. With the guidance of experienced faculty, students work both as individuals and in teams to design creative solutions to complex problems.

The overall objective of the undergraduate biosystems engineering degree program is to provide the comprehensive education necessary to prepare students for successful, productive and rewarding careers in engineering for agricultural, food and biological systems. Graduates of the program will:

be able to apply mathematical, physical, engineering, and biological principles needed to understand, analyze and solve problems in food, agricultural, environmental and biological systems.

be effective in oral, written and visual communication.

be self-motivated in accomplishing tasks, both as an individual, and as a contributor to multi-disciplinary teams.

be able to understand the social, environmental, safety and economic impact of their work in local and global contexts, and to perform in a professional and ethical manner.

be committed to enhancing knowledge and skills through continuing education.

The undergraduate educational program is divided into two components—preprofessional and professional. In the preprofessional portion of the biosystems engineering program (usually equivalent to two years of study) the focus is on the underlying biological, physical, chemical and mathematical principles of engineering, supplemented by appropriate general education courses in English, social sciences and humanities. Students who demonstrate proficiency in this portion of the program are eligible for admission to the professional school in biosystems engineering.

The professional school of biosystems engineering curriculum (typically two years) builds systematically upon the scientific knowledge acquired in the preprofessional curriculum. In professional school, students have the opportunity to focus on the option areas given above. The degree is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology under agricultural engineering and similarly named programs.

Each professional school course builds upon preceding engineering courses to develop in the student the ability to identify and solve meaningful engineering problems. The course work is specifically sequenced and interrelated to provide design experience at each level, leading to progressively more complex, open-ended problems. The course work incorporates the social and economic aspects of technical problems, and stresses the responsibilities as engineering profes-

sionals to behave ethically and promote occupational and public safety. The program culminates in senior year design courses in which students integrate the analysis, synthesis and other abilities they have developed throughout the earlier portions of their study into a capstone experience. At this point, they are able to design components, systems and processes that meet specific requirements, including such pertinent societal considerations as ethics, safety, environmental impact and aesthetics. The students have also developed and displayed the ability to conduct experiments essential to specific studies and to analyze the experimental results and draw meaningful conclusions.

An integral part of this education continuum from basic science through comprehensive engineering design are learning experiences that facilitate the students' abilities to function effectively in both individual and team environments. Moreover, the program provides every graduate with adequate learning experiences to develop effective written and oral communication skills. State-of-the-art computational tools are introduced and used as a part of their problem-solving experiences. Finally, the students' experiences in solving ever-more-challenging problems enables them to continue to learn independently throughout their professional careers.

A wide variety of employment opportunities are available for biosystems engineers in industry, public service and education. Some of these opportunities include positions in governmental agencies, consulting engineering firms, and agricultural and food equipment industries. Biosystems engineers are employed throughout the US as well as internationally.

Students interested in a degree in biosystems engineering may initially enroll in either the College of Agricultural Sciences and Natural Resources or the College of Engineering, Architecture and Technology. Students who enroll in the College of Agricultural Sciences and Natural Resources should request a biosystems engineering adviser and transfer to the College of Engineering, Architecture and Technology by the end of their first semester.

Graduate Programs

The Department of Biosystems and Agricultural Engineering offers programs leading to the Master of Science and Doctor of Philosophy degrees. These degrees emphasize research and development.

Excellent laboratory and computer facilities are available for students to

explore research and design in such areas as bioprocessing and food engineering, machine vision, sensor and control technology, waste management and utilization, hydrology, water quality, porous media flow, and intelligent systems for agricultural production.

Research projects are supported by the Agricultural Experiment Station and by state, federal and private grants and contracts. A well-trained faculty, many of them registered professional engineers with research, consulting and design experience, guide the graduate students' activities and plan programs to meet students' needs. Graduate students design experiments and special equipment to conduct their work. They are expected to demonstrate, by supporting research or by designs, the ability to identify a problem, define alternatives, propose a solution, organize a design or an experimental investigation, carry it to completion and report the results.

Admission Requirements. Admission to either the Master of Science or Doctor of Philosophy degree program requires graduation from an engineering curriculum accredited by the Accreditation Board for Engineering and Technology. Students without accredited degrees may be admitted provisionally and may be required to take additional courses. A student must be accepted by an adviser in the department prior to official admission to the graduate program.

