

A Century of Graduate Education



World Class. Face to Face.

2003-04 GRADUATE CATALOG

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Academic Calendar

First Semester	2003-04	2004-05
Classes begin, Monday	Aug 25	Aug 23
Labor Day holiday	Sept 1	Sept 6
Veterans Day holiday	Nov 11	Nov 11
Thanksgiving Vacation	Nov 24-28	Nov 22-26
Final Examinations, Monday through Friday	Dec 15-19	Dec 13-17
Final grades due, 5:00 p.m.	Dec 23	Dec 21
Second Semester		
Classes begin	Jan 12	Jan 10
Martin Luther King, Jr. Day holiday	Jan 19	Jan 17
President's Day holiday	Feb 16	Feb 21
Spring Vacation	Mar 15-19	Mar 14-18
Final Examinations, Monday through Friday	May 3-7	May 2-6
Commencement	May 8	May 7
Final grades due, 5:00 p.m.	May 11	May 10
Summer Session		
Early Session begins	May 10	May 9
Memorial Day holiday	May 31	May 30
Eight-Week Session begins	June 7	June 6
Late Six-Week Session begins	June 21	June 20
Independence Day holiday	July 4	July 4
Summer Session ends, Friday	Jul 30	Jul 29
Final grades due, 5:00 p.m.	Aug 3	Aug 2

Administration of Washington State University

Executive Officers

V. Lane Rawlins, President

Robert Bates, Provost and Academic Vice President

Board of Regents

<http://www.regents.wsu.edu/>

WSU Administration

<http://www.wsu.edu/provost/adminlist.html>

Academic Deans

Warwick M. Bayly	College of Veterinary Medicine
Anjan Bose	College of Engineering and Architecture
R. James Cook (Interim)	College of Agriculture and Home Economics
Barbara Couture	College of Liberal Arts
Harold A. Dengerink	Chancellor, WSU Vancouver
Dorothy M. Detlor	Intercollegiate College of Nursing (Spokane)
William Fassett	College of Pharmacy
Howard D. Grimes	Graduate School
Michael Griswold	College of Sciences
Larry G. James	Chancellor, WSU Tri-Cities
Len Jessup	College of Business and Economics
Rom Markin (Interim)	Chancellor, WSU Spokane
Judy N. Mitchell	College of Education
Mary Wack	University Honors College

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Graduate Education at Washington State University

Washington State University, the land-grant institution of the State of Washington, was founded in 1890. The first class of twenty-one students enrolled on January 13, 1892. Since that time, the University has grown steadily in size and diversity into an institution of nine colleges and a Graduate School, with a total enrollment for all campus locations of over 20,000. The main campus of nearly 600 acres, located at Pullman in the Palouse country of southeastern Washington, encompasses one of the largest residential universities west of the Mississippi, with more than 60 per cent of all students living on or near campus. In addition to the main campus, Washington State University offers courses of study at three urban campuses located in Spokane, Tri-Cities (Richland), and Vancouver. Further, the University maintains over 5,000 acres of farmlands and eight agricultural research centers located at various points in the state.

Washington State University offers 71 masters and 43 doctoral degrees. The Graduate Faculty numbers approximately 850 and is drawn from the faculties of the nine academic colleges. Approximately 70 percent of all full-time graduate students hold positions as teaching, research, and/or staff assistants.

The University granted its first graduate degree, a Master of Science in Botany, to William Hurford Lawrence in 1902. Graduate degrees were granted occasionally in history, economics, English, and the sciences through the first thirty years of the century, but not until the 1930's did the Graduate Division begin to emphasize the importance of graduate education and to coordinate graduate programs.

The Dean of the Graduate School administers the diverse graduate programs throughout the University within the policies and regulations established by the Graduate Faculty, the Graduate Studies Committee, and the Faculty Senate.

The Graduate Faculty is primarily responsible for directing graduate education. The faculties of the various pro-

grams, departments, and colleges elect the members of the Graduate Faculty, basing their decision on the nominees' accomplishments as teachers, scholars, and researchers. The Graduate Studies Committee of the Faculty Senate, composed of Graduate Faculty members and graduate students, assists the Graduate School in the establishment of the policies and procedures of the Graduate School.

The Graduate School is committed to helping graduate students become learned scholars, effective researchers, and masters of disciplinary and interdisciplinary knowledge. To these ends, the Graduate Faculty emphasizes both independent scholarship and research, and classroom learning. State-of-the-art equipment for the conduct of research is present in the research centers and academic departments. Student enrollments in graduate classes and seminars are limited, ensuring an active exchange between student and professor. The close relationships between students and faculty members and common aims of all involved in graduate education create an atmosphere that stimulates intellectual curiosity. The individualized nature of graduate education at Washington State University also provides students with considerable flexibility in designing programs of study, and broadens the possibilities for unique creative endeavors.

The Graduate School may be contacted at:

P.O. Box 641030

Pullman, WA 99164-1030

(509) 335-6424

E-mail: gradsch@wsu.edu

www.wsu.edu/~gradsch

Graduate Degrees

Programs of study leading to graduate degrees are offered in the following fields of study:

Accounting, M Acct
Agribusiness, MA
Agriculture, MS
Agricultural Economics, MA, PhD
American Studies, MA, PhD
Animal Sciences, MS, PhD
Anthropology, MA, PhD
Apparel, Merchandising and Textiles, MA
Architecture, MS, MArch
Biochemistry, MS, PhD
Biotechnology, MS (MS Spokane)
Biology, MS
Botany, MS, PhD
Business Administration, MBA, PhD
Chemical Engineering, MS, PhD
Chemistry, MS, PhD
Civil Engineering, MS, PhD
Communication, MA, PhD
Computer Science, MS, PhD
Criminal Justice, MA
Crop Science, MS, PhD
Economics, MA, PhD
Education, EdM, MA, MIT, EdD, PhD
Electrical and Computer Engineering, PhD
Electrical Engineering, MS
Engineering, MS
Engineering Management, M EngMgt
Engineering Science, PhD
English, MA, PhD
Entomology, MS, PhD
Environmental and Natural Resource Sciences, PhD
Environmental Engineering, MS
Environmental Science, MS (WSU Vancouver)
Exercise Science, MS (WSU Spokane only)
Fine Arts, MFA
Food Science, MS, PhD
Foreign Languages and Literatures, MA
Genetics and Cell Biology, MS, PhD
Geology, MS, PhD
Health Policy and Administration, MHPA (WSU Spokane)
History, MA, PhD (MA WSU Vancouver only)
Horticulture, MS, PhD
Human Development, MA
Human Nutrition, MS
Individual Interdisciplinary, PhD
Interior Design, MA
Landscape Architecture, MS
Materials Science, PhD
Materials Science and Engineering, MS
Mathematics, MS, PhD
Mechanical Engineering, MS, PhD
Microbiology, MS, PhD

Music, MA
Natural Resource Sciences, MS
Natural Resources, MS
Neuroscience, MS, PhD
Nursing, M Nurs
Nutrition, PhD
Pharmacology and Toxicology, MS, PhD
Philosophy, MA
Physics, MS, PhD
Plant Pathology, MS, PhD
Plant Physiology, MS, PhD
Political Science, MA, PhD
Psychology, MS, PhD
Public Affairs, MPA (WSU Vancouver only)
Regional Planning, MRP
Sociology, MA, PhD
Soil Science, MS, PhD
Speech and Hearing Sciences, MA
Statistics, MS
Technology Management, MTM (WSU Vancouver, Spokane & Tri-Cities)
Veterinary Science, MS, PhD
Zoology, MS, PhD

The above fields of study are offered through the Colleges as indicated below:

College of Agriculture and Home Economics

Agribusiness, MA
Agriculture, MS
Agricultural Economics, MA, PhD
Animal Sciences, MS, PhD
Apparel, Merchandising, and Textiles, MA
Crop Science, MS, PhD
Entomology, MS, PhD
Environmental and Natural Resource Sciences, PhD
Food Science, MS, PhD
Horticulture, MS, PhD
Human Development, MA
Human Nutrition, MS
Interior Design, MA
Landscape Architecture, MS
Natural Resource Sciences, MS
Natural Resources, MS
Nutrition, PhD
Plant Pathology, MS, PhD
Plant Physiology, MS, PhD
Soil Science, MS, PhD
Statistics, MS

College of Business and Economics

Accounting, M Acct
Business Administration, MBA, PhD
Economics, MA, PhD
Technology Management, MTM (WSU Vancouver, Spokane & Tri-Cities)

College of Education

Education, EdM, MA, MIT, EdD, PhD
Exercise Science, MS (WSU Spokane only)

College of Engineering and Architecture

Architecture, MS, MArch
Chemical Engineering, MS, PhD
Civil Engineering, MS, PhD
Computer Science, MS, PhD
Electrical and Computer Engineering, PhD
Electrical Engineering, MS
Engineering, MS
Engineering Management, M EngMgt
Engineering Science, PhD
Environmental Engineering, MS
Materials Science, PhD
Materials Science and Engineering, MS
Mechanical Engineering, MS, PhD

Intercollegiate College of Nursing

Nursing, M Nurs

College of Liberal Arts

American Studies, MA, PhD
Anthropology, MA, PhD
Communication, MA, PhD
Criminal Justice, MA
English, MA, PhD
Fine Arts, MFA
Foreign Languages and Literatures, MA
History, MA, PhD (MA WSU Vancouver only)
Music, MA
Philosophy, MA
Political Science, MA, PhD
Public Affairs, MPA (WSY Vancouver only)
Psychology, MS, PhD
Sociology, MA, PhD
Speech and Hearing Sciences, MA

College of Pharmacy

Health Policy and Administration, MHPA (WSU Spokane only)
Neuroscience, MS, PhD
Pharmacology and Toxicology, MS, PhD

College of Sciences

Biochemistry, MS, PhD
Biology, MS
Biotechnology, MS (WSU Spokane only)
Botany, MS, PhD
Chemistry, MS, PhD
Environmental Science, MS (WSU Vancouver)
Genetics and Cell Biology, MS, PhD
Geology, MS, PhD
Materials Science, PhD
Mathematics, MS, PhD
Microbiology, MS, PhD

Pharmacology and Toxicology, MS, PhD
Physics, MS, PhD
Regional Planning, MRP
Statistics, MS
Zoology, MS, PhD

College of Veterinary Medicine

Neuroscience, MS, PhD
Veterinary Science, MS, PhD

The following fields of study are interdisciplinary in nature and are offered through two or more colleges, thus providing a broad base for graduate training:

Engineering Management, M EngMgt
Environmental and Natural Resource Sciences, PhD
Individual Interdisciplinary, PhD
Materials Science, PhD
Neuroscience, MS, PhD
Pharmacology and Toxicology, MS, PhD
Plant Physiology, MS, PhD
Public Affairs, MPA (WSU Vancouver only)
Statistics, MS

Certificates

Aging (WSU Spokane)
Exercise Science (WSU Spokane)
Interdisciplinary Environmental Biogeochemistry
International Business Economics
Optoelectronics
Protein Biotechnology
School Psychology (WSU Spokane, Eastern Washington University)

Doctor of Philosophy

The degree of Doctor of Philosophy (PhD), the highest earned academic degree offered by American universities, is awarded in recognition of distinctive scholarship and original contributions to knowledge. Thus, although formal courses are required in programs leading to the Doctor of Philosophy, the award is made primarily for creative scholarship rather than for the accumulation of credits in courses. The Board of Regents of Washington State University has authorized the granting of the degree Doctor of Philosophy in 42 academic fields.

Study for the degree of Doctor of Philosophy falls into two rather clearly defined periods, the pre-candidate period and the candidate period.

During the pre-candidate period the student acquires most of the preparation necessary for research, completes most of the formal courses, acquires the necessary background expected in the chosen field, and satisfies departmental requirements. In some departments, the student may be required to pass a qualifying examination; in some, research may be begun during this period. The precandidate period terminates when the student passes the preliminary examination, thereby becoming a candidate for the degree of Doctor of Philosophy.

The candidate period is devoted largely to research and the preparation of the dissertation. During this period, the student demonstrates the qualities of a creative scholar. It is at this time that the relationship between the advisor and the candidate reaches its maximum development. This period terminates when the candidate passes the final examination, including defense of the dissertation, and has the dissertation accepted by the Graduate School.

Doctor of Education

The program of the Doctor of Education (EdD) degree—different from the Doctor of Philosophy degree that may be earned in Education—is designed to provide training for students interested in the practice of education. Demonstrated ability in some service phase of education is a prerequisite to candidacy for this degree. There is no foreign language reading requirement for this degree, but the course requirements and procedures are similar to those for the Doctor of Philosophy degree in education.

Master of Arts and Master of Science

The degrees of Master of Arts (MA) and Master of Science (MS) are awarded to graduate students for demonstration of substantial scholarly achievement beyond the baccalaureate level. This achievement represents more than the mere accumulation of additional credit, for the student is expected to demonstrate an integrated knowledge of the chosen discipline. In most departments the student is expected to demonstrate research competence in the form of a thesis. In some departments, a non-thesis option is available by which the thesis requirement may be replaced with additional course work and a special project.

Additional Master's Degrees

Master in Teaching
Master of Accounting
Master of Architecture
Master of Business Administration
Master of Education
Master of Engineering Management
Master of Fine Arts
Master of Health Policy and Administration (WSU Spokane)
Master of Nursing
Master of Public Affairs (WSU Vancouver)
Master of Regional Planning
Master of Technology Management

Facilities

Libraries - <http://www.wsulibs.wsu.edu/>

The Libraries system is an integral part of WSU's educational resources. The Libraries' collection contains in excess of 7 million items including over 2 million volumes and more than 28,000 serials publications (scientific, scholarly, and specialized journals and periodicals); re-

gional and national newspapers; foreign, federal, state, and municipal documents; United Nations publications; and other materials in a variety of print, electronic, multimedia, and micro-formats.

The Libraries' online catalog, *Griffin*, provides access to information on books, journals, documents, media materials and select electronic resources available through the Libraries. Orbis Cascade Alliance, a joint catalog that WSU shares with 25+ academic libraries in Washington and Oregon, provides an online requesting service for book delivery at participating campuses.

The Libraries provide Web access to a wide variety of electronic indexes and abstracts, as well as thousands of full-text electronic journals and books. Librarians provide personal assistance and 24x7 virtual reference to users of these traditional and electronic collections, offer instruction on use of library resources, work with teaching faculty to develop the collections, and provide access to materials from other libraries.

The Holland/New Library, one of six Pullman-campus libraries, provides extensive collections in the social sciences, business, fine arts, and the humanities, as well as sophisticated service components designed to assist students, faculty, and researchers in utilizing these resources. **Manuscripts, Archives, and Special Collections** contain rich collections of primary resource materials including books, manuscripts, maps, photographs, and digital collections to support study and research in a number of fields, including Pacific Northwest history, modern British literature, regional publishing, veterinary history, agricultural history, wildlife and outdoor recreation, WSU history, and other subjects. **Media Materials & Reserves** houses equipment and provides CDs, DVDs, videotapes, films, slides, audio tapes and other media for classroom instruction and for personal checkout, as well as housing course Reserves. Special media collections include the WSU-UI Regional Media Collection, the McCaw Classic Feature Films, Gnaedinger Historical Films, Pitzer Classic Radio Tapes, and others.

The **Owen Science and Engineering Library** supports study and research in the pure and applied sciences with substantial traditional and electronic collections in these disciplines. The Owen Library has a new Information Commons with wireless capability, Microsoft Office workstations, faster Internet connections, hotwired carrels, a reference/info center, and collaborative learning areas.

The collections of the **George W. Fischer Agricultural Sciences Library** in Johnson Hall Annex emphasize support for plant and entomological sciences.

The biomedical collections and services offered by the **Health Sciences Library**, located in Wegner Hall, primarily support the instructional and research needs of the College of Veterinary Medicine and the College of Pharmacy.

The **George B. Brain Education Library** in Cleveland Hall offers a wide range of materials and services to meet research and instructional needs from preschool through higher education and adult education.

The **Architecture Library**, which supports programs in the School of Architecture, is located in Carpenter Hall.

In addition, library facilities and services are available at the Spokane, Tri-Cities, and Vancouver urban campuses, and at the Intercollegiate College of Nursing (Spokane) and the WSU Energy Library (Olympia). Library services for students enrolled in the Distance Degree Program or other distance learning programs are available via toll-free telephone, email, and/or web-based services.

The WSU Libraries are open throughout the year, although hours vary during intersessions and holidays. Visit www.wsulibs.wsu.edu for detailed information on library resources, services and hours.

Computing Services/ Information Technology - **<http://www.wsu.edu/IT/>**

Academic Computing Services For information about these services please contact Phil Scuderi, Academic Services Manager at 335-0408.

Academic Computing Facility (ACF) For additional information, contact the Computing Information Center (335-0411). Various handouts are available free of charge; certain other manuals and publications are sold at the Personal Computing Center. Training courses, both free and fee based are available.

Museums and Collections

College of Agriculture and Home Economics

The **Minnie Barstow Drucker Memorial Collection** of Oriental art is maintained by the Department of Apparel, Merchandising, Design and Textiles. The Drucker Collection consists of Oriental furniture, accessories, art, textiles, and costumes. The collection was given to the University in 1944 by the late Arthur Eilert Drucker in memory of his wife. The Chinese, Korean, and Japanese artifacts were collected during the years the Druckers made the Orient their home. The collection is in storage in the Holland Library and managed by the Apparel, Merchandising and Textiles Program. Contact the Department of Apparel, Merchandising, Design and Textiles, 335-3823.

The **Historic Textiles and Costume Collection** contains approximately 4,000 items of women's, children's, and men's clothing and costume accessories from 1935 to the present, and quilts and woven coverlets. It also contains a limited number of ethnic textiles and costumes from around the world. The collection is housed in Kruegel Hall. Contact the Department of Apparel, Merchandising, Design and Textiles, 335-3823.

One of the largest insect collections in the Pacific Northwest, the **Maurice T. James Entomological Collection**, houses over one million insect specimens and an extensive working library. Adults and immature stages of all insect groups and many related arthropods are represented with particular strengths in the flies, beetles, and butterflies. Primarily of regional significance, the collection also includes considerable material from the New World tropics, eastern North America, and Europe. The collec-

tion functions essentially as a research facility by providing specimens on loan to recognized scientists worldwide, by offering identification services to University extension entomologists, and by serving as a repository of type specimens and other materials. The collection room is located in the Food Science and Human Nutrition building, Room 157. Contact Dr. Richard Zack, 335-3394, to arrange a tour and presentation.

The **Mycological Herbarium** was founded by Frederick D. Heald, the first chair of the Department of Plant Pathology, in 1915. It now contains more than 70,000 specimens of fungi, including representative materials of all the major groups from the slime molds and true molds to the larger, fleshy mushrooms. The parasitic fungi of northwestern North America have been emphasized; however, through exchange and purchase, representative materials of all groups from all over the world have been incorporated. Loans are freely available to individuals associated with recognized botanical institutions anywhere in the world. The Herbarium is maintained by the Department of Plant Pathology and is located on the third floor of Johnson Hall. Specialists wishing to utilize the facilities are welcome and are asked only to inform the Department of Plant Pathology, 335-9541, in advance.

The **Henry W. Smith Soil Monolith Collection** contains more than 150 preserved soil profiles, some as much as eight feet in length, representing soils from all of the geographic regions in the State of Washington and nine of the eleven soil Orders in Soil Taxonomy. Soils that are particularly well represented in the collection are those of the Palouse region and those from eastern and central Washington that contain layers of volcanic ash from the many prehistoric and historic eruptions of volcanoes in the Cascade Region. The collection is the work of Dr. Henry W. Smith, Emeritus Professor of Soils at Washington State University. The soil monoliths constitute a very valuable resource for both teaching and research within the Department of Crop and Soil Sciences. The collection is located in Johnson Hall 114, and may be viewed from an observation window any time the building is open. Persons interested in touring the collection should contact Dr. Alan Busacca at 335-1859.

College of Liberal Arts

The scope of the **Museum of Anthropology** is as broad as the discipline that it represents. Interpretive exhibits have dealt with all facets of mankind including human evolution and biological variation, the development and structure of language, cultural variation and change, and the lifestyles and manufactured products of past and present societies. The Museum serves as an introduction to the study of the human condition for students and visitors alike. Additionally, it provides a repository for artifacts, the three-dimensional expressions of human existence. As such, the Museum of Anthropology is an integral arm of the teaching, research, and public service functions of the Department of Anthropology. The Museum is located in College Hall and is open weekdays from 9:00 am-4:00 pm during the academic year. Tours may be

scheduled by calling the Department of Anthropology, 335-3441.

College of Sciences

The **Charles R. Conner Museum**, located in Science Hall, exhibits fishes, amphibians, reptiles, and several hundred mounted birds and mammals, including deer, antelope, mountain sheep, mountain goat, cougar, and small species. The display collection is open to the public from 8:00 am-5:00 pm weekdays.

The **Culver Display**, located in Webster, houses the **Jacklin Petrified Wood Collection**. This spectacular collection contains more than 2,000 cut and polished specimens of petrified wood from all major localities in the western United States. It is the largest display of its kind in the western United States. Also included in the Collection is a large selection of cut and polished agate, goedes, and dinosaur bone. The Culver Collection includes over 100 classic rock and mineral specimens from localities throughout the world. Both the Jacklin and Culver Collections may be viewed weekdays, 8:00 am-5:00 pm. Tours may be arranged by calling the Department of Geology, 335-3009.

The **Marion Ownbey Herbarium** is an internationally recognized resource for research, teaching, and service. The Herbarium houses 300,000 plant specimens, primarily from the Pacific Northwest, but including worldwide collections. In addition to native vascular plants and weeds, the Herbarium contains mosses, liverworts, lichens, and special collections of seeds and cultivated plants. The Herbarium is located in Heald G-9 and is open weekdays from 8:00 am-5:00 pm and by appointment, 335-3250.

College of Veterinary Medicine

The **Worthman Veterinary Anatomy Teaching Museum** features several hundred specimens of mammals and several exhibits of fowl. The collection consists primarily of domesticated animals, since they represent the species most important to veterinary medical education and research, yet a few wild species are included also. The only one of its kind in the nation, the Museum offers a unique learning environment. It is used extensively for teaching purposes in classes of anatomy, radiology, and surgery, and it serves as a reference tool for current research by veterinary medicine faculty members. The Museum is located on the second floor of Wegner Hall. For information, call 335-6621.

Museum of Art

The **Museum of Art** was established in 1974 around a core collection of American paintings assembled by former President E. O. Holland and former WSU Regent Charles Orton. Dedicated to serving the educational purposes of WSU and the people of the State of Washington, the Museum operates a program which embraces a wide variety of changing exhibitions ranging from antiquity to the contemporary, from design and photography to sculpture and painting, by internationally, nationally and regionally known artists. Many of the exhibits originated by

the Museum staff have toured the nation. The Museum offers a wide variety of speakers, films, and special programs throughout the year.

The Museum's collection of American 19th and 20th century paintings, drawings, and prints has grown in the past years through financial donations and important gifts from collectors and alumni in the Northwest. In 1975, the Museum of Art was a founding member of the Washington Art Consortium, a cooperative venture by four small museums to build a major national collection of works on paper by American artists. The Museum's consortium activities have provided an added focus to its own collecting of works on paper.