Degree Requirements. A candidate for either of the graduate degrees listed above follows an approved plan of study which must satisfy at least the minimum University requirements for that particular degree.

Entomology

Undergraduate Coordinator Richard Berberet, Ph.D.

Graduate Coordinator Jack Dilwith, Ph.D.

Entomology is the science and study of insects and related arthropods such as ticks, mites and spiders. This discipline offers students opportunities to explore the diversity of nature through the study of arthropods. In addition, they may learn about the sophisticated biological and physiological phenomena associated with these organisms. Discovery of the importance of arthropods as competitors with human society for food and fiber is a central theme in entomology. Arthropods serve as vectors of human and animal diseases, biomedical research organisms and pollinators. These animals also form an intricate part of the food web;

regulation of pest populations must be done in an environmentally safe manner.

A strong academic background in the physical and biological sciences is essential before enrolling in specialized subject matter in entomology. Specialized subject matter includes insect identification, biology, ecology, physiology, biochemistry, population dynamics, medical and veterinary entomology and pest management.

There are many diverse job and career prospects for graduates. Current undergraduates are preparing for careers in veterinary medicine, medicine, law and graduate school. Others gain employment with private industry, research laboratories, or county, state or federal agencies. Some develop their own businesses as consultants and entrepreneurs.

Graduate Programs

The entomology faculty offers programs of study and research leading to the degrees of Master of Science and Doctor of Philosophy. Students making application must be accepted by an adviser and approved by the program graduate committee prior to being admitted to the Graduate College.

Each program of study will be under the direction of an advisory committee. The program will be adapted to the individual's needs but will comply with all departmental and Graduate College requirements. The thesis option for the M.S. requires a minimum of 30 credit hours. An oral examination is required of all candidates and M.S. students are also required to defend publicly. Graduate student candidates are required to meet with their advisory committees every six months for program reports and examinations. Doctoral candidates are required to present public defenses of their dissertations and must assist in teaching one or more courses. Students supported as half-time research assistants are expected to be active participants in the research projects of their major professors.

Environmental Science

Director David K. Lewis, Ph.D.

The College of Agricultural Sciences and Natural Resources offers an undergraduate major in environmental science. This program is an interdisciplinary study of the biological, physical, and social sciences, and their application to envi-

ronmental concerns. These applications are designed to improve the current and future welfare of the human race with environmental policies based on scientific principles and in accordance with the true benefits and costs as evaluated by an informed society.

Since this major is interdisciplinary and science-oriented, the student will take basic courses in biology, chemistry, math, physics, statistics, and several social sciences. The student may choose one of three areas of emphasis (options): water resources, natural resources, or environmental policy. Depending on the option, upper-division course work will involve problem-solving work in water and soil quality, economic and social policy, political science, resource management and engineering. The student will also be exposed in general education subjects, including communications, philosophy, ethics and sociology.

A primary goal of this program of study is to enable graduates to solve environmental problems based on scientific principles and in accordance with society's needs. Through successful completion of this major the student earns the Bachelor of Science in Agricultural Sciences and Natural Resources.

The environmental science undergraduate major is directly supported by faculty from the departments of Agricultural Economics, Entomology and Plant Pathology, Forestry, Horticulture and Landscape Architecture, and Plant and Soil Sciences. The major and its students also benefit from working in and out of the classroom and laboratory with faculty who are conducting cutting-edge research involving environmental problems.

Graduates work in such areas as land-use planning, environmental control, natural resources management, waste disposal, water and soil quality, environmental remediation and policy analysis. Industries associated with the extraction, utilization and manipulation of natural resources have increased the number of employees with environmental training to address regulation compliance, litigation, monitoring, public relations and management practices.

Graduates may also work with federal, state and local government agencies involved in regulation, resource management and policy development. Graduates, particularly those who have gone on to earn advanced graduate degrees, find employment with consulting firms that are involved with solving environmental problems. Many graduates go on to graduate school or pursue a degree from a professional school, such as law or medicine.

Forestry

Undergraduate Coordinator Thomas Kuzmic, Ph.D.