The Museum's programs are free and open to the public. For information, call 335-1910.

Research

Research Support Units

The **Office of the Campus Veterinarian (Laboratory Animal Resources Center)** is the central coordinating facility for the care, production, procurement, and use of laboratory animals at WSU. It provides assurance to governmental agencies, granting authorities, accrediting bodies, and the public that all animals utilized by WSU in teaching, research, and testing are cared for in a humane manner consistent with established federal and state guidelines. The Office also provides formal presentations, informal assistance, and educational services to assist instructors and investigators in their use of animals.

The **Center for Integrated Biotechnology (CIB)** is an organized research unit that operates as an inter-departmental, inter-college and multi-disciplinary program across campus founded in September of 2002. The Center has broadly defined biotechnology as the use of living organisms or their products to modify human health and the human environment. The applications of biotechnology are extensive and have already had critical impacts in agriculture, human health, and environmental protection. The Center for Integrated Biotechnology promotes multi-investigator research programs and the development of new and innovative advanced technologies. The CIB is designed to enhance and increase the level of basic and applied research being done in the area of biotechnology at WSU. In addition, the CIB is designed to enhance interactions with the biotechnology industry through spin-out companies and technology transfer. University research plays a critical role in the biotechnology industry and the Centers role is to facilitate this process. Additionally the Center operates Core Laboratories that provide high-tech centralized services to members in the areas such as: bioinformatics, genomics and proteomics. These cores enhance faculty research capabilities and improve opportunities to compete for federal and industry research grants and contracts. The Center for Integrated Biotechnology plays an essential role in this process. The Center has integrated activities that include: seminars, workshops, and retreats to promote interactions with members

across campus and a campus-wide undergraduate and graduate education program that is currently under development. The Center currently has approximately 200 research faculty and is expanding rapidly. For more information please visit our web site at <http://www.biotechnology.wsu.edu>.

WSU's **Office of Grant and Research Development (OGRD)** was established with the mission of assisting the university's faculty and graduate students in securing extramural support for their scholarly, research, teaching, and community service activities. OGRD promotes and facilitates the procurement of grant and contract funding through information dissemination and outreach, proposal and award processing. OGRD offers education and training for proposal development and writing classes throughout the year. For more information please visit OGRD's web site at <http://www.ogrd.wsu.edu>.

Washington State University's **Office of Intellectual Property Administration** is the campus resource for patents and technology transfer. In this office, faculty inventions are managed and transferred into the public domain. At the same time, applying for patent protection protects the rights of WSU and the inventors.

The **Nuclear Radiation Center** serves as an all-University resource unit, supporting research and graduate education related to nuclear engineering and physics, radiochemistry, elemental analysis, and neutron activation analysis.

The **Radiation Safety Office** administers a program providing for the safe use of radiation machines and radioactive materials in research, service, and instruction at the main campus, urban campuses, and at the extension centers. The activities of this program are conducted in accordance with the statutes and rules of radiation protection specified in WAC-246, and with the conditions enumerated in Radioactive Materials License WN-C003-1 issued by the State of Washington.

The **Research Compliance Office** provides oversight and coordinates compliance efforts (as required by federal and state laws and University policies) primarily through close cooperation and coordination with the following faculty/Presidential Committees:

1. Institutional Animal Care and Use Committee (IACUC)
2. Institutional Biosafety Committee (IBC)
3. Institutional Review Board (IRB)
4. Radiation Safety Committee (RSC)

The Research Compliance Office offers support and help to researchers to identify, understand, and comply with all pertinent regulations, rules, and policies. The Office is a resource for facilitating the conduct of research at WSU.

The mission of the **Social and Economic Sciences research Center** is to strengthen research in the social, economic, and behavioral sciences at Washington State University. This mission is pursued through a variety of activities including a computer-assisted telephone interview facility, mail survey capabilities, personal interviewing capabilities, assistance to faculty in the preparation

and submission of research proposals for extramural funding, and efforts to stimulate and organize interdisciplinary research. Consultation is also provided to faculty, staff, students, and others on the development and implementation of research projects.

Although located at Washington State University, the **Water Research Center** is a cooperative venture by WSU and the University of Washington with input from other state research universities. The mission of the Center is to plan, promote, conduct, and administer research in water resources; to educate and train scientists and engineers through participation in research projects; and to disseminate the results of completed research to users through publications, conferences, seminars, short courses, and symposia. The Center operates in consultation with state, federal, and private water-interested organizations.

Statistical Services is a statistical consulting service provided by the Department of Statistics for WSU faculty, staff, and student researchers. Assistance is provided in the design of experiments and sample surveys, analysis of data including use of statistical packages, and interpretation of results of statistical analyses.

Research Facilities

College of Agriculture and Home Economics

The College of Agriculture and Home Economics (CAHE) houses many departments, units and centers whose missions involve research. The **Agricultural Research Center (ARC)** is the administrative unit within CAHE overseeing research performed within the College. Research is conducted within the following departments: Agricultural and Resource Economics; Animal Sciences; Apparel Merchandising, Design and Textiles; Biological Systems Engineering; Crop and Soil Sciences; Entomology; Food Science and Human Nutrition; Horticulture and Landscape Architecture; Human Development; Interior Design, Plant Pathology; Natural Resource Sciences; Rural Sociology and Statistics. The Institute of Biological Chemistry performs fundamental research in the biochemistry and molecular biology of plants. CAHE houses several centers, which are collaborative programs for conducting unique interdisciplinary types of research which include: the **Center for Precision Agriculture Systems**, the **Center for Nonthermal Processing of Food**, the **IMPACT Center (International Marketing Program for Agricultural Commodities and Trade)**, and the **Center for Sustaining Agriculture and Natural Resources**. There are collaborative projects and interdisciplinary research projects involving other colleges and urban campuses within the University including: the College of Engineering and Architecture (Wood Materials and Engineering Laboratory); the College of Sciences (School of Molecular Biosciences and the Center for Reproductive Biology); The Program in Environmental Science and Regional Planning), the College of Veterinary Medicine (Field Disease Investigative Unit), the Interdisciplinary Design Insti-

tute (Spokane Urban Campus) and the State of Washington Water Research Center.

The programs of research in CAHE are diverse and require many sites at which to carry out the work, especially with regard to plant-related sciences. Urban locations having extensive laboratory equipment and field research equipment include: the **WSU Prosser Irrigated Agriculture Research and Extension Center** (also the location for the Center for Precision Agriculture Systems); the WSU-Tri Cities campus **Food and Environmental Quality Laboratory**; the **WSU Wenatchee Tree Fruit Research and Extension Center**; and the **WSU Puyallup Research and Extension Center**. Other research and extension units include the **Lind Dryland Research Unit**, the **WSU Vancouver Research and Extension Unit**, the **Long Beach Research and Extension Unit** and the **Mount Vernon Research and Extension Unit**. The **Food and Environmental Quality Laboratory** has state of the art equipment to detect environmental contaminants. FEQL laboratory faculty seek to ensure the quality and safety of food, the long-term sustainability of our food-producing lands and surrounding environment, and economic viability of the agricultural and food industries of the region. Many WSU scientists are located throughout the state to solve problems associated with production and marketing of Washington's agricultural and forestry products and to provide basic knowledge for improving the efficiency, quality, and quantity of production needed to supply an ever-increasing demand for food, fiber, and improvement in the quality of life.

The International Marketing Program for Agricultural Commodities and Trade (IMPACT) Center funds interdisciplinary research, extension, and teaching to assist the state in exporting its agricultural products. Its major thrusts are in uncovering marketing opportunities, developing strategies to exploit those opportunities, solving economic and technical impediments to current agricultural exports, and finding alternative products or processes with export market potential.

The **Center for Nonthermal Processing of Food** includes faculty members from Biological Systems Engineering, Food Science and Human Nutrition, Electrical Engineering, Biochemistry/Biophysics, and Microbiology. Research at the Center is focused on pulsed electric fields, oscillating magnetic fields, and high hydrostatic pressure as alternatives to more widely used methods of food processing that involve application of heat. These new technologies produce minimally processed, fresh-like, safe food products to meet consumer demand for high quality processed foods without degradation, which often accompanies thermal processing methods.

The Center for Precision Agricultural Systems fosters collaborative research, education, and outreach programs that produce practical technologies and management systems for Precision Agriculture. The Center brings university expertise from agriculture, engineering, computer science, and other units across the state and external collaborators to address critical issues preventing economic implementation of information-based agricul-

ture. Technologies include sensors for monitoring plant and environment status, software for data analysis and modeling, decision models for system optimization, and equipment to implement precision management decisions. These technologies and related educational offerings support competitive production of agricultural commodities, while stimulating economic development and protecting the environment and natural resources.

The **Center for Sustaining Agriculture and Natural Resources (CSANR)** works to create sustainable agriculture and natural resource systems providing a high quality of life for the people of Washington. The CSANR leads in developing and implementing interdisciplinary systems-oriented research and education programs at WSU. CSANR facilitates work towards sustainable agricultural systems, provides information through educational activities and publications, encourages the use of sustainable agriculture practices including improving air, water and soil quality, and attempts to strengthen rural communities by providing farming opportunities for future generations. It sponsors capacity building programs in the areas of consensus building and conflict.

The majority of the coursework undertaken by graduate students in CAHE is centralized on the Pullman campus. On the Pullman campus most CAHE faculty hold joint appointments in teaching and research. In addition, many of the research scientists at the other research centers around the state are members of the Graduate Faculty. They serve in varying degrees in the academic guidance of graduate students in CAHE and in the direction of thesis work. The association of graduate students with the Agricultural Research Center research programs, scientists, equipment and facilities offers a depth of experience and training beyond that ordinarily encountered.

College of Business and Economics

The **Small Business Development Center**, located at WSU Spokane, provides training programs, research services, and management counseling to business firms and communities throughout Washington. To this end, the Center draws on its own professional staff as well as on the resources of the University and other cooperating Washington institutions of higher education. Specifically, the Center's Business Development Specialists provide no-fee, confidential, one-on-one counseling on all management topics. The counselors have certified, broad-based skills and significant experience as business owners or managers. They help improve profitability and growth with assistance in buying, selling or starting a business, preparing a business plan, choosing and incorporating new technology, analyzing financials, and improving marketing.

Business counseling is also available through NetCounseling. This innovative program permits live, face-to-face business counseling and technical assistance over the Internet from a designated NetCounseling site or a business owner's office or home PC.

In addition to business counseling, the SBDC evaluates new products through its Innovation Assessment Center on a fee basis.

The SBDC provides business training through many Washington community colleges. They offer seminars, workshops and conferences to assist small business owners and operators with specific skills and methods to maintain or expand their business.

College of Engineering and Architecture

The **Center for Materials Research** is an interdisciplinary effort involving faculty from physics, chemistry, mechanical and materials engineering. It involves more than 20 researchers and attracts significant funding for equipment and research in such projects as deformation and fracture, diamond and thin films, soft lithography, semiconductors, electron tunneling microscopy, and nondestructive probes (e.g., positron beams) of defects in solids at the atomic and nuclear levels (www.cem.wsu.edu/cmr).

The **Center for Multiphase Environmental Research** is an NSF IGERT center that coordinates research designed to understand the complex biological, chemical, and physical phenomena that describe environmental transport phenomena. Research is designed to understand such phenomena at a variety of scales, ranging from the molecular to the regional. Priority projects address specific industry-related problems for which the technology will be transferred. Faculty and students in biological systems engineering, chemical engineering, civil and environmental engineering, chemistry, soil sciences, geology, and microbiology collaborate. More than 35 PhD students participate in the research programs coordinated by this Center (www.cmer.wsu.edu/).

The **Wood Materials and Engineering Laboratory** is the only university-based forest product research lab in a college of engineering and architecture in the U.S. It conducts research for scores of companies and governmental groups annually. It helped revolutionize such composite materials as adhesives and polymers, laminated veneer lumber, end-gluing or finger-jointing of green lumber, and nondestructive testing of wood. More than three decades of annual Particle Board Symposia have drawn forest product leaders together worldwide. Faculty research has helped minimize waste by-products and sustain timber supplies, and develop affordable low-cost housing. The wood I-joints in many homes today were developed two decades ago in the lab. Today, grain and wheat growers in northeastern Washington are learning to recycle wheat by-products into building composites; and in Seattle, the Clean Washington Center is demonstrating how scrap wood and plastics also can be converted into composites. See <http://www.wmel.wsu.edu>.

The **Center for the Design of Analog-Digital Integrated Circuits** is an NSF-sponsored industry-university research consortium in integrated circuitry that addresses electronics industry problems in the fast growing field of mixed signal design. Emphasis is on research in low-voltage circuits, wireless communication, and design for high-performance data converters and associated sim-

ulation, modeling, and layout tools. It has garnered more than 24 industrial and four university partners and has involved more than 210 students since it began in 1990. See www.eecs.wsu.edu/cdadac.

The **Power Systems Engineering Research Center (PSerc)** is a multi-university collaborative research center supported by the National Science Foundation and the Electrical Power Research Institute. PSerc supports research on the practical problems and those particularly associated with a restructured deregulated power industry. WSU was invited to join PSerc because of its strong power engineering program.

The **Center for Nonthermal Processing of Food** investigates preservation of food by high-voltage pulsed electric field, microwaves, ultra-high pressure, oscillating magnetic fields, and combines methods. It draws both extramural corporate and government support. Novel food preservation and packaging techniques are developed for the U.S. military.

The **Albrook Hydraulic Laboratory** provides engineering services to government and industry in hydraulics and water resources. For more than four decades, it has helped solve hydroelectric power problems, salmon fish recovery efforts, facilities construction, flood mitigation, land-based hazardous waste management, hydrology, and engineered wetlands (www.wsu.edu/~albrook/).

The **Imaging Research Laboratory** uses the resources of signal processing, computer graphics and computational geometry in support of image, video and geometry compression, shape representation and description, graphics hardware design and animation production. www.eecs.wsu.edu/irl.

The **Laboratory for Atmospheric Research** is recognized worldwide for its pioneering role in development of regional and national emission inventories, tracer methods to measure air and ground gas pollution of all kinds, worldwide methane emissions surveys, windblown dust, and photochemical air contamination in the Northwest. Recent investigations include Spokane and Puget Sound health hazard research on small air particulates, ozone concentration in the Puget Sound region, and improved understanding of global warming by measuring biogenic hydrocarbons released from vegetation. See www.ce.wsu.edu/LAR/larhome.html.

The centers for **Virtual Reality In Design and Manufacturing**, and **Advanced Multiphase Materials Processing** work with industry on practical problems in superplastic forming, rapid prototyping, mass transfer, geometric modeling and other related areas.

College of Liberal Arts

The **Digital Recording Studio** was established in 2003 to serve the programmatic needs of the Music Program within the School of Music & Theatre Arts. Located in Kimbrough Music Building, the studio provides an ideal acoustic setting for limited scope recordings in the studio, and processing of on-location recordings from other venues. The recording studio is equipped with a Fazioli Concert Grand Piano and the most current versions of the

requisite digital recording, editing, and processing equipment.

The **Hearing and Speech Clinic**, located in the Health Sciences Building on the WSU Spokane campus, is operated jointly by the WSU Department of Speech and Hearing Sciences and the Eastern Washington University Communication Disorders Department. The Hearing and Speech Clinic is a state-of-the-art facility that serves the Department of Speech and Hearing Sciences' tripartite missions in teaching, research and service. The Clinic provides a full range of assessment and rehabilitation services to the community in the areas of speech, voice, language, and hearing. Graduate students gain valuable clinical experiences with patients across the lifespan under supervision of nationally certified and state licensed faculty. Clinic clientele are invited to participate in master's thesis research approved by the WSU and EWU Institutional Research Boards (IRB).

The **Humanities Research Center** was established in 1980 by the Dean of the Humanities and Social Sciences Division (now College of Liberal Arts) to provide shared facilities, equipment, and consulting services in support of humanistic research by the faculty of the College. The facilities and services of the Center are available to all faculty in the College subject to a schedule of project priorities, and since 1984 computing support has been provided to all graduate students in the College. This support is predominantly in the area of text processing (production of books, articles, and dissertations) and photocomposition of scholarly journals, as well as new visual media communications.

The **Language Learning Resource Center (LLRC)** was established in 1912 by the Department of Foreign Languages and Literatures as a teaching resource center. Since its inception the Center has been a focal point within the Department for exploring the use of technology in the teaching of languages. Continuing in this tradition the LLRC is today engaged in managing and maintaining two computer-based language learning labs offering undergraduate and graduate students access to course specific on-line language learning tools and resources. Additionally, the Center manages and maintains a Departmental web server and a streaming audio/video server that together provide students with 24-hour access to a wealth of language related educational and informational resources. Of course the LLRC also maintains equipment (such as audio and video tape players) for accessing its extensive collection of traditional audio and video resources. Overall the LLRC is both an established language learning service center for the Department and at the same time a research tool for faculty interested in exploring new teaching techniques and technologies and building new language learning tools and resources.

The Department of **Psychology** has recently developed an **Undergraduate Human Psychophysiology Laboratory**. This laboratory combines the standard E-prime computer software for testing of cognition and behavior along with equipment for the examination of central nervous system activity responsible for cognition and behav-

ior. The laboratory provides state of the art technology for measurement of brain activity by means of electroencephalograph (EEG). Also included are devices for peripheral physiological measurement of skin conductance response (SCR) and cardiovascular activity. The laboratory is designed to be used by Undergraduates with minimal technical training, but is also available for use by Graduate students.

The **Sociological Data Processing Center** and the **Social Science Computing Laboratory** are important resources for graduate students in the sociology program. Supported by the College of Liberal Arts, they are located adjacently in 231 and 233, Wilson Hall. They serve many functions, including provision of the following: Internet access and email, access to the campus UNIX system, data manipulation and analysis programs, graphics and image processing software and consultation services for statistical techniques and procedures.

While the Sociological Data Processing Center is reserved exclusively for graduate students and faculty, the Social Science Computing Laboratory is used primarily for graduate students and faculty course instruction in the College of Liberal Arts. In all, there are 28 Gateway 2000 Pentium computers with large 17-inch displays for student use. High-speed laser printers, scanners, and mass storage devices ensure that graduate students have access to quality computing resources. In recent years, new computer labs for graduate students have been installed in Anthropology, including one devoted to Physical Anthropology, and in Political Science. Another computer lab in Fine Arts is presently being expanded.

The **Writing Laboratory**, established in 1983 by the Department of English, is an instructional resource center serving students and faculty who want assistance with writing. The Laboratory offers several courses, an on-line writing component, and is a consulting resource for instructors who want assistance in incorporating writing into their courses.

The **Thomas S. Foley Institute for Public Policy and Public Service**, established in 1995 by the College of Liberal Arts, supports congressional and legislative studies, public policy research voter education, and community outreach. The Institute will also provide opportunities for public service internships in congress, state legislatures and other governmental and non-profit organization.

The **Division of Governmental Studies and Services** employs graduate students on research projects relating to government and public affairs, administers an internship program to provide practical experience in government, and maintains a collection of specialized government publications.

College of Sciences

The **Electron Microscopy Center**, located in Science Hall, is available for training and research in science and technology. Washington State University students, staff, and faculty members have access to the facilities for training consultation, and service work under flexible conditions designed to provide maximal use of the EMC. For-

mal courses in electron microscopy are offered by the Center. The EMC maintains three transmission electron microscopes (including an analytical TEM equipped with STEM and EDX), a scanning electron microscope, also with EDX, a new confocal microscope, and a full complement of ancillary equipment and facilities. The Center has a skilled staff experienced in handling a wide range of research problems in electron microscopy.

The **Environmental Research Center** is closely integrated with the academic Program in Environmental Science and Regional Planning and is the focal point for university development of interdisciplinary research on problems related to the environment.

The **James Richard Jewett Observatory** is the gift of Mr. and Mrs. George F. Jewett of Spokane and is named in honor of Mr. Jewett's father, a former professor of ancient languages at Harvard University. The Observatory houses a twelve-inch refractor with a visual lens and a twenty-five foot revolving dome. The **University Planetarium** is located in Sloan Hall 231. Information about open house and group tours of either the Observatory or Planetarium can be obtained by contacting the Program in Astronomy.

A **Center for Nuclear Magnetic Resonance (NMR)** is in the new Chemistry Synthesis Building. The Center houses three high-field superconducting NMR instruments. Additional instruments will be added within five years. The prime purpose of the instruments is to characterize structures of biological samples as solids or in solution for faculty and students in the sciences, agriculture, veterinary medicine, and pharmacy.

The **Institute for Shock Physics** was created in 1997 from the Shock Dynamics Center and given a broader mission. The Institute is involved in shock wave research that promotes the understanding of physical and chemical changes in solids and liquids under very rapid and large compressions, and applying this knowledge to fundamental and applied problems of strategic national interest. Scientific activities at the Institute examine physical and chemical changes at extreme conditions through: time-resolved, optical spectroscopy and x-ray diffraction to probe atomic/molecular processes in shock wave experiments; time-resolved, continuum measurements in shock wave experiments; static high pressure measurements using diamond-anvil-cell experiments; and theoretical developments and computational modeling to stimulate dynamic compression phenomena at different length scales.

The **Laboratory for Bioanalysis and Biotechnology (LBB)** has three units with closely related but distinct functions. LBB I provides protein and DNA sequencing as well as peptide and oligonucleotide synthesis. It also has gene chip analyzers for genomics research. LBB II houses four mass spectrometers to do proteomics and high resolution analyses of biological macromolecules. LBB III provides amino acid analysis of peptides and other biological materials.

To assist the University in attracting and conducting research in materials-related areas and to strengthen the educational capabilities of the University, the **Center for**

Materials Research was established as an interdisciplinary unit to serve the scientific community. The Center promotes interaction between researchers, provides mechanisms to improve educational programs in materials science, and provides a focal point for the purchase and construction of shared equipment and the development of other resources. It is shared between the Colleges of Science and Engineering and Architecture.

The **Center for Reproductive Biology** was formed in 1996 and is now comprised of 70 faculty investigators at WSU, the University of Idaho and National Marine Fisheries. The broadest definition possible is used for reproductive biology and research associated with the Center. In mammals any process involved or related to reproduction including neuroendocrine control, gonadal function, gamete biology, fertilization, implantation, pregnancy, reproductive tract biology, reproductive disease, (e.g. breast cancer) and fertility. In addition, reproduction in non-mammalian species and plants is considered. The current faculty has areas of interest from domestic animal and human reproduction to fish and plant reproduction. This diversity in research areas is a major strength of the Center and fosters collaborations not previously considered. The objectives of the Center are to foster research of the highest quality and promote collaborative interactions among Center members; enhance opportunities for extramural funding with an emphasis on multi-investigator grants; and to enhance the training and education programs of advanced undergraduate, graduate and post-doctoral fellows with and interest in the biology of reproduction. Additionally, the Center operates 11 Core Laboratories that provide high-tech centralized services to members. These cores enhance faculty research capabilities and improve opportunities to compete for federal and industry research grants and contracts. For more information on the Center please visit our web site at <http://www.reproduction.wsu.edu>.

College of Veterinary Medicine

Since its creation in 1974, **The Washington Animal Disease Diagnostic Laboratory (WADDL)** has provided essential laboratory services in bacteriology, parasitology, pathology, serology, toxicology, and virology. The Laboratory is an integral part of a network of tax-supported state diagnostic reference facilities throughout the United States dedicated to the betterment of animal and human health. WADDL has a responsibility to provide appropriate, timely results to safeguard the health of livestock, pets, poultry, and fish in the Pacific Northwest and to protect the public from zoonotic diseases. Advice and consultation is provided to practicing veterinarians, animal industry groups, state and federal regulatory officials, and physicians. WADDL also provides centralized service for the College by providing electron microscopy and histology support.

The **Animal Health Research Center (AHRC)** provides oversight of research programs within the College of Veterinary Medicine, with an emphasis on diseases of agricultural animals and public health. Center research is di-

vided into core programs that include transmissible spongiform encephalopathies, foodborne diseases and antimicrobial resistance, immunology and vaccine development, microbial and host genomics, vector-borne diseases, and lentiviral diseases. In conjunction with the College departmental graduate programs, AHRC research programs provide undergraduate research and graduate education opportunities.

Institute of Biological Chemistry

The **Institute of Biological Chemistry** is dedicated to research on fundamental aspects of biological chemistry relevant to agriculture and forestry. Although not offering a formal course of study leading to a degree, the Institute provides research opportunities to fulfill the requirements for the Master of Science and Doctor of Philosophy in the graduate programs in the School of Molecular Biosciences (biochemistry/biophysics, chemistry, genetics and cell biology), as well as in plant physiology and other allied biological and agricultural disciplines.

Research fellowships and assistantships are available in the Institute for incoming students on a competitive basis. Teaching assistantships are available from cooperating instructional departments and programs through which entry to the Graduate School is obtained.

The most important component of any doctorate program involves independent study and original research in the area of the student's interest. The internationally recognized research programs of the Institute cover a broad spectrum of areas from plant biochemistry, molecular biology, and genetic engineering to plant pathology and pest resistance, as well as the traditional areas of biochemistry. These programs receive support from federal, state and private sources. The Institute thus offers a unique opportunity for graduate training in an intensive research environment which complements formal study leading to the chosen degree. All recent graduates are in positions appropriate to their training in academic, industrial and governmental institutions.

The Institute is housed in modern, well-equipped laboratories, and enjoys the support of centralized campus research facilities. Broad-based support of the Institute through the cooperative efforts of several colleges within the University assures a solid foundation for a wide scope of research activities, and provides for strong interaction of the Institute faculty with other scientists. The Institute also cooperates with agricultural, academic and industrial organizations at the regional, national, and international levels. An active seminar and visiting scientists program further contributes to the focused research environment.

Cancer Prevention and Research Center

The interdisciplinary **Cancer Prevention and Research Center** functions as the focal point of cancer prevention research at Washington State University. While serving to catalyze and coordinate collaborative efforts around the University, the Center also provides central support services and shared facilities for on-going research.

Center for the Study of Animal Well-Being

The **Center for the Study of Animal Well-Being** is a joint development between the College of Veterinary Medicine and the Department of Animal Sciences in the College of Agriculture and Home Economics. The primary mission of the Center is to generate and disseminate new knowledge to make animal well-being and human-animal interactions better understood. Research areas include indicators of animal well-being, objective assessment of stress and pain, animal behavior and preferences, and the interrelationship of animal health and well-being to production and performance.

Center for Teaching, Learning, and Technology

The **Center for Teaching Learning, and Technology** is a central resource for all WSU instructors, including graduate teaching assistants. The CTLT works with faculty to identify and implement strategic methods of incorporating successful teaching approaches into their courses and programs. In addition, the CTLT applies current scholarship on effective teaching and learning to develop a variety of resources to help instructors in their efforts. The CTLT's resources include consultations about course and learning activity design, assessment techniques, and integrating instructional technologies; frequent discussions and workshops; and on-line technologies for learning and assessment. CTLT is located in ITB 2001B and can be reached at 509/335-1355 or ctltd@wsu.edu.

Extended University Services

Extended University Services (EUS) is responsible for extending the educational resources of the University to people throughout the State of Washington, and beyond. Distance Degree Programs (DDP), a unit of EUS, collaborates with University departments and administrative units to provide distance degree programs at the graduate and undergraduate levels in a variety of formats, including on-line and pre-produced video. Conferences and Professional Programs (CAPPS) provides conferencing support services for large and small programs, and DDP and CAPPS cooperate to offer both credit and noncredit on-line certificate programs. The Washington Higher Education Telecommunication System (WHETS), an interactive video system, brings WSU classes and programs to various sites in the state, including the WSU urban campuses.

DDP also provides a mechanism for academic departments to deliver select courses to various sites in the State of Washington and other areas. These courses are offered to meet a particular demand and are not a part of ongoing degree programs, although students receive WSU credit for participation in the courses.

Graduate Programs at Urban Campuses

With the creation of WSU's multi-campus system in July 1989, select graduate programs are being offered at the University's urban campuses in Spokane, Tri-Cities, and

Vancouver. Expansion of offerings will continue as the campuses grow.

Graduate students who plan to use coursework and research undertaken through the urban campuses must be admitted to the Graduate School on the Pullman campus. Requirements generally are identical to those at the Pullman campus. Brochures with program description and course offerings are available from each of the three campuses.

WSU Spokane

WSU Spokane offers master's degrees in architecture (tracks in design theory and design-build management), biotechnology, criminal justice, electrical engineering, engineering management, exercise science, health policy and administration, human nutrition (including dietetic internships), interior design, landscape architecture, materials science and engineering, speech and hearing sciences and technology management (a graduate business degree). Supporting courses toward the MS in computer science and the master's in teaching and administrative credentials (certification for principals and superintendents) also are offered. The Doctor of Pharmacy program was established in 1992 and is the only doctoral degree program located at an urban campus in the state. The Doctor of Design program has been approved by the University and awaits final approval from the Higher Education Coordinating Board. The campus also offers Graduate Certificates in Aging, Exercise Science and School Psychology and has other graduate certificate programs under development, including a Graduate Certificate in Psychiatric Rehabilitation and a Graduate Certificate in Public Service Leadership. The campus also houses upper-division baccalaureate studies in a number of disciplines, including architecture, computer engineering, construction management, interior design, landscape architecture, and real estate, with other programs under development.

Classrooms, research laboratories, and computer labs are located at the Riverpoint Higher Education Park. The full range of academic and student services is available, including the Cooperative Academic Library Service (CALs) shared by students of WSU Spokane and Eastern Washington University. Many courses are offered over the Washington Higher Education Telecommunication System (WHETS) to and from other WSU campuses and Learning Centers.

WSU Spokane also has exclusive research and public service programs in the health sciences. The Health Research and Education Center and the Washington Institute for Mental Illness Research and Training at WSU Spokane link academic scientists, health care practitioners, and funding sources for collaborative research and provide internship opportunities for students.

For specific information, contact WSU Spokane, Student Services, Health Sciences Building 125E, 310 N. Riverpoint, P.O. Box 1495, Spokane, WA 99202-1495, enroll@wsu.edu, (509) 358-7978; or, look up WSU Spo-

kane's Home Page on the Internet at <http://www.spokane.wsu.edu/>.

WSU Tri Cities

WSU has offered credit courses in the Tri-Cities for almost five decades. Master's degree programs currently are provided in biology, business administration, chemical engineering, chemistry, civil engineering, computer science, education, electrical engineering, engineering management, environmental engineering, environmental science, materials science and engineering, mechanical engineering and technology management. Supporting coursework is available in mathematics and physics.

The present facilities provide classrooms, offices, laboratories, networked computing, and an extensive library. Research is carried on in a wide variety of areas. Of particular interest here are the Food and Environmental Quality Laboratory, the Electronic Materials Laboratory, the Earth and Environmental Sciences Laboratory, and the United States Transuranium and Uranium Registries, all housed at WSU Tri-Cities. Additional opportunities are available to share research laboratories and equipment of nearby US Department of Energy contractors through individual arrangements.

Graduate assistantships are available in certain departments for qualified students who wish to pursue study and research at WSU Tri-Cities. For specific information about courses, programs, facilities or admission, contact WSU Tri-Cities, 2710 University Drive, Richland, WA 99352-1643, (509) 372-7250.

WSU Vancouver

Washington State University Vancouver has been offering undergraduate and graduate education to residents of Southwest Washington and Oregon for more than 12 years. Located on a 351-acre campus in Salmon Creek, students enjoy small classes and schedules designed for place-bound students balancing their education with career and family responsibilities.

Currently eight master's degrees are offered in business administration, education, engineering management, environmental science, history, nursing, public affairs, and technology management.

For more information contact the WSU Vancouver Office of Admissions by phone, 360-546-9779, or e-mail, admissions@vancouver.wsu.edu.

Graduate Certificate Programs

Graduate certificates are designed to provide students with an opportunity for graduate education in a specific area of study. They convey that the student has developed a mastery over course material in a specific area. While the requirements for each graduate certificate vary among departments and programs, the core is typically 9 to 12 graded courses taken at the graduate level. These core courses are generally selected to provide the student

with expertise on a specified topic. Up to six course credits used for the graduate certificate may also be applied toward other graduate degrees at Washington State University. Graduate certificates that are currently offered at Washington State University are:

Aging (WSU Spokane)
Exercise Science (WSU Spokane)
Interdisciplinary Environmental Biogeochemistry
International Business Economics
Optoelectronics
Protein Biotechnology
School Psychology (WSU Spokane, Eastern Washington University)

Regional Programs

Program for Cooperative Courses for Graduate Students at Washington State University and the University of Idaho

Washington State University and the University of Idaho have developed a program of cooperative courses in which one institution offers exclusively a particular course for use by graduate students of both. The program provides a wider variety of graduate courses than otherwise would be possible at either University.

This arrangement permits graduate students at Washington State University to take cooperative courses at the University of Idaho on the same basis that they take resi-

dent courses. No special fees are charged for these courses. In each cooperative class, the regulations of the host institution prevail, but only the institution in which the student is seeking an advanced degree records official enrollment and grades.

The cooperative program is limited to specific courses. All other courses taken at the University of Idaho must be presented as transfer courses, with the usual rules and fees applying. For further information, consult the chair of the department or program or the Office of the Dean of the Graduate School.

Western Regional Graduate Programs - WICHE

The Western Interstate Commission for Higher Education (WICHE) coordinates a program involving 17 graduate institutions where students who are residents of Alaska, Arizona, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming may attend Graduate School in Washington. WICHE students pay resident tuition and receive some admission preference.

Washington State University receives students in the following programs:

American Studies (MA and PhD)
Anthropology-Archaeology Option (MA and PhD)
English—Rhetoric and Composition Emphasis (MA and PhD)
Food Science (MS and PhD)
Health Policy and Administration (MHPA)
History—Public History Option (MA and PhD)
Neuroscience (MS and PhD)
Nutrition (PhD)

Student Services and Facilities

Campus Student and Hourly Employment Office

141 French Administration; (509) 335-1969

www.hrs.wsu.edu/

Career Services

Lighty 180; (509) 335-2546

www.careers.wsu.edu/

Center for Human Rights

French Administration 225; (509) 335-8288

www.wsu.edu:8080/~crh

Child Care

(509) 335-8847

www.studentaffairs.wsu.edu/child_center.asp

Counseling and Testing Services

Lighty 280; (509) 335-4511

www.counsel.wsu.edu/

Disability Resource Center

Administration Annex, Room 205; (509) 335-1566

www.wsu.edu/~drc/

Employment and Personnel Services

139 French Administration Building

(509) 335-4521

www.hrs.wsu.edu/

Gay, Lesbian, Bisexual, and Allies Program and Center

CUB B19A; (509) 335-6388

Graduate and Professional Student Association

Compton Union Building, Third Floor; (509) 335-9545

www.wsu.edu/~gpsa/

Health and Wellness Services

(509) 335-3575

<http://www.hws.wsu.edu/>

Housing Services

McCartan Office Suite, Streit-Perham Hall

(509) 335-4577

www.wsu.edu/hdrl/

Human Relations and Educational Services Program

French Administration Rm 132; (509) 335-6648

<http://www.wsu.edu/~hres>

Intensive American Language Center (IALC)

McAllister Hall, Room 116; (509) 335-6675

www.ialc.wsu.edu

International Programs

IP Administration Office, Bryan 206; (509) 335-2541

<http://www.ip.wsu.edu/>

Multicultural Student Services

Lighty 190; (509) 335-7852

www.wsu.edu/multicultural/

Office of Student Programs

CUB room 337; (509) 335-9667

<http://www.cub.wsu.edu/osp/>

Ombudsman's Office

Wilson Hall 2; (509) 335-1195

www.wsu.edu/~ombuds/

Parking, Vehicle, and Driver Licensing

WSU Police Department, Safety Building

(509) 335-8548

<http://www.wsu.edu/parking/>

Psychology Clinic

Johnson Tower 362; (509) 335-3587

www.wsu.edu/psychology/2001/clinic/psychology_clinic_home.htm

Speech and Hearing Clinic

Daggy Hall 133; (509) 335-1509

Student Advising and Learning Center (SALC)

Lighty 260; (509) 335-6000

<http://www.salc.wsu.edu/>

Student Legal Services/Housing Commission

Compton Union Building, 3rd floor; (509) 335-9539

<http://www.cub.wsu.edu/sls/>

University Recreation

www.cub.wsu.edu/urec/index.shtml

Veterans Affairs

French Administration, Room 345

509-335-1875

<http://www.va.wsu.edu/>

Women's Resource Center

Wilson Hall 8; (509) 335-6849

<http://www.wsu.edu/~wrc/>

Women's Transit Program

(509) 335-6830

<http://www.wsu.edu/~transit/>

Admission and Registration

Admission

General Information

Admission to Washington State University is granted without regard to age, sex, race, religion, color, creed, disability, national or ethnic origin, sexual orientation, or marital status. Graduates of Washington State University and other colleges and universities whose degrees are recognized by this institution and who meet the requirements for admission to the Graduate School may be admitted to the Graduate School.

Inquiries and requests for application material may be sent to the Office of the Graduate School, Washington State University, Pullman, WA 99164-1030, (509) 335-1446. A variety of information, including the application, is also available via the World Wide Web. WSU's home page address is www.wsu.edu. The home page has links to general information about WSU and provides access to the Graduate School home page. Applicants for admission must have official transcripts from colleges or universities from which any degrees have been granted or are expected and those transcripts which show the last 60 graded semester or 90 graded quarter hours of undergraduate work taken. In addition, transcripts are required from colleges or universities showing graded graduate level coursework taken after the bachelor's degree. Official transcripts are those mailed directly to the Graduate School from the Registrar of the institution attended. Transcripts mailed by the student are not considered official. One set of transcripts is to be sent to the Graduate School and a second set is to be sent to the chair of the department or program concerned. Complete credentials should be on file at least one month before registration. Transcripts from other institutions cannot be returned. Records of previous work at Washington State University need not be submitted.

The Dean of the Graduate School may approve admission of a student from a foreign university if the student presents a superior academic record, furnishes satisfactory evidence of adequate ability in English, and has sufficient financial resources. Such applications should be completed at least six months in advance of the proposed date of enrollment in the Graduate School. International students who have undertaken graduate study in other institutions will be accepted only after evaluation of their undergraduate records, as well as their performance in graduate study and the minimum criteria, as described above, will apply.

In a graduate program, a student is required to complete appropriate advanced courses, to participate in sem-

inars, and to make an original contribution to knowledge. At least one academic year of graduate study, or the equivalent, is necessary for the completion of a program leading to a master's degree. The residence requirement for the master's degree is one academic year.

The period of study for the Doctor of Philosophy and Doctor of Education degrees is at least three years (six semesters) beyond the baccalaureate degree. For students without a master's degree, at least two of these three years shall be in residence at Washington State University (enrolled full time and present on a campus where a given program has received approval to grant residency). For students with a master's degree, at least one of these three years shall be in residence at Washington State University (enrolled full time and present on a campus where a given program has received approval to grant residency). For the Doctor of Education, at least two of the three years beyond the baccalaureate shall be in residence at Washington State University, including a minimum of four semesters, with at least one summer session and one semester being contiguous, when the student is enrolled full time and present on the Pullman campus. Full time enrollment for four summer sessions may be substituted for two academic year semesters. Summer session cannot be substituted for the semester contiguous with a summer session requirement for the doctoral degree.

Most advanced-degree programs emphasize the preparation of students for careers as productive scholars, and accomplishments in research constitute an important part of the training. It is recognized also that those who earn advanced degrees often become teachers in institutions of learning. For this reason, in many departments special attention is given to the preparation of students for careers in the teaching profession.

Departmental approval is required for any admission regardless of grade point average, and departments may require higher levels of performance than those cited. Because of limitations within certain departments, it may be necessary to deny admission to some qualified applicants.

Except as they apply to undergraduate students only, graduate students are subject to the usual procedures and regulations of the institution and to such Graduate School rules and procedures as outlined in the Graduate School Policies and Procedures Manual.

Enrollment Requirements

The normal load for a graduate student is 12-18 credit hours per semester (6-8 hours in an eight-week summer session). Graduate students on half-time teaching or research assistantships are expected to carry 10-14 credits

per semester with no more than 12 hours of graded credit (3-6 in an eight-week summer session). See the Graduate School Policies and Procedures Manual for requirements for graduate students on appointment or taking examinations.

Classification of Students

Regular Student Status

Applicants with at least a B (3.00 on a 4.00 scale) grade point average, or the equivalent in the last 60 graded semester (90 quarter) hours, from a recognized college or university; or at least a B grade point average in any graduate work from a recognized graduate school are eligible for admission to regular student status. Applicants with at least 12 semester hours of approved in-course work from recognized graduate schools with at least a B grade point average are eligible for admission to regular student status.

Provisional Student Status

A student not eligible for regular student status may be admitted on provisional student status upon special recommendation of the chair of the major department and with approval of the Associate Dean of the Graduate School.

Registration

Instructions for registration and policies and procedures for dropping and adding classes are included in the Time Schedule available in the Registrar's Office. Students register via the World Wide Web (METRO). Instructions are included in the Admission Packet from the Graduate School or from the Office of the Registrar.

All graduate students must maintain continuous enrollment in the Graduate School, registering for each semester and summer session from the time of first enrollment until all requirements for the degree are completed. *Continuous enrollment may be maintained by registering in one of the following categories:* 1) full-time enrollment 2) part-time enrollment or 3) graduate leave status enrollment.

Students on graduate leave status may discontinue enrollment for credit for a period of 12 months without penalty. After that time, graduate leave status students will be assessed a fee of \$25. Students on graduate leave status will be considered by the Graduate School to be in good standing for up to four consecutive years. *Graduate leave status enrollees who wish to enroll for credit must give the Graduate School one month notice prior to the enrollment date.* Graduate students who fail to maintain continuous enrollment will be dropped from the University.

Special Projects or Independent Study (600), Master's Research, Thesis and/or Examination (700), Master's Special Problems, Directed Study, and/or Examination (702), and Doctoral Research, Dissertation, and/or Examination (800) shall have as prerequisite regular or provisional student status in the Graduate School.

Graduate students must register for the required amount of 700, 702, or 800 credit during the semester or summer session in which they take their final examination. Fall and spring semesters and summer session officially end at the last day of finals week. Examinations normally are not scheduled between regular terms. However, students who have received special permission from the Graduate School to schedule final master's or doctoral oral examinations in the interim nonclass period after the end of a term will be required to register for the following semester or summer session.

Academic Regulations

Scholarship Standards

A student must earn a 3.00 grade point average for all course work (including all courses listed on the program and other graduate upper- and lower-division courses). No work of C grade or less may be dropped from a program, nor can a course be repeated for a higher grade if the final grade is C or higher. Any course listed on the program in which a grade of C-, D, or F is earned must be repeated.

Any graduate student who fails to maintain a cumulative grade point average of 3.00 or higher for all course work subsequent to admission to the Graduate School will be dropped from the University. A student who is dropped may be permitted to re-enroll if the chair of the major department makes a special recommendation with the concurrence of the Dean of the Graduate School.

Requirements for a Graduate Degree

The graduation requirements of the Graduate School (as published in the *Graduate School Policies and Procedures Manual*) in effect at the time of the student's initial admission as a regular or provisional graduate student must be met for completion of a graduate degree program. Departmental requirements for graduation are those in effect at the time the student files a program.

Subsequent changes in degree requirements of the Graduate School or in departmental requirements may be substituted at the option of the student upon approval by the master's or doctoral committee, by the department chair, and by the Dean of the Graduate School.

If a student is dropped from the University for failure to maintain continuous enrollment, the graduation requirements of the Graduate School are those in effect at the time of readmission to the Graduate School.

The time limit for the use of graduate credits toward a master's degree is six years from the beginning date of the earliest course applied toward the degree.

Each program for a doctoral degree is considered individually. In all cases, work for the degree must be completed within three years of the date of the satisfactory completion of the preliminary examination. At least four

months must elapse between preliminary and final examinations for doctoral degrees.

Transfer Credit and Credit Restrictions

Detailed policies and procedures on transfer credit and credit restrictions are outlined in the Graduate School Policies and Procedures Manual.

Transfer of Graduate Credits

Appropriate credits (with a grade of B or higher) earned in other accredited graduate schools may be applied to a limited extent toward an advanced degree; however, they may not be substituted for residence requirements.

Graduate Work through Continuing Education

Credit earned in graduate-level courses taken through the WSU Office of Extended University Services will be accepted on graduate student programs without limit subject only to customary program approvals. No extension credits from other institutions, or work done by correspondence with this or any other institution, or credit earned by special examination may be used to meet advanced degree requirements.

Graduate Study by Seniors

Seniors who have at least a 3.00 grade point average in the last half of their undergraduate work at Washington State University may register for up to six semester hours of work in the Graduate School in excess of the number of hours required to complete the bachelor's degree. Graduate School approval is required at the time of registration. Only grades of "B" or higher may be applied toward an advanced degree. Seniors who wish to enroll in 500-level courses for undergraduate credit must obtain approval of the major advisor and the chair of the department or program in which the course is offered.

Tuition and Fees

Tax sources of the state finance the major portion of facilities and operation of the instructional programs, student services, and related activities. Graduate students share in the costs by paying tuition, fees, and other charges as established by the Board of Regents.

Tuition, fees, and other charges are subject to change, and are effective when established by the Legislature of the State of Washington and adopted by the WSU Board of Regents. For the most up-to-date rates, please go to <http://www.wsu.edu/studacct/tuition.htm>.

Payment of registration fees is due on or before the fifth Friday of class. Receipt of payment after that day will result in a 5% late payment fee. Any tuition balances not paid by the eighth Friday of class will receive another 10% late payment fee.

Resident graduate tuition for academic year 2003-04 for more than 9 hours of enrollment is \$3139 per semester; nonresident tuition for more than 9 hours is \$4508 per semester. Part-time tuition for 9 hours or less is \$314 credit hour for residents and \$765 per credit hour for non-residents. Part-time students must pay for a minimum of 2

credit hours per semester. (NOTE: Graduate students appointed to graduate assistantships may receive waivers of tuition. See **Assistantships, Fellowships, and Traineeships** section.)