Graduate Coordinator Stephen Hallgren, Ph.D.

America's forests are an invaluable renewable natural resource. With proper decisions concerning management, forests can provide a bounty of uses and values for generations to come.

Professional foresters play a vital role in managing, sustaining and utilizing the forest and its diverse resources: timber, water, wildlife, range forage, recreation and wilderness. Foresters devote effort to protecting forests from the harmful effects of fire, disease and insects. Foresters are problem-solvers using a blend of ecology, technology, economics and sociology to provide benefits and services desired by society. Foresters may work with private landowners or city planners, teach and conduct research at universities, administer parks and recreation areas, manage the business of the forest industry, or manage public forest lands.

Graduates may be employed by federal agencies, including the U.S. Forest Service, Bureau of Land Management, the Natural Resources Conservation Service, the Fish and Wildlife Service, or the Bureau of Indian Affairs. In addition, state, county and municipal governments employ foresters in a variety of resource management and service positions. Wood-using industries retain foresters for land management, land and timber acquisition and harvesting positions as well as in mill production and administrative positions. Foresters work for associations promoting the use of forest products and in many other public relations jobs. Some foresters are self-employed as consultants, specializing in timber and land appraisals, management planning and a variety of special services. Recipients of advanced degrees, especially the doctorate, may conduct industrial research or may enter the academic profession.

The forestry faculty supports a major in forestry leading to the degree of Bachelor of Science in Agricultural Sciences and Natural Resources degree.

The forestry curriculum leads to the first professional degree in forestry and is accredited by the Society of American Foresters (SAF). SAF is recognized as the specialized accrediting body for forestry in the United States. Considerable breadth exists in the forestry curriculum, affording the student and faculty adviser the opportunity to develop a specialized curriculum focused on a wide array of natural resource specialties,

such as water, recreation, range or wildlife. For the student with a research career in mind, course work in basic and applied science is available. Requirements for a B.S. degree include the successful completion of a seven-week summer camp and a total of 130 credit hours of course work. The summer camp is scheduled to follow the sophomore year and is held annually in diverse forest settings. Past summer camps have been held across the U.S. from Maine to Oregon, from Montana to Florida, and even in Brazil. Field forestry skills, forest ecology, and state-of-the-art operations are emphasized at camp.

A forestry research station is located in southeastern Oklahoma in the midst of the Ouachita National Forest, and industrial timber holdings. Oklahoma has an active and progressive forest industry. One of the largest paper mills in the southern United States is located in the pine-oak forests of southeastern Oklahoma. Oklahoma forests are also prized for their clean water and recreational and wildlife benefits. Field trips to this area comprise part of the instruction in some forestry courses.

Graduate Programs

The forestry faculty offers instruction leading to Master of Science degrees in forest resources and environmental science for students interested in graduate training with a research orientation. The Master of Agriculture degree with an emphasis in forestry is offered for students interested in non-research graduate work. Programs of instruction and research leading to a Doctor of Philosophy degree are available through cooperating departments, such as the Department of Agricultural Economics or Zoology, or interdisciplinary programs in environmental science, crop science, or plant science, with a forestry adviser.

Instructional programs are designed to serve the needs of individual students and allow concentration in the areas of: biometry, ecology, physiology, economics, genetics and tree improvement, silviculture, forest management, wildlife, and watershed management. The prerequisite for graduate study in forestry is a bachelor's degree in an area aligned with the students' research interests with an overall undergraduate grade-point average of 3.00 ("B" average). Students without a bachelor's degree in a field of study aligned with their research interests may be required to complete a core of supporting courses as determined by the student's adviser and graduate committee. Applicants for graduate study who are also requesting financial assistance are required to submit test results from

the Graduate Record Examination for full consideration.

Students preparing for the Master of Science in forest resources are required to complete 30 credit hours of course work including six hours of Research and Thesis (FOR 5000) (Plan I). Students preparing for the Master of Agriculture degree may elect to meet the requirements of Options A, B or C. (See the "Graduate Programs" section of "General Agriculture.")

A student must be accepted by a forestry adviser on the Graduate Faculty prior to official admission to the program.

Horticulture and Landscape Architecture

Professor and Head Dale M. Maronek, Ph.D.