On the Pullman Campus, fees for Student Health (\$87), Student Recreation Center (\$120), and Pullman Transit (\$15) are charged each semester. (NOTE: Graduate students appointed to half-time graduate assistantships qualify for medical insurance coverage. See **Assistantships, Fellowships, and Traineeships** section.) Other fees, including parking permits and health insurance, are options.

Along with the application form, a \$35 application fee is required to cover handling and processing costs. This fee is nonrefundable and may not be credited against any other fees charged by WSU.

NOTE: Overdue accounts owed the University will prevent release of transcripts and enrollment. Registration is not complete until all of the student's tuition and fees are paid.

Student Financial Aid Programs

Financial Aid

Graduate students wishing to apply for financial aid must complete the Free Application for Federal Student Aid (FAFSA). The FAFSA priority processing date is March 1. Students may apply on-line at www.fafsa.ed.gov or pick up a paper version at any local high school, community college, public library, or the Washington State University Office of Student Financial Aid and Scholarship Services (OSFA/OSS), 380 Lighty Student Services Building.

Graduate students are considered for the following programs: Federal Family Educational Loans (Subsidized and Unsubsidized Stafford loans) and Federal or State Work Study Programs. Work Study Program funds may be used toward funding graduate assistantships. The Office of Student Financial Aid determines student eligibility for these programs. Letter of eligibility will notify students. Financial aid counselors are available to assist students and families with their financial aid concerns (509) 335-9711.

Each academic year, a number of graduate students at WSU are awarded a graduate assistantship from their departments. The assistantship usually covers the majority of tuition costs. This Operating Fee Waiver is considered a resource when the OSFA determines the student's eligibility for other financial aid programs. In order to ensure your Financial Aid Award Notification is correct, please notify the OSFA if your department has granted you an Operating Fee Waiver. If the OSFA is notified after the first disbursement of your loan, any subsequent disbursement may be reduced accordingly.

NOTE: All graduate awards are initially based on resident tuition costs, regardless of resident status. You may request (in writing) an adjustment for non-resident tuition costs.

If you have unmet need on your Financial Aid Award Notification and/or the Cost of Attendance has not been met, you may qualify to borrow an Alternative Loan. Contact the OSFA for more information.

Short Term Loans may be available to students who encounter delays in their financial aid delivery through the OSFA.

Satisfactory Academic Progress (SAP) Policies

To receive and continue to be eligible to receive financial aid, graduate students must be in good standing with their department and the Graduate School. Note: The maximum time frame calculation is based on all semesters of enrollment regardless of whether or not financial aid was received each semester. Semesters in which enrollment is less than 10 hours will be counted as one-half of a full-time semester.

Maximum Time Frame for financial aid (exclusive of graduate assistance):

- Master's degree candidates-three years (6 full-time semesters)
- Doctoral degree candidates who have a previous master's degree - three years (6 full-time semesters)
- Doctoral degree candidates without a master's degree - six years (12 full-time semesters)
- Professional students and veterinary medicine students - five years (10 full-time semesters)

Assistantships, Fellowships, and Traineeships

Teaching and research assistantships are available in most departments offering advanced degrees, and non-service research fellowships and traineeships are granted in some departments. Ordinarily, graduate appointments are limited to those who pursue programs of study leading to advanced degrees at Washington State University. The *Graduate School Policies and Procedures Manual* should be consulted concerning qualifications, eligibility, and application procedures.

As most appointments for fall semester are made by April 1, or as soon thereafter as possible, it is desirable to have applications completed by February 1; nonservice appointment applications should be completed by January 1. Spring semester applications should be completed by September 1. Applications received at a later date can be considered only for positions still available.

Assistantship appointments require part-time service. The term of a graduate appointment may be for a nine-month period, a semester, or a summer. Students on appointment must maintain regular enrollment in the Graduate School (10 credit hours or more during the academic year; 3 credit hours during summer session) for the duration of their appointments. Stipends vary according to the amount of required service, the extent of the student's training, and merit factors (e.g., academic record, experience). Contact the Graduate School Office for salary information.

Graduate students, who are not residents of the State of Washington, appointed to assistantships of one-half time service (20 hours per week) or more by the Board of Regents, and who reside in the State of Washington while attending WSU, may receive a waiver of the nonresident portion of the tuition. *(NOTE: Non-resident tuition waivers cannot be assured beyond the first year of graduate students' assistantships. Students who intend to remain in the state are encouraged to review Washington statutes and associated administrative rules governing the establishment of residency for tuition purposes. These may be obtained from the Office of Student Affairs, the Graduate School, or found on the World Wide Web at <http://www.wsu.edu/NIS/Residency.html>.*

The resident operating fee may also be waived for resident students who hold half-time (or greater) service appointments (20 hours per week) and who qualify based on merit factors, and for nonresident students who reside in the State of Washington, who hold half-time graduate service appointments and who qualify based on merit factors. Further, graduate students who hold half-time (or greater) service appointments automatically qualify for and receive medical insurance coverage. All students on assistantships pay the general tuition and activities fees. *(Please note: To be eligible for any waiver, a student must be physically living in the State of Washington.)*

Forms for assistantship or fellowship applications are included as part of the general application for admission to Graduate School. For information about special scholarships and fellowships, write to the Dean of the Graduate School or the chair of the department concerned.

Washington State University subscribes to the following resolution of the Council of Graduate Schools in the United States regarding scholars, fellows, trainees, and graduate assistants:

Resolution Regarding Scholars, Fellows, Trainees, Assistants

Acceptance of an offer of financial support (such as a graduate scholarship, fellowship, traineeship, or assistantship) for the next academic year by a pro-

spective or enrolled graduate student completes an agreement that both student and graduate school expect to honor. In that context, the conditions affecting such offers and their acceptance must be defined carefully and understood by all parties.

Students are under no obligation to respond to offers of financial support prior to April 15; earlier deadlines for acceptance of such offers violate the intent of this Resolution. In those instances in which a student accepts an offer before April 15, and subsequently desires to withdraw that acceptance, the student may submit in writing a resignation of the appointment at any time through April 15. However, an acceptance given or left in force after April 15 commits the student not to accept another offer without first obtaining a written release from the institution to which a commitment has been made. Similarly, an offer by an institution after April 15 is conditional on presentation by the student of the written release from any previously accepted offer. It is further agreed by the institutions and organizations subscribing to the above Resolution that a copy of this Resolution should accompany every scholarship, fellowship, traineeship, and assistantship offer.

Departments, Programs, and Courses

Explanation of SYMBOLS

- 2 Figure following course title indicates the hours of credit and the number of lectures per week.
() hours of lecture and laboratory required each week during the semester, with lecture being the first figure and laboratory the second
(a/y) Indicates alternate years.
c// Indicates concurrent enrollment.

Courses listed in this catalog are subject to change through normal academic channels. New courses and changes are initiated by the cognizant departments or programs, approved through the appropriate academic dean, the Catalog Subcommittee, the Academic Affairs of Graduate Studies Committees, the University Senate. Additions to the curriculum for the ensuing year are published each fall in the Catalog Supplement within the Fall Time Schedule. It is the obligation of the student to be acquainted with all the pertinent information in this Bulletin and the Graduate School Policies and Procedures Manual to see that all departmental requirements are satisfied. **All applicants are required to present graduate record examinations scores or their equivalent.**

Accounting

(See Business Administration)

Adult and Youth Education

(See Human Development)

Agricultural and Resource Economics

Degrees Granted: Master of Arts in Agricultural Economics; Master of Arts in Agribusiness; Doctor of Philosophy

GRADUATE FACULTY

C. R. Shumway, Chair; K. L. Casavant, F. R. Chaddad, H. Chouinard, K. D. Duft, R. J. Folwell, H. R. Hinman, D. W. Holland, R. G. Huffaker, E. Jessup, S. C. Matulich, J. J. McCluskey, V. A. McCracken, R. C. Mittelhammer, R. T. Schotzko, T. I. Wahl, P. R. Wandschneider, H. H. Wang, J. K. Yoder, D. L. Young

The Department of Agricultural and Resource Economics offers programs of study leading to the degrees of Master of Arts in Agricultural Economics, Master of Arts in Agribusiness and Doctor of Philosophy (Agricultural Economics). Study can be concentrated in a number of fields including agribusiness management, marketing, production economics, resource economics, and quantitative applications. Courses in Agricultural and Resource Economics are complemented by courses selected from Economics, Business Administration, Mathematics, Computer Science, Statistics, and other related fields.

The degree programs are supported by services of the University libraries (Holland and Owen Science and Engineering Libraries), and the Agricultural Sciences Library. Research activities are enhanced by access to state-of-the-art computing facilities.

The program leading to the Master of Arts in Agricultural Economics prepares the student either for professional work as an agricultural economist or for further graduate study. The program leading to the Master of Arts in Agribusiness prepares the student for entry or mid-level positions with agribusiness firms throughout the world. Each candidate for the master's degree must complete an acceptable program of study of not less than 30 credit hours. A minimum of nine hours is required in economic theory and quantitative methods. At least six additional hours must be 500 level field courses. Fifteen hours of formal courses must be at the 500 level. In addition, the candidate must write an acceptable M.S. thesis and pass a final oral examination. A non-thesis option is available. It requires additional course work and an acceptable special problems paper instead of the thesis.

The doctoral program is the highest level of academic preparation possible for students who wish to become professional agricultural economists. Students must accumulate a minimum of 72 hours of credit beyond the bachelor's degree, including credit earned through the core program, additional coursework, allowed transfer credit, and research. The core program is common to agricultural economics, economics, and finance. It consists of at least 15 hours of economic theory, 10 hours of quantitative methods, and 12 hours of advanced topics courses. Six of the latter 12 hours must be in agricultural production, markets, and/or resource economics. Students are required to take a comprehensive oral preliminary examination after they have completed qualifying examinations and prepared a research proposal. Each student must prepare an original, scholarly dissertation representing a significant contribution to knowledge in agricultural economics. Doctoral candidates must pass a final oral examination which is primarily a defense of the dissertation, but which may also cover the general field of knowledge pertinent to the degree.

Any undergraduate or graduate major is invited to consider graduate study in Agricultural and Resource Economics. Previous students have come from a wide variety of fields including agriculture, social sciences,

and engineering. Prior to taking courses in agricultural economics for graduate credit, a student should have developed an understanding of basic economic theory at the intermediate level and should have been introduced to methods of handling statistical data pertaining to economics. Knowledge of mathematics (including calculus) is essential. A student who plans to do work in agricultural economics beyond the Bachelor of Science degree should consult with this Department as early as possible to develop an appropriate study program. All applicants meeting Graduate School requirements, demonstrating a proficiency in the English language and having a 3.0 gpa in agricultural economics, mathematics, and statistics courses are normally admitted to the master's program.

Agricultural Economics

Ag Ec

- 500 Economic Theory I** 3 Same as Econ 500.
- 501 Economic Theory II** Same as Econ 501
- 502 Economic Theory III** Same as Econ 502
- 503 Economic Theory IV** Same as Econ 503
- 504 Economic Theory V** 3 Prereq Ag Ec 502 and 503. Advanced duality topics, demand and supply system modeling, financial economics and risk.
- 507 Decision Analysis in Agricultural Economics** 3 Prereq Math 201, 202. Decision analysis tools for agricultural and resource economics and agribusiness; linear, nonlinear, integer programming; transportation, assignment, inventory, input-output models. Graduate-level counterpart of Ag Ec 407; additional requirements. Credit not granted for both Ag Ec 407 and 507.
- 508 Microeconomic Analysis** 3 Prereq Econ 302 or consent of instructor. Master's-level calculus-based producer and consumer theory with selected managerial economics topics. Cooperative course taught by WSU, open to UI students (Ag Ec/Econ 510).
- 509 Applied Statistical Methods in Agricultural Economics** 3 Application of sampling techniques, linear regression and analysis of variance and covariance to agricultural economics research problems. Graduate level counterpart of Ag Ec 409; additional requirements. Credit not granted for both AgEc 409 and 509.
- 510 Statistics for Economists** 4 Prereq college calculus and matrix algebra. Statistical theory underlying econometric techniques utilized in quantitative analysis of problems in economics and finance.
- 511 Econometrics I** Same as Econ 511
- 512 Econometrics II.** 3 Econometric methods for systems estimation, simultaneous equations, discrete and limited depended variables, panel data, time series.
- 521 Topics in Agricultural Economics** V 1-3 May be repeated for credit; cumulative maximum 6 hours. Current topics in agricultural development, marketing, farm management, and agricultural policy.
- 525 Economic Analysis of Environmental Policies** 3 Prereq Ag Ec 311 or Econ 301 or Econ 302. Nature and practice of environmental policy analysis using economics concepts and tools including benefit cost, social indicators and environmental accounts. Credit not granted for both Ag Ec 425 and 525.
- 540 Agricultural Production Economics** 3 Prereq Ag Ec 508 or consent of instructor. Production economics theory and methods applied to problems of production response, economic optimization, technology, policy, risk and dynamics.
- 550 Agricultural Marketing** 3 Prereq Ag Ec 508 or consent of instructor. Application of economic theory to topics in agricultural marketing and price analysis.
- 560 Agribusiness Management and Marketing** 3 Rec Ag Ec 460. Management and marketing problem situations in agribusiness; alternative policies, strategies, and decisions.
- 580 Resource Economics** 3 Prereq Ag Ec 508 or consent of instructor. Economic analysis of the allocation and use of environmental and natural resources. Cooperative course taught by WSU at UI (AgEc 551).
- 590 Advanced Topics in Mathematical and Quantitative Methods** V 1-6 May be repeated for credit; cumulative maximum 12 hours. Prereq Ag Ec 500 and 501 or permission of instructor. Topics may include advanced econometrics, dynamic optimizations, computer applications, methodology.
- 591 Advanced Topics in Monetary and Public Economics** V 1-6 Same as Econ 591.

592 Advanced Topics in International and Development Economics V 1-6 Same as Econ 592.

593 Advanced Topics in Health, Education, Labor, and Demographic Economics V 1-6 Same as Econ 593.

594 Advanced Topics in Markets and Industrial Organization V 1-6 May be repeated for credit; cumulative maximum 12 hours. Prereq Ag Ec 500 and 501 or permission of instructor. Topics may include industrial organization or agricultural and sports markets, price analysis, market structure, economic growth, rational regulation.

595 Advanced Topics in Resource and Production Economics V 1-6 May be repeated for credit; cumulative maximum 12 hours. Prereq Ag Ec 500 and 501 or permission of instructor. Topics may include resource scarcity, decision making under risk, bioeconomics, production applications, welfare analysis.

596 Advanced Topics in Financial Economics V 1-6 Same as Fin 596.

597 Agribusiness Internship V 2-4 May be repeated for credit; cumulative maximum 4 hours. Off-campus student work-study in the agribusiness industry.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis and/or Examination Variable credit. S, F grading.

702 Master's Special Problems, Directed Study, and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation and/or Examination Variable credit. S, F grading.

American Studies

Degrees Granted: Master of Arts in American Studies; Doctor of Philosophy

GRADUATE FACULTY

T. V. Reed, Director; J. Alamillo, S. Armitage, D. L. Ashby, M. Bloodsworth-Lugo, J. H. Bodley, J. Burbick, D. L. Coon, Y. Flores Niemann, A. L. Hammond, M. T. Hayes, L. Heidenreich, P. W. Hirt, R. L. Hume, W. D. Johnson, N. Kawamura, M. R. Kendrick, J. Kicza, A. Kuo, R. G. Law, L. LeLoup, F. E. Lutze, L. Mercier, R. Ong, J. Peterson, C. Roman, M. Salvador, C. Siegel, J. Streamas, N. Sturgeon, O. J. Svingen, V. Villanueva, A. J. von Frank, W. Willard (Emeritus), G. L. Young (Emeritus)

Washington State University offers the Master's degree and the Doctor of Philosophy degree in American Studies. The program provides students the opportunity to choose an emphasis in Ethnic Studies, Feminist Studies, History, Literature or another discipline, and an interdisciplinary specialization that crosses the borders of these fields. We feature a portfolio of publishable papers, rather than an exam structure, and students have the option of electronic, creative or traditional theses.

The program explores interdisciplinary analysis of the United States as a multiethnic, multiracial, multigendered, and multicultural society, shaped by transnational forces. We draw most of our faculty from Comparative Ethnic Studies (Chicano/a Latino/a, Native American Indian, Asian/Pacific American, African American), History, English, and Women's Studies. We also have faculty in Anthropology, Communications, Environmental Sciences, Fine Arts, Political Science, and Sociology. In addition to taking our own American Studies courses, students are free to take graduate courses in these other departments, and to synthesize them into individualized programs of study.

While most of our graduate students enter careers in university and college teaching, an American Studies advanced degree can also be a useful preparation for community activism, museum and archive work, traditional and electronic publishing, and government service, among other careers. Among the options in the program are theses done in multimedia, electronic format. The MA electronic thesis can be used as a portfolio by students seeking to work with community-based organizations, in multimedia publishing, or to show teaching competence in new technologies.

The program offers a broad array of possibilities for doing American cultural studies, but among our strengths are: Ethnic Studies, including comparative and transnational dimensions; Feminist Studies, including US and Third World perspectives and theories; Multicultural American West; Cultural Environmental Studies; Chicano/a Studies; American Indian/Native American Studies; Asian/Pacific American Studies; Nineteenth Century Historical, Literary and Cultural Studies; US Popular Culture; Social Movements and Activist Research; Borderlands, Transnationalism and Globalization; Labor History; Cultural Theory; and Cyberculture Studies and Digital Diversity.

Students take a small core of required seminars (outlined below), then proceed to create a linked set of courses from various disciplines and independent study to create an area of specialization for thesis or dissertation work.

American Studies

AmSt

- 500 Colloquium 1** May be repeated for credit; cumulative maximum 12 hours. Current research in American studies. S, F grading.
- 501 Readings in American Studies I 3** May be repeated for credit; cumulative maximum 6 hours. Readings in key texts in American culture, beginnings to 1865.
- 502 Readings in American Studies II 3** May be repeated for credit; cumulative maximum 9 hours. Readings in key texts in American culture, 1865 to present.
- 503 Contemporary Theories of Race and Ethnicity 3** Prereq graduate standing. Major theoretical readings and key recent texts in United States and transnational ethnic studies scholarship.
- 504 Contemporary Feminist Theories and Practices 3** Prereq graduate standing. Major theoretical readings and key recent texts in U.S. and transnational feminist scholarship.
- 513 Theory and Method in American Studies 3** Same as Engl 513.
- 524 History of American Popular Culture 3** Same as Hist 424. Credit not granted for both Am St 424 and 524.
- 525 Social Movements in American Cultures 3** Theoretical and historical study of the role of social movement in United States culture.
- 590 Seminar in American Studies 3** May be repeated for credit; cumulative maximum 9 hours. Interdisciplinary topics in American culture.
- 596 Topics in American Studies 3** May be repeated for credit; cumulative maximum 9 hours. Graduate level counterpart of Am St 496; Same as Engl 596. Credit not granted for both Am St 496 and 596. (SS)
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Graduate students may also take courses from any of our ten affiliated departments.

Animal Sciences

Degrees granted: Master of Science in Animal Sciences; Doctor of Philosophy

GRADUATE FACULTY

R. W. Wright, Jr., Chair; J. R. Busboom, B. P. Chew, M. V. Dodson, L. K. Fox, J. A. Froseth, C. T. Gaskins, J. H. Harrison, Z. Jiang, K. A. Johnson, R. L. Kincaid, R. W. Leid, D. J. McLean, J. P. McNamara, M. L. Nelson, R. C. Newberry, J. J. Reeves, S. S. Ristow, P. L. Senger

The Department of Animal Sciences offers graduate study and research programs leading to the degrees of Master of Science in Animal Sciences and Doctor of Philosophy, and it participates in the genetics, nutrition, and statistics interdepartmental programs. Requirements for admission include a letter of application stating qualifications and personal goals

and objectives, GRE scores, college transcripts and three letters of recommendation. Information regarding admission and graduate programs in the Department is available at www.ansci.wsu.edu. Graduate students in the Department of Animal Sciences may become candidates for degrees in these interdepartmental programs. The Department is especially qualified and equipped for graduate study and research in the following areas: (1) genetics; (2) nutrition; (3) reproduction; (4) genomics; (5) food safety and meat science (6) production; and (7) animal well-being/behavior.

The formal courses in the graduate program of the individual student are flexible, depending upon the student's interest and undergraduate preparation. Requirements for the degree of Master of Science in Animal Sciences include graduate courses in animal sciences, biometry, biochemistry and other basic and applied areas. Research experience is required through the preparation of a thesis. The program for the degree of Master of Science is designed as preparation for careers in a variety of animal related industries and as preparation for the degree of Doctor of Philosophy. The requirements for the degree of Doctor of Philosophy in the Department of Animal Sciences conform to the general requirements of the Graduate School. For continued enrollment, doctoral candidates are required to take and perform satisfactorily in their preliminary examinations. Teaching experience is required in the Ph.D. degree. Graduates find employment related to their training in teaching, research, extension and industries related to animal agriculture.

The Department maintains laboratory and animal facilities for graduate study and research. Facilities and equipment are available for bioassay, chemoassay, radioimmunoassay of hormones, antibody and cellular immune assays, electrophoretic and chromatographic techniques, real-time RTPCR, in vitro cell culture, DNA microarrays, microbiological assays, trace mineral and proximate analysis, enzyme studies, aquaculture, animal metabolism, physiological measurements, computer facilities for statistical analysis, simulation, word processing, presentation graphics and networking. The Department maintains herds and flocks of domestic animals and several species of laboratory animals and fish for teaching and research.

Undergraduate students who contemplate graduate study in the Department of Animal Sciences at Washington State University should have a major in animal science, biology, zoology or some related field. Minimum admission recommendations are: 15 hours of general biology (including zoology, physiology, genetics, nutrition), 2 semesters of inorganic chemistry, 2 semesters of physics, and 1 semester of animal production.

Animal Sciences

A S

- 500 Seminar in Animal Sciences 1** May be repeated for credit. Current developments in animal sciences.
- 504 Special topics V (1-4)** Current concepts in protein and energy metabolism and function related to nutrient requirements for maintenance, growth and development of animals. May be repeated for credit. Cumulative maximum 12 hours. Cooperative course taught by UI, open to WSU students (AVS 504).
- 505 Experimental Nutrition V 1 (0-3) to 3 (0-9)** Prereq Chem 220; MBioS 303. Laboratory techniques used in nutritional research; modern biochemical methods of analysis, introduction to physiological chemistry. (a/y)
- 506 Non-ruminant Nutrition 3 (2-3)** Advanced digestion, metabolism nutrient use by non-ruminant animals, problem analysis and solving in practical applications. Prereq A S 313. Graduate level counterpart of A S 406; additional requirements. Credit not granted for both A S 406 and 506.
- 507 Advanced Nutrient Metabolism 3** Prereq A S 404 or 410; 504 ; MBioS 303. Advanced topics in metabolic regulation of carbohydrate, fat and amino acid use by animals. Cooperative course taught by WSU, open to UI students (AVS 512). (a/y)
- 508 Ruminant Nutrition 3 (2-3)** Anatomy, physiology, and metabolism in ruminant animals. Graduate level counterpart of A S 408; additional requirements. Credit not granted for both A S 408 and 508. Not for animal science graduate students.
- 510 Digestion and Nutrient Utilization in Animals 2 (1-2)** Gastrointestinal physiology, rate of passage, feed intake regulation, measures of digestibility, starch, fat and nonstarch polysaccharide, and diges-

tion and utilization of nutrients. Cooperative course taught by WSU, open to UI students (AVS 510).

- 513 Mineral and Vitamin Metabolism 4** Prereq A S 404 or 408; MBioS 303. Absorption, excretion, metabolism, dietary requirements and interactions of mineral and vitamins in animals and humans. Cooperative course taught by WSU, open to UI students (AVS 513).
- 520 Preparation of Scientific Literature in Animal Sciences 2** Prereq graduate standing. Preparation of grant proposals, manuscripts, and literature reviews on research topics.
- 528 Topics in Animal Breeding 2** May be repeated for credit; cumulative maximum 4 hours. Prereq A S 330. Systems of selection and mating for genetic improvement in farm animals. Credit not granted for both A S 428 and 528.
- 540 Seminar in Animal Physiology 1** May be repeated for credit. Current developments in animal physiology. Cooperative course taught jointly by WSU and Idaho. (AVS 520).
- 550 Advanced Reproduction 4 (3-3)** Prereq A S 350. Physiology of sexual maturation; gametogenesis; sexual cycle; fertilization; embryonic development; physiological, chemical and immunological characterization of hormones of reproduction. (a/y) Cooperative course taught by WSU, open to Idaho students (AVS 526).
- 551 Endocrine Physiology 3** Structure and physiology of glands of internal secretion and their hormonal effects on processes of growth, development, metabolism, and production of vertebrates; minor emphasis on invertebrates. Graduate level counterpart of A S 451; additional requirements. Credit not granted for both 451 and 551. Cooperative course taught jointly by WSU and UI (AVS 551).
- 556 Embryo Transfer in Domestic Animals 2** Prereq A S 350. Embryo transfer in domestic animals including techniques, equipment, and state of the art biotechnology.
- 557 Laboratory in Embryo Transfer 1 (0-3)** Prereq c// in A S 556. Laboratory principles and practices in embryo transfer.
- 558 Molecular and Cellular Reproduction 3 (2-2)** Same as GenCB 558.
- 560 Domestic Animal Growth 2** Prereq A S 406, 408, or 440; MBioS 303 or 513. Advanced topics in principles of growth and regulation in domestic animals. Cooperative course taught jointly by WSU and UI (AVS 560).
- 573 Advanced Dairy Management 3 (1-6)** Prereq A S 472. Current dairy record-keeping and database management systems. Credit not granted for both A S 473 and 573.
- 588 Perspectives in Biotechnology 3** Prereq 3 credits in MBioS, GenCB or Micro. Theory and application of biotechnology in agriculture, industry, and medicine; methodological, environmental, social, and economic concerns. Credit not granted for both A S 488 and 588.
- 598 Advanced Topics in Animal Sciences V 1-2** May be repeated for credit. Recent research in various disciplines of animal sciences. Cooperative course taught by WSU, open to Idaho students (AVS 596).
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Anthropology

Degrees Granted: Master of Arts in Anthropology; Doctor of Philosophy

GRADUATE FACULTY

W. Andrefsky Jr., Chair; L. A. Ackerman, R. E. Ackerman, J. H. Bodley, M. Collard, A. Duff, B. S. Hewlett, G. A. Huckleberry, T. A. Kohler, W. D. Lipe, K. D. Lupo, J. M. Mageo, N. P. McKee, L. S. Stone, S. A. Weber, C. Wilkinson-Weber, W. Willard

The Department of Anthropology offers graduate study leading to the degrees of Master of Arts in Anthropology and Doctor of Philosophy. Through departmental programs, the faculty provide the training required for positions in teaching, research and applied fields.

The curriculum includes courses in the fields of archaeology, cultural and social anthropology, linguistics and physical anthropology. Through coursework a student gains an understanding of the concepts of contemporary anthropology, the major subject areas within each field, and the anthropology of the primary geographic regions of the world. In addition to training in the core of anthropology, special instruction is offered in the environments of the past, the problems of native peoples in their encounter with industrial societies, and issues in international development anthropology. Collections of the Department of Anthropology include extensive archaeological, palynological and faunal materials from western North America as well as ethnographic specimens from other parts of the world.

Experience in original research, employing documentary materials or involving field study, is required in the preparation of the master's thesis and the doctoral dissertation. Recent faculty and student research areas include western North America (Alaska, the Pacific Northwest, the northern Rockies, the Great Basin, and the Southwest), as well as Egypt, Nepal, Indonesia, Samoa, Central Africa, and Ecuador.

For the Master of Arts and Doctor of Philosophy degrees, foreign language and other special requirements are established by the student's committee in accordance with the student's research interest and needs. Departmental policy requires that students for advanced degrees perform research and/or teaching functions as part of their normal course of study.

Requirements for admission include Graduate Record Examination scores, statement of purpose and goals, three letters of recommendation, vita or resume, official copies of transcripts from all undergraduate and graduate colleges and universities where work has been undertaken, and, in the case of students entering with a master's degree, evidence of the completion of the degree and a copy of the thesis or an equivalent research paper. A department counseling examination is given to entering archaeology and physical anthropology graduate students prior to registration.

Graduate programs in archaeology, sociocultural anthropology and evolutionary anthropology each with its own requirements for advanced degrees. The program in archaeology has a strong emphasis in western North America, including Alaska. Methodological specialties include quantitative methods, modeling and simulation, lithic analysis, geoarchaeology, paleoecology/palynology and zooarchaeology. Archaeology faculty have areal research interests in Alaska, Plateau, Basin, and Southwest areas of North America, as well as Africa, Mesoamerica, Northeast Asia and China. The sociocultural program emphasizes issues in international development, psychological anthropology, cultural ecology, medical anthropology and gender. Sociocultural faculty have areal interests in Latin America, South Asia, Northwest Coast, Plateau, Oceania and Central Africa. The evolutionary anthropology program emphasizes evolutionary psychology, behavioral ecology, evolutionary cultural anthropology, evolutionary archaeology and paleoanthropology. Evolutionary faculty have research interests that span several continents including the Americas, Europe and Africa.

Anthropology

Anth

- 500 Field School V 2 (0-6) to 8 (0-24)** Prereq permission by application. Training in gathering and analyzing field data. (SS)
- 501 History of Anthropological Theory 3** Prereq 6 hrs Anth. Development of theories in cultural anthropology; contributions of specific individuals; representative classics. Credit not granted for both Anth 401 and 501.
- 502 Cross-Cultural Gender and Kinship 3** Prereq Anth 101 or Soc 101. Principles of kinship in anthropology applied to questions of cross-cultural gender definition. Credit not granted for both Anth 402 and 502.
- 504 Tribal Peoples and Development 3** Global and historic perspectives on the complex issues surrounding the problem of tribal peoples and development.
- 507 Advanced Studies in Culture Theory 3** May be repeated for credit; cumulative maximum 6 hours. Prereq 6 hrs Soc S. Evaluation of major theories and methods and their relationship to problems in cultural-social analysis.
- 510 Fundamentals of Cultural Anthropology 3** Overview of basic concepts and theory in cultural anthropology based on in-depth analysis of selected theoretical and ethnographic materials.

- 513 Lithic Technological Organization** 4 (3-3) Methods and theory of lithic technology.
- 519 International Development and Human Resources** 3 History of and recent changes in international development emphasizing anthropological perspectives.
- 528 Topics in Ethnography** 3 May be repeated for credit; cumulative maximum 9 hours. Prereq 3 hours Anth. Culture history, ethnography, theoretical and contemporary problems of selected culture areas. Credit not granted for both Anth 428 and 528.
- 530 Archaeological Method and Theory** 3 History of archaeological method and theory; analysis of current literature.
- 535 Cultural Resource Management** 3 Prereq graduate standing. Role of archaeology in historic preservation and resource conservation; legal and institutional frameworks; research and interpretation in a CRM context. Cooperative course taught by WSU, open to Idaho students (Anthr 535).
- 536 Ethnoarchaeology** 3 Multidisciplinary approach (archaeology, ethnography and history) to the interpretation of man's past human cultures. Credit not granted for both Anth 436 and 536.
- 537 Quantitative Methods in Anthropology** 4 (3-3) May be repeated for credit; cumulative maximum 8 hours. Prereq undergraduate stat course. Sampling, data analysis, inferential statistics, microcomputer and mainframe use applied to anthropological problems with emphasis on archaeology.
- 539 Prehistory of the Southwest** 3 Prehistory of the American Southwest; emphasis on Pueblo, Mogollon and Hohokam traditions and relationships to historic native groups.
- 540 Prehistory of the Northwest Coast** 3 Prehistoric cultures, chronologies and interrelationships on the Northwest Coast of North America.
- 542 Prehistory of Alaska and Eastern Siberia** 3 Prehistoric cultural developments in the Arctic and sub-Arctic zones of Asia and North America.
- 543 Plateau Prehistory** 3 Archaeology of the interior Northwest.
- 545 Historical Archaeology** 3 Excavation and analysis of historical archaeological sites; acculturational implications. Cooperative course taught by UI (Anthr 531), open to WSU students.
- 546 Prehistory of the Desert West** 3 Changing desert environments and human adaptations; perspectives for understanding desert prehistory; ancient lifeways of the Desert West.
- 547 Models in Anthropology** 3 Models and model-building as an anthropological approach to present and past cultures.
- 548 Hunters and Gatherers: Past and Present** 3 Prereq graduate standing. Introduction to hunter-gatherer studies in anthropology and archaeology exploring uses of evolutionary approaches to modeling and reconstruction hunter-gatherer behavior in contemporary and prehistoric contexts.
- 549 World Archaeology** 3 Current thought on major transitions (sapienization, advent of Neolithic and of civilization) in human prehistory around the world.
- 550 Descriptive Linguistics** 3 Introduction to analysis and description of natural languages; phonological, syntactic, and semantic analysis of data from a variety of languages. Credit not granted for both Anth 450 and 550. Cooperative course taught by WSU, open to UI students (Anthr 550).
- 554 Anthropological Field Methods** Seminar 3 Prereq Anth 450/550. Elicitation, recording techniques and analysis of sociocultural and linguistic field data.
- 561 Current Trends in Physical Anthropology** 3 May be repeated for credit. Prereq Anth 465. Intensive review of major current trends in physical anthropology.
- 563 Human Races** 3 Prereq Anth 260. Graduate level counterpart of Anth 463; additional requirements. Human population biology, dynamics of evolution, human ecology, and their relationship to the problem of human racial variation. Credit not granted for both Anth 463 and 563. Cooperative course taught jointly by WSU and UI (J 412/512).
- 565 Human Evolution** 3 Prereq Anth 260. Graduate level counterpart of Anth 465; additional requirements. Human origins in the light of the fossil record and evolutionary theory. Credit not granted for both Anth 465 and 565. Cooperative course taught jointly by WSU and UI (J 411/511).
- 566 Human Osteology** 3 (2-3) Prereq Anth 260. Graduate level counterpart of Anth 466; additional requirements. Observations and measurements of human skeleton; variations based on age, sex, and race; comparisons with fossil man and higher primates. Credit not granted for both Anth 466 and 566. Cooperative course taught jointly by WSU and UI (J451/551).
- 567 Forensic Anthropology** 4 (3-3) Prereq Anth 566. Determining age, sex, stature, population affinities, personal identifying characteristics, and evidence of trauma for human skeletal material for criminal and human rights cases. Graduate level counterpart of Anth 467; additional requirements. Credit not granted for both 467 and 567.
- 568 Paleoanthropology** 4 (3-3) Prereq Anth 565. An in-depth survey of the fossil evidence for human evolution, incorporating research methods and theory.
- 570 Sediments in Gearchaeology** 4 (3-3) Sediment-forming processes, sedimentological techniques, reconstruction of quaternary environments, and sedimentology of site-forming processes.
- 573 Zooarchaeology** 4 (2-6) Identification of animal bones from archaeological sites, methodological and theoretical techniques for interpreting faunal remains. Cooperative course taught by WSU, open to Idaho students (Anthr 573).
- 576 Palynology** 4 (3-3) Pollen and spore morphology, evolution, production, dispersal, and preservation; index fossils, dating, archaeology, and vegetational history. Field trip required.
- 591 Special Topics in Anthropology** 3 May be repeated for credit; cumulative maximum 9 hours. Examination of current areas of anthropological theory and research.
- 592 Special Topics in Anthropology** 3 May be repeated for credit; cumulative maximum 9 hours. Examination of current areas of anthropological theory and research.
- 593 Seminar in Communicating Anthropological Research** 3 Preparation of original research reports in anthropology; survey of types of professional communication, and of standards and techniques.
- 598 Advanced Anthropology Internship V** 1-15 Prereq graduate standing. May be repeated for credit; cumulative maximum 30. Participation as archaeological or cultural anthropological intern in public or private sectors; requires special arrangement with faculty advisor. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Apparel, Merchandising, Design and Textiles

Degrees Granted: Master of Arts in Apparel, Merchandising, Design and Textiles

GRADUATE FACULTY

L. Arthur, Chair; K. Cho, C. J. Salusso,

Faculty of the Department of Apparel, Merchandising, Design and Textiles offer degree programs that provide students with additional depth in the disciplines and opportunity to focus on individualized scholarship areas. Graduates have been highly successful securing positions in business and industry, and higher education.

Apparel, Merchandising, Design and Textiles

AMDT

- 512 Apparel Product Development** 3 Prereq AMT 594. Creative problem solving approach to analysis and understanding of design and research perspectives with respect to product development.
- 517 Critical Perspectives on Appearance** 3 Prereq graduate standing. Exploration of appearance issues, theory, and research from the perspectives of social science, feminist theory, postmodern and poststructural discourses.
- 518 Apparel Merchandising Analysis** 3 Analysis of marketing and retailing strategies, trends and technological developments in relation to business and consumer aspects within a global context.

- 519 Research Methods** 3 Prereq AMT 594, graduate standing. Analysis and understanding of research methods, exploration of thesis topic and literature review development as applicable to the fields of textiles, apparel, and interior design.
- 520 Aesthetic Analysis of Fashion Design** 3 Prereq graduate standing. Framework for in-depth analysis of apparel fashion design provided through exploration of aesthetic and human perception theories within a socio-historic context.
- 528 International Experience in Apparel/Textiles Field** 3 By interview only. Study abroad developing a knowledge of culture and industry representatives in Europe. Credit not granted for both AMT 428 and 528.
- 594 Readings in Apparel, Merchandising, and Textiles** 3 Prereq graduate standing. Exploration of current topics through readings in apparel, merchandising, and textiles.
- 596 Advanced Instructional Practicum** 3 Prereq graduate standing; Univ 590 or *c//*. Information and direction for graduate student teaching assistants seeking professional development in classroom teaching. S, F grading.
- 598 Topics in Apparel and Textiles** V 1-3 May be repeated for credit; cumulative maximum 8 hours. Current topics in apparel and textile theory and research.
- 600 Special Projects or Independent Study.** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.

Architecture

Degrees Granted: Master of Architecture; Master of Science in Architecture

GRADUATE FACULTY

G. Kessler, Director; J. Abell, D. Ascher-Barnstone, R. Barnstone, T. J. Bartuska, K. L. Carper, P. Hirzel, B. Kazimee, K. Keane, D. N. Mirkovich, A. W. Mutin, M. S. Owen, S. M. Recken, M. R. Samizay, D. Wang

Master of Architecture

The School of Architecture and Construction Management offers as its professional accredited degree in architecture the Master of Architecture. Once completed, this degree allows students to participate in an organized internship program after graduation leading to qualifying for the State Architecture Licensing exam. Most states require an accredited degree by the National Architectural Accrediting Board (NAAB) in order to take the licensing exam.

The accredited graduate program at WSU is a three-semester sequence of courses and studios that are taken after a student receives a four-year undergraduate degree. The program requirements stipulate forty (40) semester credits that include a required summer module of four (4) credits.

The Master of Architecture is offered at both the Pullman and Spokane campus. Two thirds of the Master of Architecture students will be conducting their studies at the main WSU campus in Pullman. Students who enter WSU as freshman and transfer students will have the option to continue their graduate studies in Pullman utilizing the resources and infrastructure of the campus.

A maximum number of 1/3 of the students admitted will be allowed to conduct their studies at the Interdisciplinary Design Institute at WSU-Spokane. Students at Spokane will participate in the same curriculum offerings as Pullman students. The Spokane campus allows students to live and study in an urban environment and also work directly with graduate students in Interior Design and Landscape Architecture. Determination as to whether students will study in Pullman and Spokane will be based upon student preference and available resources. Students that are interested in the Master of Architecture degree and who have undergraduate degrees in other disciplines should contact the School of Architecture and Construction Management.

Admission

Admission to the professional Master of Architecture program is made during the spring semester of the fourth year for WSU students. Applicants must successfully complete all application and academic requirements and be admitted by the Graduate School in order to enter the program. A 3.0 undergraduate g.p.a. is required for admission. Transfer students must also be accepted by the Graduate School. In addition, all transfer applicants must submit a portfolio of previous design work to the School of Architecture and Construction Management as well as present transcripts of previous coursework and degrees to the School no later than March 1st. A Statement of Intent should be included as part of the portfolio. Transfer students will also have the option to study at the main Pullman campus or the urban campus in Spokane.

The curriculum consists of a total of forty semester credit hours. Students will engage in advanced course work in structures, technology and theory. The culmination of work will be revealed through each student's graduate studio project. The graduate project will be developed over a two-semester sequence of studio courses where students will develop an innovative architectural design project. It is expected that the project will be based on a defined hypothesis that demonstrates a comprehensive understanding relative to issues, theories and technologies of architecture.

Master of Architecture

Arch

- 511 Design VIII/Graduate Design Project** 6 (0-12) Prereq Arch 403. Studio course is divided between eight weeks of urban design and eight weeks of preliminary design on graduate project.
- 513 Graduate Design Project** 6 (0-12) Prereq Arch 511, 515. Final graduate design studio focusing on individualized topics.
- 515 Research Methods & Programming** 3 Prereq Arch 403. Exploration of traditional research methods and investigations for architects.
- 525 History & Theory** 3 History and theory of 20th Century Architecture focusing on cultural philosophical principles related to design.
- 527 (427) Site and Landscape Design** 3 Exploration of issues of site context analysis, topography, planning and landscape design.
- 531 (331) Advanced Tectonics** 3 Prereq Arch 330, 403. Tectonic theory of concrete and metal construction with focus on skin design and technology as formative elements in architecture.
- 542 Issues in Architecture** 3 Prereq graduate standing; Arch 409, 525. Examination of issues in architecture related to society, culture, environment, politics and philosophy.
- 563 Structures III** 3 Prereq Arch 351, 352. Wind and seismic loads on architectural structures; high-rise structure systems; reinforced concrete and masonry structures.
- 573 (473) Ethics & Practice** 3 Prereq Arch 472. Ethical and professional practice issues related to the business and practice of architecture; investigations into marketing Client and business orientation.
- 577 Theories and Methods of Urban Construction** 3 Prereq graduate standing. Morphology, theoretical concepts, planning and spatial structure of cities and analysis of the transformation of the city core in Europe and America.
- 580 Architecture Internship** V 1-4 May be repeated for credit. Prereq graduate student in M.S. Arch degree program. Placement in an approved industrial, professional, or governmental situation for specialized or general experience.

MS in Architecture

The Master of Science in Architecture is a post-professional advanced specialization degree and is offered in two emphases: Design Theory, or Design Build Management.

The Design Theory emphasis usually appeals to individuals who already possess a professional degree in architecture or a related design discipline, although it is not limited to this audience. Individuals with a non-design undergraduate degree may apply and be admitted on a provisional basis. The program allows students to gain advanced knowledge related to architecture in a specific area of one's profession; and prepares students for teaching and/or a doctoral level degree.

The Design Build Management emphasis is one of few such courses of study in the nation and has been recognized by the Design Build Institute of America (DBIA) for its excellence. This degree is ideal for

professionals who are currently working for contractors, architects, engineers, owners, and facility managers who seek professional career advancement in the design-build industry.

The MS Arch is a 30 credit minimum degree with core courses in theory and research methods. One design studio is required for the Design/Theory emphasis. In either emphasis, electives related to the student's field of research are available, and the MS. Arch culminates in a thesis. The degree is available either on the full-time basis or via the part time Executive Track Program, which is designed for working professionals to obtain the degree while staying on the job.

Admission

Admission into the MS Arch Design Theory emphasis requires an undergraduate baccalaureate degree, preferably in architecture or a related design field. 3.0 undergraduate GPA is required as well as the TOEFL for non-US resident students. While the GRE is not required, it is preferred, especially in cases needing more clarity of academic competence. Applicants must also provide a research area of interest statement, a portfolio of past work related to the research interest, and three letters of recommendation.

Admission into the MS Arch Design Build Management emphasis requires a bachelor's degree in Architecture, Construction Management, Civil Engineering, or related design degree preferred; a 3.0 minimum GPA, TOEFL for international applicants, a statement of research interest, and three letters of recommendation,

Arch

- 520 Directed Topics in Architecture** V 1-3 May be repeated for credit; cumulative maximum 6 hours. Topics related to areas of emphasis in the program and student specialization.
- 530 Philosophies & Theories of the Built Environment** 3 Focuses on systematic thought that may describe the behavior of the built environment.
- 534 Theory Case Studies** 3 In depth exposure to the literature of selected theory typologies covered in Arch 530 (Necessity Empirical Observation, History, Comparison, etc.)
- 535 Design/Theory Case Studies** 3 In depth analysis of social-cultural-technological factors affecting designs of the built environment.
- 540 Research Methods** 3 Covers a variety of research methods, from quantitative to technical to philosophical, directed towards qualitative research.
- 546 Computer Animation** 3 Prereq Arch 446 or Cpt S 446; by interview only Maybe repeated for credit; cumulative maximum 9 hours. Advanced computer animation techniques; advanced specialization in building/design simulation, dynamic modeling and visualization, engineering animation.
- 550 Design Applications** 2 Emphasizes the cognitive and behavioral practices of design. Exploration in terms of content and the value.
- 551 Design/Build Firm Management** 3 Introduction to design/build firm management procedures, policies, and strategies.
- 552 Design/Build Project Management** 3 Introduction to policies, contracts and joint venture organizational structures related to management of design build policies.
- 553 Design and Construction Law** 3 Introduction to contract law affecting the design and construction industry.
- 554 Design/Build Case Studies** 3 Design/Build Case Studies 3 Prereq graduate standing. Case studies of specific design/build projects from legal, economics, technology, or firm management perspectives.
- 560 Interdisciplinary Seminar** 3 Explores the chronological development of selected place-types in the US, Western Europe and Asia.
- 561 Interdisciplinary Seminar II** 2 Builds upon the knowledge gained from ARCH/ID/LA 560. Expected to conduct an in-depth investigation of a specific aspect of dwelling.
- 570 Advanced Architectural Studio/Laboratory** 6 (0-12) In-depth study of design problems relating to cultural, environmental, technological and other issues as related to the student's area of emphasis.
- 580 Architecture Internship** V 1-4 May be repeated for credit. Prereq graduate student in the MS in Arch degree program. Placement in an approved industrial, professional, or governmental situation for specialized or general experience.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis and/or Examination Variable credit. S, F grading.