Horticulture is the science and art associated with the culture, production, preservation and processing of flowers, trees, shrubs, turfgrass, vegetables, fruits and nuts. It also includes the proper environmental use and maintenance of plants in the landscape. Thus, horticulture is involved with the production and processing of a significant part of the nation's food supply and provides a major source of the beauty in and around homes, cities, parks, highways, golf courses and other public areas.

Today, horticulture requires highly trained and capable people to help meet the food demands of society and to be involved in activities that lead to a better quality of life. The horticulture student must have a good understanding of plant biology and commercial production/maintenance and business practices.

Educational opportunities for study in horticulture cover a wide variety of plants and subjects and range from the cellular to the whole plant level. Factors such as nutrition, irrigation, genetics, propagation, control of flowering, and fruit and seed production are considered in their relationship to culture, production, harvesting, processing and storage. Students can prepare themselves for careers in public grounds administration (arboreta, parks and zoos), golf course management, horticulture business, sales and marketing, production, teaching, extension and research.

The training that the student obtains is related to the specific area of emphasis that is chosen. Regardless of one's interest, objectives, or area of emphasis, a

good knowledge and understanding of horticulture is a necessity. A student can receive a B.S. degree and choose from the following three options:

Horticulture provides the training and expertise for production and preservation of fruits, nuts, vegetables, nursery crops, flower crops, etc. Training can be general, have a business or science orientation, or be chosen to emphasize a particular commodity area of horticulture.

Turf management provides the training for turfgrass production and for management of turfgrass in golf courses, parks, athletic fields, home landscapes, and along highways.

Public horticulture emphasizes the administration, leadership, and management of public gardens and their diverse operations. This four-year program is one of very few in the United States and is appropriate for individuals interested in careers in arboreta, botanic gardens, zoos, horticultural societies, park systems, museums, habitat restoration (especially disturbed areas and/or wetlands) civic garden centers, and other public sector institutions. Students complete a well-rounded selection of horticulture courses and courses in business management, design, leadership, education and botany. The option can also lead to graduate study. Students have the opportunity to be involved in the Oklahoma Botanical Garden and Arboretum and the department's television show, *Oklahoma Gardening*.

After the B.S. degree is completed, a qualified student may choose to pursue a graduate degree, specializing in any option. Students from other departments may also choose to pursue a formal academic minor in horticulture.

Landscape architecture as a field deals with the planning and design or arrangement of natural and artificial elements on the land through preservation of existing natural and synthetic resources, and through application of cultural and scientific knowledge.

Landscape architecture is the study of design of outdoor spaces, with supporting courses in art, construction, ecology, horticulture and social science in a five-year professional program leading to the Bachelor of Landscape Architecture (B.L.A.) degree. The B.L.A. degree is accredited by the American Society of Landscape Architects. Typical employers include landscape architecture firms, architectural engineering firms and government agencies dealing with land planning, urban planning, parks and recreation.

In an effort to maintain an effective balance between students, faculty, and facilities, enrollment in the fourth and fifth years of the program is limited to 15

students each. Students will be evaluated during their third year by the faculty in order to select the most qualified candidates based upon academic achievement and professional potential. Minimum requirements may vary each year; however, a student must have completed a minimum of 60 credit hours.

Landscape contracting is a program that emphasizes the construction and management phases of landscape development. It is a four-year program leading to an accredited B.S. degree. The degree is accredited by the Associated Landscape Contractors of America. Course work includes basic landscape architectural design, construction technology, business and horticulture. Students have the option of specializing in either landscape construction or landscape management. Graduates are employed by landscape contracting companies, design-build firms, landscape maintenance companies and landscape nurseries.

Graduate Programs

The department offers programs of study leading to the degrees of Master of Science in horticulture and Master of Agriculture with specialization in horticulture, and to the Ph.D. degree in crop science, environmental science, and plant science, each with a specialization in horticulture. Areas of study include floriculture crops, fruit and nut crops, vegetables, ornamental nursery crops, and turf. In addition to commodity-oriented specialities, students may emphasize food processing, postharvest physiology, or stress physiology disciplines. Applicants should indicate their interest area(s). Research opportunities range from whole plant production/management studies to fundamental cellular studies.