701 Thesis Project Variable Credit. Prereq Graduate Standing. Thesis work comprising a design component along with a research component.

702 Thesis Project V 1-6 Prereq graduate standing. Thesis work comprising a design component along with a research component.

Asia Program

There are no advanced degrees offered in Asia Program; however, the following course is available as a supporting course for degrees in other fields.

Asia

536 Politics in Japan 3 Same as Pol S 536.

Biological Sciences

Degrees Granted: Master of Science in Biology, Master of Science in Botany, Master of Science in Zoology; Doctor of Philosophy (Botany, Zoology)

GRADUATE FACULTY

V. R. Franceschi, Director; J. Bishop, R. A. Black, P. A. Carter, M. Dybdahl, G. E. Edwards, V. R. Franceschi, S. D. Hacker, H. L. Hosick, L. D. Hufford, K. V. Kardong, M. S. Ku, R. Lee, R. N. Mack, J. M. Mallatt, A. McCubbin, D. F. Moffett, S. B. Moffett, M. T. Morgan, J. L. Paznokas, C. Portfors, W. Rickard, E. Roalson, C. T. Robbins, P. C. Schroeder, H. G. Schwabl, A. Storfer, M. Tegeger, G. H. Thorgaard, P. A. Verrell, M. Webster

Those contemplating graduate study in The School of Biological Sciences are advised to obtain a broad background in biological and physical sciences. All applicants are required to submit a formal application, a departmental supplemental application, official transcripts of all college work, three letters of recommendation and scores of the general aptitude tests from the Graduate Record Examination. Foreign students must score at least 550 on the TOEFL examination to be eligible for admission to Washington State University and will be tested for language proficiency if awarded a teaching assistantship. There is no general foreign language requirement. Reading proficiency in a foreign language may be required by the student's advisory committee.

For the thesis master's degree in botany or zoology, a minimum of 21 credits of graded coursework, a thesis or a manuscript accepted for publication by a referred journal and a final oral defense of the thesis are required. A committee of three or more faculty members is appointed to develop and recommend the program of study. The committee chair is selected from among the faculty of the school. Graduate faculty in all areas of the biological sciences may serve as committee members. Two committee members must be from the faculty of the School of Biological Sciences.

For the non-thesis master's degree, a minimum of 26 credits of graded coursework, an individual investigation of a special problem and a final oral examination are required. At least 20 credits must be in the biological sciences. A committee of three or more faculty members is appointed to develop and recommend the program of study. Graduate faculty in all areas of the biological sciences may serve either as committee chairs or as committee members. Normally each of the faculty members represents a different biological discipline. One committee member must be from the biology program faculty.

For a Ph.D. degree in botany or zoology, a minimum of 35 credits of graded coursework, a thesis or published manuscript in a referred journal, preliminary oral examinations, a defense of a research proposal, and a final oral defense of the thesis are required. A committee of three or more faculty members and the majority must be from The School of Biological Sciences is appointed to develop and recommend the program of study. The committee chair is selected from among the faculty

in The School of Biological Sciences. Graduate faculty in all areas of biological sciences may serve as committee members but the majority of the committee must be faculty from within The School of Biological Sciences.

Undergraduate majors in such subjects as the applied plant sciences, the biological sciences, and the physical sciences may be well prepared for graduate study. Students having deficiencies are given adequate opportunity to fulfill departmental requirements.

Botany

The School of Biological Sciences also offers study and research leading to the degrees of Master of Science and Doctor of Philosophy in Botany. Depth in one or more fields of botany and introduction to the methods of botanical research are provided for candidates for the master's degree. Those who seek the degree of Doctor of Philosophy may gain depth in two or more fields and intensive experience in research. Graduate study may involve specialization and research in anatomy, morphology, morphogenesis, cytology, genetics, ecology, physiology, taxonomy and systematics, and ultrastructure.

Modern facilities are available for research in these areas. Special equipment includes controlled-environment facilities, facilities for radiobiological research, gas exchange equipment for monitoring whole plants under a variety of controlled environmental conditions, computer terminals and a well-equipped Electron Microscope Center. The Ownbey Herbarium of Washington State University is one of the important regional plant collections in the nation and, in conjunction with the experimental laboratory, garden, and greenhouse facilities, provides excellent opportunities for graduate studies in systematics and evolution. Students who plan to enter graduate study in botany should include the following courses as part of their undergraduate preparation: organic chemistry, mathematics through integral calculus and one year of college physics.

Graduate students in plant ecology are currently pursuing studies in the general areas of ecophysiology, genecology, population ecology, plant-animal interaction, and structure and function of plant communities. Specific investigations include demographic studies in local grassland habitats, determinants of reproductive success, the coevolution of plants and their insect herbivores, and the ecophysiology of arid land plants. There are active programs in systematics centered in modern molecular, biochemical, electrophoretic, and cytotoxic studies. Research in plant physiology includes effects of global climate change (e.g., ultraviolet radiation and carbon dioxide) on photosynthesis, mechanisms of tolerance to plant stresses, regulation of carbon and nitrogen partitioning, and the study of phloem transport. In addition to these whole plant studies, there are active research programs investigating the structure and function of plasma membrane transport proteins, regulation of gene expression, targeting of specific proteins to discrete subcellular locations, and signal transduction events.

Zoology

The School of Biological Sciences offers a program of graduate study leading to the degrees of Master of Science and Doctor of Philosophy in Zoology. Study leading to the Master of Science in Zoology provides a broad background in zoology and cognate areas. Experience in research is provided through the presentation of a thesis. The degree of Doctor of Philosophy involves specialization in a selected area of zoology, additional study in related areas, and a thesis. Teaching experience is required of all candidates for graduation.

Faculty interests and research programs are diverse, ranging from cellular and developmental biology, through various aspects of organismal biology, to ecology and evolutionary biology. Ecology and Evolutionary Biology are particularly prominent areas of the department's graduate program. A list of specific faculty interests can be obtained by writing to The School of Biological Sciences.

There are modern facilities for graduate study in cell and developmental biology, genetics, physiology, functional morphology, systematics and behavioral, environmental and evolutionary biology. The University's rural location is conducive for field studies. Special facilities include the vertebrate collections of the Charles R. Conner Museum, the George E. Hudson Biological Preserve of 800 acres, the Electron Microscopy Center, and the Eastlick Vivarium for maintaining lab animals.

Biology

The School of Biological Sciences offers graduate study leading to the degree of Master of Science in Biology. Degree programs are offered in Pullman and at WSU Tri-Cities. The Pullman program is non-thesis, interdisciplinary and designed to provide a balanced and broad understanding of various biological sciences. Students are given the opportunity to develop individualized programs of study that include a broad selection of courses from among all of the biological science units. Such programs are designed by students who plan: 1) to continue graduate education in biology; 2) to enter professional schools, e.g., dentistry, physical therapy, and veterinary medicine; and 3) to enter careers in biology teaching. At WSU Tri-Cities the thesis program offered is multidisciplinary and career-oriented, providing continuing education and professional advancement to members of the scientific community associated with the DOE Richland operations.

Cooperation with numerous other campus units extends research opportunities. Cooperative arrangements with faculty in biochemistry and biophysics, botany, entomology, genetics and cell biology, animal sciences, natural resource sciences and the veterinary college are readily achieved.

Admission with regular status requires at least a B average or its equivalent in the last half of undergraduate study, or an average of B or better for 12 semester hours of study in a recognized Graduate School. For admission, scores on the verbal, quantitative, and analytical sections of the GRE must be submitted. As a rule, students are expected to have completed approximately 30 semester hours of biology, including courses in development, ecology, evolution, genetics, and physiology, as well as one semester each of organic chemistry and calculus, and two semesters of physics. Virtually all of the advanced degree graduates have obtained teaching and/or research positions commensurate with their areas of specialization.

Biological Sciences

Biol

- 500 (Bot) Seminar 1** May be repeated for credit. Prereq 20 hours Bot. S, F grading.
- 504 (Bot) Experimental Methods in Plant Physiology 3** (2-3) Rec Biol 320. Advanced techniques and instrumental methods applicable to research in plant physiology.
- 505 (Principles of Organic Evolution 3** (2-3) Prereq Biol 301. The evolutionary processes that influence adaptation, population differentiation, and speciation in organisms. Credit not granted for both Biol 405 and 505.
- 506 (Bot) Microtechnique 4** (2-6) Graduate-level counterpart of Biol 406, E Mic 406; additional requirements. Credit not granted for both Biol 406, Emic 406 and Biol 506.
- 507 Electron Microscopy Laboratory 4** (2-6) Prereq one year biology; one year org chem; one year phys; by interview only. Techniques of transmission electron microscopy, especially those applicable to biological materials; theory and practice for electron optics and specimen preparation.
- 509 (Bot 510) Plant Anatomy 4** (2-6) Graduate-level counterpart of Biol 409; additional requirements. Credit not granted for both Biol 409 and 509.
- 510 Fish Population Ecology 2** Review of abiotic and biotic factors controlling or regulating fish population densities and critical review of relevant literature. Cooperative course taught by UI (Fish 514), open to WSU students.
- 511 (Zool) Principles of Systematic Biology 3** (2-3) Prereq Biol 103, 104; 10 additional hours Zool. Principles, methods, and literature of systematic biology; speciation mechanisms; concepts and problems of species and higher taxa; codes of nomenclature.
- 512 (Bot) Molecular Mechanisms of Plant Development 3** Prereq Biol 320. Physiology of growth; metabolism during development and reproduction.
- 513 (Bot) Plant Metabolism 3** Prereq Biol 320, MBioS 303. Metabolic processes unique to plants, including the primary incorporation of nitrogen, sulfur, carbon dioxide and phosphate into bio-molecules.
- 514 (Zool 516) Fish Genetics 2** Prereq MBioS 301. Chromosomal, biochemical, quantitative, and ecological aspects of fish genetics with emphasis on applications to aquaculture and fish management. Cooperative course taught by WSU, open to UI students (FISH 519).

- 515 (Zool) Fish Physiology 2** Prereq Fish 411 and permission. Principles and methods used to study vital organs, organ systems, growth, and reproduction of fishes; emphasis on osmoregulation, metabolism, endocrinology, and respiration. Cooperative course taught by UI (Fish 511), open to WSU students.
- 516 (Bot) Water Relations and Intercellular Transport 3** Prereq Biol 320. Movement of water and solutes in plants, from the cellular level to the whole-plant level.
- 517 (Bot) Stress Physiology of Plants 3** Graduate-level counterpart of Biol 417; additional requirements. Credit not granted for both Biol 417 and 517.
- 518 (Bot) Photosynthesis, Photorespiration, and Plant Productivity 3** Rec Biol 320 or MBioS 303. Photosynthesis, photorespiration and the interrelationship of those biochemical, physiological, and environmental factors which determine plant productivity.
- 519 Introduction to Population Genetics 3** Prereq MBioS 301. Survey of basic population and quantitative genetics. Cooperative course taught by WSU, open to UI students (For 511/Gene 505).
- 520 Conservation Genetics 2** Prereq Biol 301. Genetic studies and approaches relevant to efforts to conserve threatened and endangered populations of organisms.
- 521 Quantitative Genetics 2** Prereq MBioS 531. Fundamentals of quantitative genetics; evolutionary quantitative genetics.
- 522 Molecular Population Genetics and Evolution 2** Prereq MBioS 531. Evolutionary change of molecular sequences; genetic distance and phylogeny; genomic evolution.
- 523 (Zool 513) Advanced Fishery Management 3** Compensation as a phenomenon basic to exploration; yield in numbers and weight; models of yield; stock recruitment functions; economic yield; application of theory of physical and economic yield to empirical examples in commercial and sport exploitation. Field trip required. Cooperative course taught by UI (Fish 510), open to WSU students.
- 525 (Bot) Experimental Plant Ecology 3** (1-6) Same as NATRS 525.
- 526 (Zool) Population Analysis 1** Same as NATRS 526.
- 527 (Zool 517) Fish Behavior 3** Causes, mechanisms, and functions of fish behavior, including reproduction, communication, schooling, feeding, migration, and orientation. Cooperative course taught by UI (FISH 520), open to WSU students.
- 529 (Zool) Principles of Population Dynamics 1** Same as NATRS 529.
- 530 Statistical Ecology 4** (2-6) Prereq introductory statistics course. Collection and interpretation of ecological data according to biometrical procedures.
- 531 Principles of Systematic Biology 3** Graduate-level counterpart of Bot 431; additional requirements. Credit not granted for both Bot 431 and 531.
- 532 Biology of Amphibians and Reptiles 4** (3-3) Graduate-level counterpart of Biol 432; additional requirements. Credit not granted for both Biol 432 and 532.
- 533 (Bot) Modern Methods in Systematics 4** (2-6) Rec Biol 431 or 511. Selecting, gathering, and analyzing morphological, cytological, molecular data for phylogenetic and evolutionary studies.
- 534 (Zool 530) General and Comparative Neurophysiology 4** Same as Neuro 530.
- 535 (Bot) Angiosperm Families of the World 3** (2-3) Prereq Biol 332 or 431. Description, classification, and geographic distribution of families of flowering plants of the world.
- 538 (Zool) [M] Animal Behavior 3** (2-3) Graduate-level counterpart of Zool 438; additional requirements. Credit not granted for both Biol 438 and 538.
- 543 (Zool) Predator-Prey Dynamics 1** Same as Entom 543.
- 548 (Zool) Evolutionary Ecology 3** Rec Biol 372, 405. Evolutionary dynamics of natural populations and the co-evolution of species. Cooperative course taught by WSU, open to UI students (WLF 548).
- 551 (Zool) Comparative Vertebrate Reproduction 3** Graduate-level counterpart of Biol 451; additional requirements. Credit not granted for both Biol 451 and 551. Cooperative course taught by UI (Zool 511), open to WSU students.
- 552 Comparative Physiology and Biochemistry 2** Species have evolved in distinct modes of functioning which enable them to survive in their respective environments; focus on particular environmental or functional themes.
- 555 (Zool) General and Cellular Physiology 4** (3-3) Same as V Ph 555.
- 557 (Zool) Advanced Mammalian Physiology 4** Same as V Ph 557.
- 558 (Zool) Molecular and Cellular Reproduction 3** (2-2) Same as MBioS 528.
- 560 (Bot) Plant Ecophysiology 3** Graduate-level counterpart of Biol 460; additional requirements. Credit not granted for both Biol 460 and 560.
- 561 (Zool 560) Environmental Physiology 3** Prereq Biol 350 or 353. Graduate-level counterpart of Biol 460; additional requirements. Credit not granted for both Biol 460 and 560. Cooperative course taught by WSU, open to UI students (WLF 560).
- 562 (Bot) Community Ecology 3** Graduate-level counterpart of Biol 462; additional requirements. Credit not granted for both Biol 462 and 562.
- 563 (Bot) Field Ecology 2** (0-6) Graduate-level counterpart of Biol 463; additional requirements. Credit not granted for both Biol 463 and 563. Cooperative course taught by WSU, open to UI students (Bot 537).
- 564 Molecular Ecology and Phylogeography 3** Prereq Biol 301 or equivalent; Biol 405 or equivalent. Use of genetic markers for the study of ecological phenomena, including kinship, population structure, and phylogeography.
- 565 (Zool 591) Topics in Ecology and Evolution V** 1-3 May be repeated for credit; cumulative maximum 6 hours. Current topics in ecology, population, biology, evolution, behavior, systematics, and biogeography.
- 566 Mathematical Genetics 3** Same as Math 563.
- 570 Diversity of Plants 3** Prereq graduate standing. Graduate-level counterpart of Biol 470; additional requirements. Credit not granted for both Biol 470 and 570.
- 573 (Zool) Cellular and Molecular Aspects of Development 3** Prereq MBioS 401, MBioS 303, or Biol 321. Current biochemical and ultrastructural research in developmental biology.
- 583 (Zool) Physiological Interactions in Predator-Prey Relations 1** Same as Entom 583.
- 586 Special Projects in Electron Microscopy 2** (0-6) or 3 (0-9) May be repeated for credit. By interview only. Practical training in one or more areas of electron microscopy; TEM, SEM, ultramicrotomy, specimen processing, darkroom procedures and light microscopy.
- 587 Special Topics in Electron Microscopy 1** May be repeated for credit; cumulative maximum 4 hours. S, F grading.
- 589 (Zool) Advanced Topics in Zoology V** 1-3 May be repeated for credit; cumulative maximum in Biol 589, 590 - 10 hours. Recent advances in zoology.
- 590 (Bot) Advanced Topics in Botany V** 1-4 May be repeated for credit. Recent research in plant science.
- 591 (Bot 515) Seminar in Plant Physiology 1** May be repeated for credit. Same as PI Ph 515.
- 592 (Zool) Advanced Topics in Cell Biology V** 1-3 Same as MBioS 526.
- 593 (Zool) Seminar I 1** May be repeated for credit. Literature and problems.
- 594 (Zool) Advanced Topics on Vertebrate Form and Function V** 1-3 May be repeated for credit. Analysis of animal structure and function emphasizing the evolution of complex systems; constructional morphology; ecomorphology; phylogenetics; heterochrony; size and shape.
- 595 (Zool) Seminar II 1** May be repeated for credit; cumulative maximum 8 hours. Literature and problems.
- 597 (Zool) Teaching Practicum V** 1-4 May be repeated for credit; cumulative maximum 4 hours. Zoology laboratory teaching internship. S, F grading
- 600 (Bot, Zool) Special Projects or Independent Study** Variable credit. S, F grading.
- 700 (Bot, Zool) Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 (Bot, Zool) Master's Special Problems, Directed Study and/or Examination** Variable credit. S, F grading.
- 800 (Bot, Zool) Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Biological Systems Engineering

Degrees Granted: M.S. in Engineering; Ph.D. in Engineering Science, M.S. in Agriculture

GRADUATE FACULTY:

Biological Systems Engineering

G. Barbosa-Canovas, R. P. Cavalieri, S. Chen, D. C. Davis, C. Fraisse, G. M. Hyde, D. K. McCool, F. Pierce, M. J. Pitts, C. O. Stöckle, J. Tang, J. Wu

Agriculture, MS

G.E. Bledsoe, R.P. Cavalieri, C. Clary, D.C. Davis, J.K. Fellman, E.P. Fiske, L.K. Hiller, V.N. Hillers, R.L. Hummel, G.M. Hyde, M.D. Kleene, R.E. Knowles, B.C. Moore, B. Rasco, R.D. Saylor, K.A. Schekel, M.K. Swan, B.J. Swanson, R.E. Thornton, W.J. Turner

The Department of Biological Systems Engineering participates in College of Engineering and Architecture programs leading to the degrees of Master of Science in Engineering and Doctor of Philosophy (Engineering Science). The Department also offers a Master of Science in Agriculture (see Agriculture for further details).

Although both thesis and non-thesis options are available to students interested in the Master of Science in Engineering, the Department prefers the thesis option. For entering students with a Bachelor of Science in Engineering, two years of study is usually required for the master's degree. Three years beyond the master's degree is normally required to complete a PhD program. In addition, a special program is available to allow qualified students with undergraduate degrees in other fields to pursue a Master of Science in Engineering with a minimal number of remedial courses.

Students and faculty work closely to develop programs of graduate study and research that prepare students for challenging and rewarding careers in water-soil-environmental engineering, food engineering, and biomass processing/bioproducts engineering.

The Department has several major facilities and pieces of equipment available to graduate students. They include a state-certified Water Quality and Waste Analysis Laboratory and other facilities for water quality and soil analysis, a computerized GIS and Environmental Modeling Laboratory, a food processing pilot plant and other food processing laboratory equipment, a controlled atmosphere facility, an electronics shop, and extensive equipment fabrication facilities. Graduate students have used facilities at the USDA's Conservation Research Farm in Pullman and at WSU's Irrigated Agriculture Research and Extension Center in Prosser, Washington. Faculty members who have substantial collaborative arrangements with food processing companies or government laboratories send students to off-campus laboratories to use highly specialized equipment or to learn advanced techniques.

The Department cooperates with other departments in the Colleges of Engineering and Architecture and Agriculture and Home Economics to create a variety of courses and research opportunities for graduate students in biological systems engineering. Many graduate students benefit from cooperative research programs with U.S. Department of Agriculture researchers stationed in Pullman, Prosser and Wenatchee. Additionally, students are able to earn WSU credit for many courses taken at nearby University of Idaho.

The **Master of Science in Agriculture** degree focuses on the agricultural professional, practitioner, and educator; its applications reflect the increased need for prepared individuals to apply new and emerging technologies and scientific findings. This degree offers practitioners the opportunity to continue their education while they continue employment either inside or outside of the Pullman area. The M.S. in Agriculture is designed for students enrolled at WSU at a distance and on campus who are preparing for careers in agriculture or advancing careers they have already begun. A maximum number of electives is permitted to enable students to emphasize one or two fields or otherwise tailor the curriculum to fit particular needs.

The M.S. in Agriculture is based at WSU in Pullman and transmitted cooperatively, using a variety of instructional techniques through Distance Delivery technologies within the state, region, and world. The

unique characteristic of this program is that it is delivered through the use of distance education technologies so that students are not required to relocate or stop employment while completing the degree requirements. Pursuing this degree exposes students to the technologies of the future as well as to multiple teaching faculties. A variety of distance learning formats is employed to enhance student learning. These include two-way audio-video interactive classrooms, video conferencing, Internet based instruction, computer-aided instruction, computer-generated visual aids and state-of-the-art instructional technologies.