Prerequisites. Admission requires a bachelor's degree in horticulture or a related field with at least a 3.00 ("B") grade-point average. Students with course work deficiencies in fundamental areas may be required to take remedial courses to attain proficiency in accordance with the advisory committee's guidance. In addition to Graduate College requirements, applicants must submit official GRE scores.

Prior to admission to the program, all horticulture applicants for advanced degrees must be approved by the graduate committee and an advisor on the Graduate Faculty in the department. The program of study and research will be directed by the student's graduate adviser and advisory committee.

Plant Pathology

Graduate Coordinator Jack Dilwith, Ph.D.

Plant pathology is a broad discipline that ranges from basic studies of physiological and genetic aspects of plant diseases to the development of practical plant disease controls. It encompasses the science required to understand the causes of plant diseases as well as the art of preventing or controlling these diseases. Thus, the plant pathologist must have knowledge of plant biology as well as practical plant culture. Plant pathology, as a discipline, is actively involved in the newly emerging field of biotechnology.

Graduates in plant pathology (Ph.D.-level individuals) commonly find employment as research scientists in universities, the government (U.S. Department of Agriculture), industry or with various international development agencies. Graduates with the M.S. degree often work as research technicians in industries, universities or government laboratories or as sales or technical representatives in the agrichemical or plant breeding industries.

To qualify for graduate study in plant pathology an undergraduate student should obtain a solid background in the basic sciences, especially biology and chemistry, mathematics, English and communication skills.

In order to become a fully trained plant pathologist, one or more graduate degrees in plant pathology are required. The department offers both M.S. and Ph.D. programs with opportunities to specialize in a wide range of basic or applied research fields.

Graduate Programs

The department offers programs of study and research leading to the Master of Science, Master of Agriculture in the emphasis area of plant pathology, and Doctor of Philosophy degrees. Programs are concerned with the cause, development, and management of plant diseases. Research problems are involved with on-going projects in the Oklahoma Agricultural Experiment Station, which include investigations on disease management (chemical, cultural, biological, and genetic) soil-borne diseases, virology, phyto bacteriology, genetics, host-parasite physiology, and application of biotechnology and molecular genetics to basic plant disease research. Individual programs can be developed toward basic research or can be developed to provide a broad practical background in plant health and pest management.

Admission Requirements. It is desirable that applicants have a strong background in biological or agricultural sciences. All requirements of the Graduate College must be satisfied by each applicant. In addition, applicants for graduate programs in plant pathology are required to take the Graduate Record Examination and to submit their scores with their applications and transcripts. Approval for admittance will be determined by the departmental screening committee and the department head. During the first semester of enrollment, each student, after council with the department head, will select a faculty adviser. Each graduate program is under the direction of the major adviser and a selected faculty committee and is adapted to the needs of the graduate student. There is no graduate credit for courses below the 4000 level. Each student will follow a program of study and research approved by his or her committee and, except for the Master of Agriculture degree, must submit an approved thesis.

Plant and Soil Sciences

Undergraduate Coordinators Jeffory Hattey, Ph.D.; Jonathan Shaver, Ph.D.

Graduate Coordinator Art Klatt, Ph.D.

Plant and soil sciences includes strong programs in the basic disciplines of plant breeding and genetics, biotechnology and physiology, crop production, range science, weed science, and soil science. The undergraduate major in plant and soil sciences includes options in agronomy, biotechnology, business, crop science, range ecology and management and soil science. Each of these options provides a thorough preparation in the sciences relating to its specialization, and permits students of varying backgrounds and experiences to attain a level of preparation commensurate with their capabilities and motivation. There are no specific prerequisites.

Modern agricultural production requires a highly technical approach to emerging issues in soil and water conservation, introduction of genetically engineered crops, range land utilization and management, prevention and abatement of agricultural sources of environmental pollution, use of agricultural chemicals, and land application of biosolids. In the vast field of agribusiness, technical preparation in plant and soil sciences is essential in supplying agricultural producers with up-to-date information, as

well as improved seed, fertilizer, pesticides and management systems. Processing, distribution and marketing of food, fiber and feed crops require an integration of production technology with economics at all levels. Plant and soil scientists are in demand for research and marketing positions in universities, industry and government. Concern for future food supplies creates an urgency for technological advancement in food production that cannot be ignored.

A major challenge facing plant and soil scientists is the concern for preserving environmental quality while maintaining efficient food production systems. Plant and soil scientists are involved with detailed evaluation of the impact of crop and soil management practices on land, water and air resources. Recent concerns for environmental quality and food safety have created a high demand for professional plant and soil scientists to assist farmers in proper utilization of production input such as fertilizers and agricultural chemicals. New technologies for precision application of crop production input using global positioning systems, remote sensing methods, and newly developed sensor technology are creating many jobs for plant and soil scientists. Advancements in basic science fields such as genetics and molecular biology have created a need for plant and soil scientists to develop new plant varieties using biotechnology. Land application of municipal biosolids and animal wastes requires plant and soil scientists to ensure that proper rates and methods are used.

Typical careers in plant and soil sciences include farm or ranch operation and management; crop consulting; technical sales and service for seed, fertilizer or agricultural chemical supply companies; federal employment in soil and range conservation; research positions as plant and soil scientists, with federal agencies, state experiment stations or private industries; teaching and extension positions with colleges and universities; and a broad range of employment or ownership in retail businesses supplying feed, seed, grain, fertilizers, equipment, agricultural chemicals and other agricultural supplies and services.

In addition to a standard plant and soil sciences academic program, study for the B.S. degree provides a thorough understanding of biological and physical sciences and communications, with sufficient elective hours to permit flexibility.

Graduate Programs

Programs of course work and research are offered leading to the Master of Agriculture in the emphasis area of plant and

soil sciences and the Master of Science degree in plant and soil sciences. The Doctor of Philosophy degree can be attained in crop science, environmental science, plant science, and soil science. Specific programs are available in the areas of plant breeding and molecular biology, biotechnology, cytogenetics, range ecology and management, forage management, weed science, crop physiology, soil morphology and genesis, soil microbiology, soil fertility and plant nutrition, soil physics, soil-water management, soil chemistry, and waste management. Applicants should indicate their specific area of interest upon application.

The graduate programs in plant and soil sciences prepare individuals for successful careers in a variety of areas, including farming and ranching, extension education, agricultural business, research, teaching, environmental sciences, waste management, and all aspects of crop production.

Prerequisites. Admission to the graduate program requires a B.S. degree in plant and soil sciences, agronomy or a closely related field. Applicants should have completed basic courses in plant and soil sciences, agronomy, biology, chemistry and mathematics required of undergraduate majors. Deficiencies in fundamental course requirements will be met by the student with the direction of the student's advisory committee. Applicants must be accepted by an adviser in an appropriate discipline prior to official admission.

Degree Requirements. Students must follow approved plans of study that meet the minimum University and program requirements for the respective degrees they are pursuing.

The Master of Science degree in plant and soil sciences may be earned by using the thesis option.

This plan requires a minimum of 30 credit hours of course work, including six credit hours of PLNT, RLEM, or SOIL 5000, master's thesis.

The Master of Agriculture degree may be earned by utilizing one of three options:

Option A—Formal report (non-thesis), minimum of 32 credit hours of course work, including two credit hours of PLNT, RLEM, or SOIL 5000, master's thesis.

Option B—Minimum of 36 credit hours of course work and a creative component.

Option C—Minimum of 36 credit hours of course work including six hours of credit (PLNT, RLEM, or SOIL 5230, Research) for a professional internship. The internship will consist of professional practice and an informal report. Internships for students with previously established

vocations and career experience must be in areas other than the specific vocational field of the students.

The degree plans of study for the Doctor of Philosophy degree in crop science, environmental science, plant science, and soil science are developed individually for each candidate. Doctoral programs in crop science and soil science must include 10 credit hours of disciplinary courses at the 5000 level or above (excluding thesis), and meet certain requirements in basic disciplines such as statistics, mathematics, botany, and chemistry. Study of a foreign language is not required but can be incorporated if the student and advisory committee feel that it is desirable. Degree plans for doctoral students in plant science, that include molecular, organismal, or ecological programs of study, and in environmental sciences, that include a broad spectrum of soil, water, and waste management issues, are developed for candidates in conjunction with advisory committee approval.