Biological Systems Engineering

BSysE

- 510 Fundamentals of Research** 3 Prereq graduate standing. The research process and the graduate research project; objectives, techniques, and challenges; scientific method and the design process; use of literature; creativity; writing and speaking about research; preparation of a research proposal. Cooperative course taught by UI (For 510), open to WSU students.
- 541 Instrumentation and Measurements** 3 (2-3) Prereq Math 172; Phys 102 or 202. Instrumentation systems and measurement concepts, electronic signal-conditioning components and circuitry, digital electronics and microprocessor basics. Cooperative course taught by UI (AgE 541), open to WSU students.
- 550 Advanced Hydrology** 3 Principles of the hydrologic cycle in mountainous areas, including precipitation, snowmelt, and systems simulation. Cooperative course taught by UI (AgE 551), open to WSU students.
- 551 Advanced Biological Systems Engineering Topics** V 1-4 May be repeated for credit; cumulative maximum 6 hours. Directed group study of selected advanced topics in biological systems engineering. Cooperative course taught by WSU, open to UI students (AgE 561)
- 552 Advanced Biological Systems Engineering Topics** V 1-4 May be repeated for credit. Directed group study of selected advanced topics in biological systems engineering. Cooperative course taught by WSU, open to UI students (AgE 561).
- 555 Natural Systems for Wastewater Treatment** 3 Prereq senior or graduate standing. Principles and design procedures of natural systems for wastewater treatment for agricultural and non-agricultural applications.
- 557 Design for Watershed Management** 3 (2-3) Prereq junior or graduate standing. Modeling water movement and mass transport; design for balance between animal, plant, soil, water, and air resources in watershed. Cooperative course taught by WSU, open to UI students (BSyE 457).
- 558 Fluid Mechanics of Porous Materials** 3 Statics and dynamics of multi-flow systems in porous materials, properties of porous materials; steady and unsteady flow. Cooperative course taught by UI (AgE 558), open to WSU students.
- 562 Systems in Integrated Crop Management** 3 (2-3) Same as Entom 562. Credit not granted for BSysE 462 and 562.
- 581 Advanced Physical Properties of Foods** 3 Prereq BSysE 481, Math 315. Analysis, modeling, and experimental procedures to measure food physical properties for use in food processing system design.
- 582 Food Process Engineering Design** 3 Prereq BSysE 386 or Ch E 330. Design of food processing systems; design and simulation of sterilization and pasteurization processes in foods. Credit not granted for both BSysE 482 and 582. Cooperative course taught by WSU, open to UI students (AgE and FST 587).
- 583 Food Separation Processes Design** 3 Prereq BSysE 482. Design of food separation unit operations including concentration, dehydration, and membrane processes. Credit not granted for both BSysE 483 and 583. Cooperative course taught by WSU, open to UI students (AgE 583).
- 584 Thermal Processing of Foods** 3 (2-3) Prereq Ch E 332 or M E 404; graduate standing. Principles and practices of food preservation methods based on application of heat.
- 586 Food Rheology** 3 (2-3) Prereq BSysE 386. Principles and applications on the rheology of foods, including fundamental and empirical equations; viscoelasticity; normal forces, time dependency and in-

strumentation. Credit not granted for both BSysE 486 and 586. Cooperative course taught by WSU, open to UI students (BSyE 586).

- 587 Food Plant Design** 3 Graduate level counterpart of BSysE 487; additional requirements. Design of food processing systems; food properties; thermal and physical processes. Credit not granted for both BSysE 487 and 587. Cooperative course taught by WSU, open to UI students (FST 587)
- 588 Food Powders** 3 Engineering principles applied to handling and processing of food powders, including particle size distribution, morphology, physical properties, agglomeration, attrition, segregation. Credit not granted for both BSysE 488 and 588. Cooperative course taught by WSU, open to UI students (BSyE 588).
- 589 Food Quality Instrumentation** 3 (2-3) Instrumentation used in food quality assessment; classification of assessment techniques by product properties and evaluation methods. Cooperative course taught by WSU, open to UI students (BSyE 589).
- 590 Advanced Theory of Irrigation Water Requirement** 3 Energy balance and consumptive use of water; influence on farm and project irrigation system design criteria, management, and efficiencies. Cooperative course taught by WSU, open to UI students (AgE 552).
- 592 Advanced Theory and Design of Irrigation Systems** 3 (2-3) Prereq BSysE 453 or 590. Design and development of irrigation water application systems. (a/y) Cooperative course taught by WSU, open to UI students (AgE 553).
- 594 Advanced Topics in Bioprocessing and Biotreatment** 3 Analysis of bioprocessing and biotreatment processes including energetics, stoichiometry, species competition, process infiltration, product separation and optimization.
- 595 Groundwater Flow and Contaminant Transport** 4 (3-3) Prereq Math 315; BsysE 351 or C E 351 or Geol 475. Physics of flow and contaminant transport in saturated porous media including governing equations, well hydraulics and computer modeling.
- 598 Graduate Seminar** 1 May be repeated for credit. Required of all graduate students in agricultural engineering. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation and/or Examination** Variable credit. (for PhD in engineering science only.) S, F grading.

Agricultural Technology and Management

AgTM

- 505 Precision Agricultural Systems Management** 3 Prereq admission to graduate program. Evolving technologies involved in precision agriculture and their application to agricultural systems.
- 526 Energy Concepts in Agricultural Structures** 3 (2-3) Graduate level counterpart of AgTM 426; additional requirements. Heat transfer, psychometrics applied to temperature-moisture relationships in agricultural structures; renewable alternative energy sources.
- 535 Instrumentation for Data Acquisition in Agriculture** 3 (2-3) Prereq AgTM 331 or c//. Agricultural applications of instrumentation and measurement principles; the use of microcomputers for data acquisition, data analysis, and control applications. Credit not granted for both AgTM 435 and 535. Cooperative course taught by WSU, open to UI students (ASM 535).
- 536 Agricultural Technology Design** 2 Prereq graduate standing. Graduate-level counterpart of AgTM 436; additional requirements. Credit not granted for both AgTM 436 and 536.
- 537 Agricultural Technology Design Laboratory** V 1 (0-3) to 2 (0-6) May be repeated for credit; cumulative maximum 4 hours. Prereq graduate standing. Graduate-level counterpart of AgTM 437; additional requirements. Credit not granted for both 437 and 537.

Agricultural Education

AgEd

- 504 Special Topics in Vocational Education** V1-3 Special topics in agricultural education or agriculture that will provide advanced training for teachers of agriculture.

- 508 Foundations of Vocational Education** 2 Historical philosophical, social, political and economic factors that influence education in vocational environments.
- 511 Seminar in Vocational Education** 1 or 2 Prereq graduate standing. Seminar addressing new and emerging legislation and educational programs in vocational education.
- 536 Microcomputers in the Vocational Classroom** 3 (2-3) Implications and applications of microcomputers for experienced classroom teachers.
- 597 Cooperative Education Programs** 3 Program principles and design; teacher coordination procedures and responsibilities; classroom and on-the-job instruction; public relations; teacher administrative responsibilities.
- 600 Special Projects of Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.

Agriculture

Agri

- 501 Agriculture Master's Practicum** V 2-3 May be repeated for up to 6 credit hours. Prereq admission to graduate program, advisor approval. Course individually designed to provide practical participation/experience under professional supervision in areas related to student's specialization.
- 502 Graduate Seminar** 3 Prereq admission to graduate program. Presentations and discussions of contemporary issues, trends, and recent research and development by graduate students, faculty, and visiting scholars.
- 560 Advanced Agricultural Topics** V 1-3 Prereq admission to graduate program. May be repeated for credit; cumulative maximum 4 hours. Directed group study of selected advanced topics in agriculture and related areas.
- 562 Advanced Topics** V 1-3 May be repeated for credit; cumulative maximum 4 hours. Prereq admission to graduate program. Directed group study of selected advanced topics in agriculture and related areas.
- 587 Issues in Agriculture** 3 Prereq admission to graduate program. Exploration and assessment of current issues associated with domestic and international agriculture programs.
- 598 Internship** V 1(0-3) to 3 (0-9) May be repeated for credit; cumulative maximum 12 hours. Supervised experience in continuing, extension, and/or vocational educational environments.
- 600 Special Projects of Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.

Business Administration

Degrees Granted: Master of Accounting; Master of Business Administration; Master of Technology Management, Doctor of Philosophy (Business Administration)

GRADUATE FACULTY

Accounting, Information Systems, and Business Law

R. R. Greenberg, Director; J. Cote, D. T. Croadsdell, A. H. Frakes, M. A. Fuller, S. Gill, T. J. Hess, M. Q. Huynh, L. M. Jessup, K. D. Joshi, C. K. Latham, T. Nunamaker, R. E. Orwig, D. L. Sanders, S. Sarker, W. W. Stammerjohan, J. T. Sweeney, J. M. Thornton, R. B. Toolson, J. S. Valacich, J. D. Wells, B. Wong-on-Wing

Finance, Insurance, and Real Estate

H. J. Turtle, Chair; K. R. Beller, G. Caton, D. R. Epley, H. S. Kerr, G. C. Lai, M. J. McNamara, J. R. Nofsinger, R. W. Sias, D. A. Whidbee

Management and Decision Science

R. Reed, Chair; S. Ahn, D. D. Baker, T. Baker, K. D. Butterfield, B. Chen, J. B. Cullen, S. Fotopoulos, J. D. Goodstein, K. Kuhn, D. J. Lemak, V. D. Miskin, C. P. Morgan, C. Munson, T. M. Tripp, K. Wade, M. C. Wang

Marketing

D. Muehling, Chair; J. A. Cote, J. Giese, P. W. Henderson, J. L. Johnson, J. Rose, D. A. Sclar, E. R. Spangenberg, D. E. Sprott, D. E. Stem, P. S. Tansuhaj, U. N. Umesh.

Hotel and Restaurant Administration

W. T. Umbreit, Director; K. W. Kendall, W. Maynard, M. C. Paxson, D. G. Rutherford

The School of Accounting, Information Systems, and Business Law offers the degree of Master of Accounting. The Master of Business Administration and the Doctor of Philosophy degrees are offered through the combined programs of accounting, business law, decision sciences, finance, marketing, and management, and are administered by the Director of Graduate Programs in Business Administration.

PhD Program. The Doctor of Philosophy in Business Administration degree is designed to prepare its graduates for careers in teaching and research positions at colleges and universities and for research-oriented positions in business, industry and government.

The educational objectives of the Ph.D. in Business Administration degree program at Washington State University are to give our graduates:

1. in-depth preparation in the core statistical concepts and research methodologies for their chosen areas of study,
2. proficiency and expertise in their 'major' fields of study sufficient for them to explore original and relevant topics leading to a dissertation,
3. sufficient background and preparation in one or more supporting fields to enrich and support the dissertation,
4. preparation for continued and productive research beyond the dissertation, and
5. opportunities and training to develop effective classroom teaching skills.

The Ph.D. program in business administration is an intensive, research-oriented program. It prepares graduates with the research methodologies and teaching skills important to their success. The program requirements reflect the belief that holders of the degree must be competently trained in the general skills of research and teaching, with specific content expertise in their major fields of study. These are selected from the following business disciplines.

- Accounting
- Decision Science
- Finance
- Management
- Management Information Systems
- Marketing

The doctoral program consists of three major areas of formal coursework: the research tool requirement, the major field requirement, and the minor field requirement. The dissertation requirement consists of a major research project of original and independent work designed to advance the field of knowledge in the student's area of specialization.

Successful PhD candidates are expected to pass their written and oral field examinations near the end of their third year of study and to defend their dissertation research near their eighth or ninth semester. Students whose undergraduate training is not in business may require an additional semester or two to develop a basic foundation in business while students holding an MBA degree may require one or two semesters fewer.

All applicants must submit a completed application form and provide official transcripts of all previous college coursework. Graduate Management Admission Test (GMAT) scores must also be submitted (GRE scores may be used for PhD applicants). Students whose native language is not English must submit scores on the Test of English as a

Foreign Language (TOEFL). Applicants for admission and for financial aid are accepted for either the fall or spring semester.

MBA Program. With nationally prominent faculty and relatively small class sizes, the Master of Business Administration (MBA) degree at WSU encourages frequent and personal interaction among faculty and students. While continuing a strong focus on developing leadership skills and decision-making expertise, the MBA program includes the study of current business technologies as an integral part of the MBA experience.

The educational objectives of the MBA program at Washington State University are to give our graduates:

1. strong leadership skills preparation through a common set of managerial courses,
2. an in-depth understanding of the specific corporate business functions,
3. an integrated learning experience across all managerial and functional disciplines, and
4. a strong foundation in information technology to manage effectively in today's dynamic marketplace.

The following principles guide the development and delivery of the MBA course at Washington State University:

- Concentration on the emerging technologies in business across all functional disciplines.
- Participation in strategic leadership development skills with special attention to effective communication and team building.
- Program-sponsored industry interaction opportunities with business visitors, applications, projects and internships.

The MBA program utilizes a hands-on, problem-solving approach to learning by combining the more traditional business areas of managerial leadership, accounting, finance and marketing with the very latest in business technologies. It is designed to build on these managerial strengths as it increases its emphasis on the managerial application of information technologies.

The MBA degree program offers two tracks: an MBA managerial track and an MBA technology track. Both tracks require four graduate level leadership and technology courses with three advanced business functions courses and a two-credit final review assignment. The managerial track requires three additional electives for a total of 32 graduate semester credit hours. The technology track requires four additional electives (including an additional technology applications class) for a total of 35 graduate semester credit hours. There are no thesis or foreign language requirements.

The MBA program is open to any qualified holder of a bachelor's degree from a recognized college or university, regardless of undergraduate field of study. The cumulative undergraduate GPA or the GPA for 12 or more semester credits in recognized graduate courses must be 3.0 or above to be eligible for regular admission. Foreign students must have the equivalent of the above credentials and complete the TOEFL with a score of 580 or better. Applicant's Graduate Management Admission Test (GMAT) scores and letters of recommendation (three) will also be used to determine admission status. All applications will be evaluated on these credentials and on the strength of their other supporting documentation.

MTM Program. The Master of Technology Management program at Washington State University is an advanced management degree. It is especially designed to develop leaders in the management of technology in an organizational context. This program has been specifically developed to support those already engaged in corporate technologies and to prepare those planning for a career in the strategic application and integration of technology in the corporate setting.

The educational objectives of the MTM program at WSU are to give our graduates:

1. extensive knowledge and practice in current business management functions and business communication skills,
2. an introduction to and in-depth understanding of the role of technology as a critical business resource, and
3. strategic and operational decision-making expertise and experience.

The MTM program will prepare graduates with the awareness and skills to apply emerging technologies in support of business strategies

and operations at all managerial levels. Students graduating with a master's degree in Technology Management will have the ability to:

1. Analyze the impact of technology on today's global economy and the opportunities it presents within the organization.
2. Explore the continuing development of emerging technologies and their effective diffusion into business organizations.
3. Understand the economic and financial frameworks of business with an expanded vision of technology's role in the organization and society.
4. Master the technology and human skills needed to create successful innovation and implementation of information technologies.
5. Create and maintain high performance work teams across all business functions and levels.
6. Plan and control complex projects to implement emerging technologies into the strategic functions and goals of the organization.
7. Continue the life-long learning process needed to keep pace with evolving technologies.

The MTM program's three components total 32 credits: core courses (21 credits), electives (9 credits), and final assessment requirement of MGT 702 (2 credits).

Core courses are (by title):

- Operations Management
- Financial Management and Capital Investment for the High-Tech Firm
- Strategy Formulation and Organizational Design
- Managerial Leadership and Productivity
- Information Systems Management
- Telecommunications and Networking in Business
- Technology and New Product Marketing

Students without prior college-level coursework in basic accounting, finance, marketing, mathematics, statistics, operations, or computer systems will need to complete approved foundation courses in these areas in addition to the 32 credits required for the MTM degree.

Admission requirements for the MTM degree are:

- a bachelor's degree from an accredited institution of higher education;
- previous technology experience or a degree in a management or technology-related field;
- a cumulative grade point average of 3.00 or above;
- a Graduate Management Admissions Test (GMAT) score of 550 or above; and
- three letters of reference regarding the applicant's academic or industry experience, as well as evaluating the applicant's capability for graduate work;
- international applicants must also achieve a TOEFL score of 580 or above

MACC Program. The educational objectives of the Master of Accounting program are 1) to provide greater breadth and depth in accounting education than is possible in baccalaureate or MBA programs, 2) to provide a solid foundation in accounting information systems (accounting and information systems track) or to develop technical and specialized competency in taxation (accounting and taxation track), and 3) to develop communication, analytical, interpersonal, and ethical skills necessary for effective decision making. This provides preparation for a professional career in public accounting or consulting, for a career in private, governmental, and non-profit accounting, for a career in information technology, or for entering a Ph.D. program in accounting.

The Master of Accounting degree program offers two tracks: an Accounting and Information Systems track and an Accounting and Taxation track. Both tracks require 32 graduate semester credit hours. This includes 15 hours of graduate level accounting courses (including 3 taxation courses for the taxation track), 15 hours of support coursework (including 3 Management Information Systems courses in the systems track), and 2 hours of a final oral examination. There are no thesis or foreign language requirements.

A full-time graduate student with no prerequisite requirements can complete the Master of Accounting program in one year (two semesters). Graduate students with half-time teaching assistantship appoint-

ments normally take three semesters to complete the program. In no event should more than two years be required.

Regular admission to the Master of Accounting program requires a baccalaureate degree in Business Administration with a major in accounting (or its equivalent), a grade point average of 3.0 (on a scale of 4.0) or higher determined from the last half of undergraduate study or total graduate study of 12 hours or more, a score of 500 or more on the Graduate Management Admission Test (GMAT), at least 1150 admission index (AI = GMAT + (200)(GPA)), and three satisfactory letters of recommendation.

Accounting

Acctg

530 Accounting Theory 3 Recent developments with respect to the determination of income and the valuation of assets.

531 Federal Taxation 3 Prereq Acctg 335. Overview of federal taxation of individuals, partnerships, corporations, estates and gifts.

532 Contemporary Accounting Cases and Problems 3 Accounting theory applied to external financial reporting practices.

533 Administrative Control 3 Prereq Acctg 550 Managerial evaluation of budgeting, cost accounting, and financial analysis techniques; their utilization in control of operations.

535 Taxation of Partners and Partnerships 3 Prereq Acctg 335. Federal income tax impact on partners and partnerships of forming, operating, and liquidating partnerships.

536 Taxation of Corporations and Stockholders 3 Prereq Acctg 335. Federal income tax impact on corporations and their stockholders from forming, operating, and liquidating corporations.

537 Tax Research and Estate Planning 3 Legal tax research methodology; federal estate and gift taxation and retirement planning.

538 Seminar in Cost/Managerial Accounting 3 Cost concepts, cost and managerial accounting systems; current issues and research in cost and managerial accounting.

539 Seminar in Public Accounting and Auditing 3 Prereq Acctg 439. Public accounting and auditing to present; current issues including statistical sampling and computers.

550 Introduction to Financial and Managerial Accounting 3 Fundamentals of financial and managerial accounting; primarily for graduate students who wish to meet the MBA core requirements in accounting.

596 Doctoral Topics 3 May be repeated for credit; cumulative maximum 15 hours. Advanced topics in accounting.

600 Special Projects or Independent Study Variable credit. S, F grading.

702 Master's Special Problems, Directed Study, and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Business Law

B Law

510 Business Law I 3 The legal process, constitutional and administrative law; torts, crimes, sales, agency and employment law.

511 Business Law II 3 prereq B Law 210 or 510. Law of partnerships, corporations, securities regulations, negotiable instruments, secured transactions, property, insurance and bankruptcy; government regulation of businesses and professions.

Decision Sciences

Dec S

516 Time Series 3 Prereq Dec S 591 or Stat 443. ARIMA models; identification, estimation, diagnostics, and forecasting; seasonal adjustments, outlier detection, intervention analysis and transfer function modeling.

517 Quality Improvement for Management 3 Philosophy and evolution of quality control, control charts, process capability analysis, applications.

518 Techniques of Sampling 3 Prereq Dec S 591. Sample surveys for business use; theory and application with emphasis on appropriate sample types and the estimation of their parameters.

519 Applied Multivariate Analysis 3 Prereq Dec S 591 or Stat 443. Principal components, factor analysis, discriminant function, cluster analysis, multivariate normal distribution, Hotelling's T^2 and MANOVA.

- 540 Deterministic Business Models** 3 Prereq Dec S 340. Decision analysis, linear optimization models, nonlinear models, network analysis including PERT, and dynamics programming as applied to business.
- 542 Applied Stochastic Models** 3 Prereq Dec S 215. Stochastic processes, Markov models, stochastic dynamic programming, queues and simulation applied to business problems.
- 581 Operations Management** 3 Prereq Dec S 340. Analytical approach to solving problems in production and operations management.
- 586 Applied Multiple Time Series Analysis** 3 Prereq Dec S 516. Approaches to modeling and analysis of multiple time series.
- 591 Statistical Analysis for Business Decisions** 3 Prereq Dec S 215, Math 201, 202. Analytical skills for decision-making; data collection and analysis, sampling, inferential, regression methodologies, experimental design, time series, forecasting analysis.
- 596 Doctoral Topics** V 1-4 May be repeated for credit; cumulative maximum 15 hours. Advanced topics in decision sciences.
- 598 Research and Professional Development** 1 May be repeated for credit; cumulative maximum 6 hours. Ph.D.-level professional development colloquium designed to improve research, teaching, and presentation skills and to provide professional socialization. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable Credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable Credit. S, F grading.

Finance

Fin

- 500 Economic Theory I** 3 Same as Econ 500.
- 501 Economic Theory II** Same as Econ 501.
- 502 Economic Theory III** Same as Econ 502.
- 503 Economic Theory IV** 3 Same as Econ 503.
- 504 Economic Theory V** 3 Same as Ag Ec 504.
- 510 Statistics for Economists** 4 Same as Ag Ec 510.
- 511 Econometrics I** 3 Same as Econ 511.
- 512 Econometrics II** 3 Same as Ag Ec 512.
- 521 Interest Rates and Financial Markets** 3 Prereq Fin 325. Real and nominal interest rates; bond pricing; term and risk structure of interest rates; investment and commercial banking; financial futures.
- 524 (502) Financial Management** 3 Prereq Acctg 550; Econ 101. Financial management of the firm; capital budgeting, working capital management, capital acquisition, and dividend policy.
- 525 Advanced Financial Management** 3 Prereq Fin 325. Theory of financial management; quantitative analysis of financial problems of the firm; empirical studies on financing modern corporations.
- 526 Problems in Financial Management** 3 Prereq Fin 325. Application of financial principles to problems in financial management; credit policy, capital budgeting, leasing and mergers, cash management.
- 527 Investment Analysis** 3 Prereq Fin 325. A decision-making approach to the problems of asset management for personal and business portfolio.
- 528 Portfolio Theory and Financial Engineering** 3 Prereq Fin 325; 427 or 527. The theory of portfolio management and the use of derivative securities in portfolio risk management.
- 529 Financial Management for High-Tech Firms** 3 Prereq Fin 325. Application of finance principles to firms in high-tech industries; financing, risk management, capital investment, and mergers/acquisitions.
- 581 International Finance** 3 Same as I Bus 581.
- 590 Advanced Topics in Mathematical and Quantitative Methods** 3 Same as Ag Econ 590.
- 591 Advanced Topics in Monetary and Public Economics** V 1-6 Same as Econ 591.
- 592 Advanced Topics in International and Development Economics** V 1-6 Same as Econ 592.
- 593 Advanced Topics in Health, Education, Labor, and Demographic Economics** V 1-6 Same as Econ 593.
- 594 Advanced Topics in Markets and Industrial Organization** V 1-6 Same as Ag Ec 594.

- 595 Advanced Topics in Resource and Production Economics** V 1-6 Same as Ag Ec 595.
- 596 Advanced Topics in Financial Economics** V 1-6 May be repeated for credit; cumulative maximum 12 hours. Prereq Fin 504 and 512 or permission of instructor. Topics may include financial theory and empirical methods as applied to financial management, investments, international finance, and markets/institutions.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Insurance

Ins

- 520 Employee Benefits Risk Management** 3 Social and group insurance and retirement plans in the context of employee benefits risk and insurance management.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.

International Business

I Bus

- 580 International Business Management** 3 Decision-making in the international environment; political, cultural, and economic risk management.
- 581 International Finance** 3 Prereq Fin 325, I Bus 380 or 580. Principles of international finance; the financial management of multinational corporations; international investments.
- 582 International Marketing Management** 3 Prereq Mktg 505. Principles of international marketing; marketing decision making in international environments; problems of adapting marketing programs to international marketing.
- 595 Seminar in Research and Theory Development** 3 Theory development and research on business in a global context.
- 596 Doctoral Topics** 1 May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Advanced topics in international business.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Management

Mgt

- 501 Management of Organizations** 3 Leading, organizing, decision-making, planning, controlling, conflict management, and behavior in work organizations.
- 582 Personnel and Human Resource Management** 3 Prereq Mgt 501. Human resources and personnel administration; selection, training, compensation, performance appraisal, labor relations, health and safety, EEO legislation.
- 583 Organization Design** 3 Development and design of contemporary systems of organization and management.
- 585 Graduate Seminar in Negotiations** 3 Bargaining skills across a broad range of business settings; experiential work. Credit not granted for both Mgt 485 and 585.
- 586 Seminar in Management** 3 May be repeated for credit; cumulative maximum 6 hours. Prereq admissions to MBA program. Special topics in management, organization behavior, organization theory, human resource management and strategic management.
- 587 Business Ethics** 3 Prereq Phil 260. The nature and sources of ethical conflicts and dilemmas individuals and organizations confront in the business context. Credit not granted for both Mgt 487 and 587.
- 588 Management of Innovation** 3 Prereq graduate standing. Technological transitions and technology strategy; knowledge and creativity in organizations; managing innovation processes, technical employees, and cross-functional cooperation.

- 590 Strategy Formulation and Organizational Design** 3 Relationship between the formulation of strategy and the selection of effective organizational structures and systems.
- 593 Managerial Leadership and Productivity** 3 Organizational behavior and human motivation in the workplace; organization and leadership theories, studies, projects and models leading to improved productivity.
- 596 Doctoral Topics** 3 May be repeated for credit; cumulative maximum 15 hours. Advanced topics in management.
- 597 Doctoral Topics** 3 May be repeated for credit; cumulative maximum 9 hours. Advanced topics in macro organizational behavior.
- 598 Research and Professional Development** 1 May be repeated for credit; cumulative maximum 6 hours. Ph.D.-level professional development colloquium designed to improve research, teaching, and presentation skills and to provide professional socialization. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Management Information Systems

MIS

- 507 Computers and Systems for Managers** 3 Data base concepts, management information systems, design of application programs, and computer concepts.
- 572 Database Management Systems** 3 Prereq admission to MBA program. Database management, data modeling, system design and implementation; the application of DBMS technologies to organizational and business problems.
- 574 Telecommunications and Networking in Business** 3 Prereq admission to MBA program. Business applications of data communications, infrastructure, protocols, topologies and management, wired and wireless solutions, and related research issues.
- 575 Electronic Commerce and the Internet** 3 Prereq admission to the MBA Program. Technologies underlying electronic commerce and the internet; strategies and implementation plans for managing the implementation of electronic commerce systems.
- 576 Emerging Technologies** 3 Prereq admission to the MBA Program. Special and advanced topics in MIS.
- 580 Information Systems Management** 3 Data processing organization; operations, application development, computer selection, management of computer personnel and systems.
- 582 Systems Analysis and Design** 3 Prereq admission to MBA program. Research on and application of systems analysis, design, development and management of information systems; systems development life cycle.
- 596 Doctoral Topics** 3 May be repeated for credit; cumulative maximum 9 hours. Prereq graduate standing. Advanced topics in management information systems.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Marketing

Mktg

- 505 Survey of Marketing** 3 Marketing management; relevance of marketing to company profitability and consumer satisfaction; decision regarding price, product, promotion, and distribution.
- 506 Marketing Management and Administrative Policy** 3 Marketing management and administrative policies as they relate to concepts, strategies, and decision making.
- 560 Research Methodology** 3 Prereq Dec S 215. Types of data needed and available, collection and analysis of data as they relate to decisional research.
- 561 Technology and New Product Marketing** 3 Prereq Mktg 360. Introduction of new products that are based on new technology, exploration of actual products in the market.

- 565 Seminar in Marketing** 3 May be repeated for credit; cumulative maximum 9 hours. Marketing structure and behavior from economic and behavioral perspectives; social evaluation and behavioral implications of marketing strategy.
- 567 Consumer Behavior Theory** 3 Prereq Mktg 505. Theory in consumer and buyer behavior; conceptual and empirical research role of purchase and consumption behavior on society and marketing.
- 596 Doctoral Topics** 3 May be repeated for credit; cumulative maximum 15 hours. Advanced topics in marketing.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Real Estate

RE

- 522 Advanced Topics in Real Estate** 3 Basic forces that motivate and affect investors in their use and possession of real estate.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.

Hotel and Restaurant Administration

HA

- 535 International Tourism Strategy and Planning** 3 Tourism components; social, economic, and cultural effects on societies; the management of tourism businesses.
- 580 Hospitality Services Marketing** 3 Prereq Mktg 505. Services marketing concepts and principles applied to hospitality organizations; strategies to market services and control quality.
- 581 Hospitality Services Management** 3 Prereq Mgt 501. Design and management of service systems in hospitality operations; control of customer interaction, personnel activities, and inventory.
- 597 Special Topics** 3 Strategic business policy, concepts, and practices in hospitality management.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.

Chemical Engineering

Degrees Granted: Master of Science in Chemical Engineering; Doctor of Philosophy

GRADUATE FACULTY

R. L. Zollars, Chair; C. F. Ivory, J. M. Lee, K. C. Liddell, R. C. Miller, J. N. Petersen, B. M. Peyton, W. J. Thomson, B. Van Wie

The Department of Chemical Engineering offers graduate work leading to the degrees of Master of Science in Chemical Engineering and Doctor of Philosophy.

The Department's research efforts are housed in the newest engineering building on the Pullman campus with 18 separate graduate student laboratories and an excellent assortment of specialized research equipment. While the research interests of the faculty cover most of the traditional areas of chemical engineering, there is particular emphasis on modern bioprocessing. Specialized equipment in support of research includes a dynamic X-ray diffractometer, a colloidal characterization lab with field flow fractionation and quasi elastic light scattering capabilities, large scale fermentors, ICP/MS, gas-tight bioreactors for study of bioremediation of volatile materials, a laser cell sorter, access to electron microscopes and a wide variety of analytical instrumentation. The department is an active collaborator with numerous other departments on a variety of interdisciplinary projects, the largest being the Center for Multiphase Environmental Research.

The graduate program in Chemical Engineering is flexible so that a program can be developed to fit the needs of an individual student. A typical master of science program can be completed in 12-15 months and a

Ph.D. in 3-4 years after completion of the bachelor of science degree. In addition, a special program is available to allow qualified students with undergraduate degrees in the physical sciences to pursue a Master of Science in Chemical Engineering with a minimum of remedial coursework.

Chemical Engineering

Ch E

- 510 Transport Processes** 3 Transport of mass, energy and momentum; unsteady and steady state as applied to chemical processing; macroscopic and microscopic analyses. Cooperative course taught jointly by WSU and UI. (ChE 515).
- 515 Convection Heat Transfer** 3 Same as M E 515.
- 523 Basic Concepts in Catalysis** 3 (2-3) Preparation and characterization of supported heterogeneous catalysts, mechanistic interpretation of surface reactions and chemisorption, deactivation and kinetics from lab experiments. Cooperative course taught by WSU, open to UI students (Ch E 523).
- 525 Polymer Reactor Engineering** 3 Prereq Ch E 321. Reaction engineering applied to polymerization reactions; effects on polymerization rate, molecular weight, and copolymer composition. Cooperative course taught by WSU, open to UI students (ChE 524).
- 526 Microscopic Thermodynamics** 3 Same as M E 526
- 527 Macroscopic Thermodynamics** 3 Same as M E 527
- 529 Chemical Engineering Kinetics** 3 Interpretation of kinetic data and design of nonideal chemical reactors; fundamentals of heterogeneous catalysis, catalyst preparation, characterization and theory. Cooperative course taught jointly by WSU and UI (ChE 529).
- 541 Chemical Engineering Analysis** 2 Mathematical analysis of chemical engineering operations and processes; mathematical modeling and computer application.
- 546 Mass Transfer Operations** 3 Diffusional and equilibrium operations. Cooperative course taught jointly by WSU and UI (ChE 546).
- 551 Discrete Digital Control** 3 (2-3) Prereq Ch E 441. Design and implementation of digital control algorithms; Z-transforms; state space methods. Cooperative course taught jointly by WSU and UI. (Ch E 551).
- 552 Process Optimization** 3 Fundamentals associated with the optimization of chemical process plants.
- 560 Biochemical Engineering** 3 Chemical engineering applied to biological systems; fermentation processes, biochemical reactor design, downstream processing, transport phenomena in biological systems, biochemical technology. Cooperative course taught jointly by WSU and UI (ChE 560).
- 565 Fundamentals of Multiphase Environmental Processes** 3 Prereq graduate standing. Principles of material and energy balances, reaction kinetics, phase equilibria, chemistry and microbiology governing environmental transport phenomena.
- 567 Current Topics in Multiphase Environmental Systems** 3 Prereq graduate standing. Interdisciplinary course focused on reactions and processes at air, water, and soil interfaces in the environment.
- 571 Advanced Plant Design** V 2-3 Design of process plants for optimum cost and economic return; scale-up of pilot plants. Cooperative course taught by the University Idaho (ChE 571), open to WSU students.
- 574 Protein Biotechnology** 3 Same as BC/BP 574.
- 575 Introduction to Biochemical Engineering** 3 Prereq Ch E 301, 310. Graduate-level counterpart of Ch E 475; additional requirements. Credit not granted for both Ch E 475 and 575.
- 576 Biomedical Engineering Principles** 3 Graduate-level counterpart of Ch E 476; additional requirements. Credit not granted for both Ch E 476 and 576.
- 581 Advanced Topics in Chemical Engineering** V 1-3 May be repeated for credit; cumulative maximum 9 hours. Filtration, reaction engineering, two-phase flow, non-Newtonian fluids, interfacial phenomena, fluidization, novel separations, biomedical engineering.
- 585 Interfacial Phenomena** 3 Prereq Ch E 301, 310. Graduate-level counterpart of Ch E 485; additional requirements. Credit not granted for both Ch E 485 and 585.
- 596 Research Methods and Presentation I** 2 Prereq graduate standing. Establish sound practices for graduate research and presentation of results; techniques used for performing through literature searching and establishing and testing research hypotheses.

597 Research Methods and Presentation II 2 Prereq graduate standing. Establishing sound practices for presentation of research programs and research results.

598 Research Seminar 1 May be repeated for credit. Seminar presentations on current topics in Chemical Engineering research. S, F grading.

700 Master's Research, Thesis, and/or Examination Variable credit. S, F grading.

702 Master's Special Problems, Directed Study, and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Chemistry

Degrees Granted: Master of Science in Chemistry; Doctor of Philosophy

GRADUATE FACULTY

R. G. Yount, Chair; J. Bruce, S. B. Clark, H. H. Hill, Jr., K. W. Hipps, J. K. Hurst, J. P. Jones, A. D. Li, D. S. Matteson, U. M. Mazur, K. A. Peterson, R. C. Ronald, J. D. Satterlee, J. O. Schenk, S. Wherland, R. D. Willett, Z. S. Zhou

The Graduate Program in Chemistry at Washington State University is designed to develop each student's capacity for mature and independent scientific work to its fullest. Research, formal courses, seminars, and informal study groups combine in a flexible program focused on the professional development of the individual student and his or her capacity to undertake independent research. The program is directed by an active faculty in an informal atmosphere. Direct personal contact between the student and faculty member is a priority.

The Department of Chemistry offers Doctor of Philosophy and Master of Science degrees in the areas of analytical, inorganic, organic, and physical chemistry. Degree programs with specialization in environmental chemistry, materials chemistry and chemistry of biological systems are supervised by appropriate faculty members. Interdisciplinary research programs in areas such as organometallic and theoretical and computational chemistry are developed individually through the appropriate selection of courses and research topics. Graduate students in the Department of Chemistry have considerable flexibility in the design of their individual course and research programs.

Course programs for the Doctor of Philosophy are designed to provide depth in a student's chosen research area and command of essential material in other areas of chemistry. All students take a core course in three of the following four core areas of chemistry during the first two years in the program: analytical, inorganic, organic, and physical chemistry. Courses for the first semester are selected by the student in consultation with an advisory committee. During that semester, the student also investigates the research groups and topics in the department. After deciding on a research problem and a faculty advisor, the student selects the remainder of the course program in consultation with the advisor.

The Department offers numerous seminars and a variety of informal study groups. These are important in developing an awareness of the excitement and scope of chemistry and in providing students with a forum for the presentation and discussion of research results and theoretical developments. Seminars and study groups also play an important role in preparing students for the preliminary examination. This examination, usually taken in the third year of graduate work, investigates the student's capacity to use current ideas and knowledge at a professional research level, and is based upon a research proposal prepared by the student.

While courses, seminars and the preliminary examination are important components of a student's program, their purpose is to prepare the student for the research which culminates in the dissertation. Current research topics span the spectrum from materials chemistry to biologically related chemistry, from computational theoretical chemistry to applied environmental chemistry, and from synthesis to analysis. Most students' research, while quite focused on a specific problem, will involve contributions from many areas of chemistry. More detailed descriptions of the research areas of current interest are available from the

Department of Chemistry and through the Department's website (<http://www.chem.wsu.edu>). Information on closely related areas in Materials Science and the School of Molecular Biosciences can be found in this Bulletin.

The Department of Chemistry is housed in five contiguous buildings, two of which were completed recently at a cost of \$19 million. These provide a low-vibration environment for sensitive experiments such as laser spectroscopic studies and a multi-story facility for organic, inorganic, and biochemical research. Renovation of the Department's older buildings is proceeding.

Major research facilities available within the Department's buildings include the Center for NMR Spectroscopy with 300, 400, 500 and 600 MHz instruments and associated computers; the Laboratory for Bioanalysis and Biotechnology (LBB) with facilities for synthesis and characterization of both large and small molecules of biological and environmental interest; and X-ray crystallographic laboratories for structure determination of both large biomolecules and small molecules. Modern instruments and computers are available for IR spectroscopy, Raman spectroscopy, and EPR spectroscopy. Inelastic electron tunneling spectroscopy (IETS), scanning tunneling microscopy (STM), and atomic force microscopy (AFM) experiments can be carried out in the Scanning Probe Microscopy Facility. The Laboratory for Visualization, Analysis, and Design in the Molecular Sciences makes available hardware and software for applications such as quantum and molecular mechanics calculations, protein and nucleotide sequencing, genetic engineering, and interactive graphic display and manipulation of results. In addition, each research group maintains instruments necessary for its specific work. These include a variety of spectroscopic and chromatographic instrumentation, inert atmosphere equipment, high-vacuum apparatus, etc. With appropriate consultation and training, all graduate students are welcome to use these facilities as needed in their research.

Other University Facilities: University facilities also include the Nuclear Radiation Center with a one-megawatt nuclear research reactor, a cobalt-60 irradiator, and a 14-MeV neutron generator for fast-neutron activation analysis, the Water Research Center, the Environmental Research Center, the Air Pollution Research Unit, and the Electron Microscope Center. These facilities are supported by modern technical shops which assist with design, construction, modification and repair of scientific instruments and apparatus. Cooperative research projects with the Environmental Molecular Science Laboratory (EMSL) of Battelle Pacific Northwest Laboratories at Richland, Washington, provide opportunities for additional access to very well equipped facilities. Advanced communication links support interaction with scientists at this Department of Energy research and development site.

Science Library: The University's modern seven-story Owen Science and Engineering Library is adjacent to the main chemistry facilities and contains extensive holdings in chemistry, biochemistry, chemical physics, and related fields. The library also provides access to national literature search and interlibrary loan services.

Students who apply for graduate study in chemistry usually will have satisfied the requirements for the baccalaureate degree in chemistry and are expected to have adequate undergraduate training in subjects recommended by the Committee on Professional Training of the American Chemical Society. This training will normally include courses in physics, mathematics through calculus, and at least one year of foreign language. Students with bachelors' degrees in physics, mathematics or biology who have had the basic courses in chemistry are also eligible for admission to graduate study in chemistry.

Inorganic Chemistry

Chem

- 501 Advanced Inorganic Chemistry** 3 Rec Chem 332. Periodic table survey, typical compounds and their reactivity; models and reactivity, acid-base, oxidation-reduction, and electronic structure contributions.
- 502 Advanced Inorganic Chemistry II** 3 Rec Chem 501. Transition metal chemistry.
- 503 Advanced Topics in Inorganic Chemistry** 1-3 May be repeated for credit. Rec Chem 501. Recent significant developments. Cooperative course taught by WSU, open to Idaho students (Chem 503).
- 504 Organometallic Chemistry** 3 Prereq Chem 501. Structure, bonding, and reaction chemistry of organotransition metal compounds;

applications to homogenous catalysis. Cooperative course taught by UI (Chem 568), open to WSU students.

- 507 Topics in Coordination Chemistry** 3 Rec Chem 501. Principles, complex ions and coordination compounds; theory of acids and bases; bonding theory, nonaqueous solvents; familiar elements; periodicity. Cooperative course taught by UI (Chem 564), open to WSU students.
- 508 Topics in Inorganic Chemistry V** 1-9 Rec Chem 501. Coordination compounds; halogens; less familiar elements; cathrate, interstitial, nonstoichiometric compounds; chemical bonding; inorganic reaction mechanisms. Cooperative course taught at UI (Chem 565), open to WSU students.
- 501 Nuclear Magnetic Resonance Spectroscopy** 3 Rec Chem 332. Theory and practice of nuclear magnetic resonance spectroscopy; application in solution-state and solid-state and imaging.

Analytical, Environmental, and Radiochemistry

Chem

- 510 Introduction to Proteomics** 2 Prereq graduate standing or permission of the instructor; introductory biochemistry, MBios 303 or equivalent. Techniques and applications for the analysis of the proteome.
- 512 Bioanalysis** 2 Rec Chem 220 or 425. Methods for the measurement of biological compounds.
- 514 Mass Spectrometry** 2 Prereq Chem 425. Current methods, techniques and interpretation of mass spectrometric analysis.
- 515 Trace Element Analysis** 2 Rec Chem 425. Techniques for the analysis of inorganic materials at trace levels. Credit not granted for both Chem 415 and 515.
- 517 Chromatography** 2 Prereq Chem 425.
- 518 Electrochemistry** 2 Prereq Chem 425.
- 520 Advanced Analytical Chemistry** 3 Prereq Chem 425. Statistics in chemical analysis; sampling; control of contamination and losses in analysis; electrochemical methods; separation in analysis; spectroscopic techniques.
- 521 Radiochemistry and Radiotracers** 2 Prereq Chem 331. Credit not granted for both Chem 421 and 521.
- 522 Radiochemistry Laboratory** 1 (0-3) Prereq Chem 222, 331; Phys 202. Credit not granted for both Chem 422 and 522.
- 524 Activation Analysis** 2 (1-3) Prereq Chem 331 or 421. Credit not granted for both Chem 424 and 524.
- 527 Environmental Chemistry** 2 Natural water chemistry, Agri processes, kinetics, thermodynamics, modeling in lake, river, and sea water.
- 529 Selected Topics in Analytical Chemistry V** 1-3 May be repeated for credit. Selected current developments. Cooperative course taught by WSU, open to Idaho students (Chem 525).
- 550 Special Topics in Nuclear Processes and Radioactive Waste Management V** 1-3 May be repeated for credit; cumulative maximum 6 hours. Prereq permission of instructor. Fundamental chemistry of the nuclear industry, chemical processing and waste management.
- 581 Environmental Chemistry I** 3 Prereq graduate standing. chemistry of natural and pollutant species and their reaction in the atmospheric environment. Graduate level counterpart of Chem 481; additional requirements. Credit not granted for both Chem 481 and 581.

Physical Chemistry

Chem

- 509 Chemical Group Theory** 3 Rec Chem 332. Mathematical definitions of groups and representations, applications to chemical structure and spectra, ligand field theory, chemical reactions and selection rules.
- 531 Advanced Physical Chemistry I** Prereq Chem 331 or equivalent. Classical physical chemistry including basic thermodynamics and kinetics; an introductory discussion of surface chemistry and electrochemistry is included.
- 532 Advanced Physical Chemistry II** 3 Prereq Chem 332 or equivalent. Introduction to quantum mechanics; postulates of quantum mechanics; exact solutions and approximation methods are introduced.
- 534 Chemical Statistical Mechanics** 3 Rec Chem 531, 532. Statistical theory of thermodynamic variables and chemical equilibrium; calcu-

lation of equilibrium properties from spectral data; fluctuations about equilibrium; quantum statistics.

- 535 Computational Quantum Chemistry** 3 Rec Chem 332 or Phys 303. Computer simulation of chemical behavior using latest methods; theory and practice of quantum chemistry.
- 536 Quantum Chemistry** 3 Prereq Chem 532 or equivalent. Quantum mechanics applied to chemical problems: states of atoms and molecules, transitions and spectra, ladder operators and many electron methods.
- 537 Advanced Topics in Physical Chemistry** V 1-3 May be repeated for credit. Selected subjects; irreversible thermodynamics; chemical bonding; NMR; ligand field theory; x-ray diffraction; neutron diffraction. Cooperative course taught by WSU, open to UI students (Chem 537).
- 561 Atomic and Molecular Phenomena** 3 Graduate level counterpart of Chem 461; additional requirements. Credit not granted for both Chem 461 and 561.
- 564 Molecular Phenomena** 3 Rec Chem 461 or 561, 509; Phys 450. Phenomena which yield information on structure, energy levels, and interactions of molecules in solid, liquid, and gaseous phases.

Organic Chemistry

Chem

- 540 Organic Reaction Mechanisms** 3 Rec Chem 331,342. The major classes of organic reaction mechanisms and their significance; kinetics and introductory theory.
- 541 Advanced Organic Chemistry** 3 Rec Chem 540. Reactions of organic compounds; fundamental theory and reaction mechanisms.
- 542 Advanced Organic Chemistry** 3 Rec Chem 540. Synthesis of organic compounds; recent developments from current literature.
- 543 Theoretical Organic Chemistry** 3 Rec Chem 540. Relationship of reactivity to molecular structure; mechanisms of organic reactions.
- 544 Advanced Topics in Organic Chemistry** V 1-3 May be repeated for credit. Rec Chem 540. Current research in organic chemistry. Cooperative course taught by WSU, open to UI students (Chem 544).
- 546 Spectroscopic Identification of Organic Compounds** V 1-3 May be repeated for credit; cumulative maximum 3 hours. Rec Chem 342. Structural interpretation of ^1H and ^{13}C NMR, vibrational and mass spectra of organic compounds; audio-tutorial.

Problems, Seminar, Research and Thesis

- 555 Teaching Chemistry** I Teaching chemistry, some workshops for new graduate teaching assistants in chemistry focusing on tutorials and labs.
- 590 Introduction to Research Topics** 1 Presentation and description of research areas and projects of current interest to faculty. S, F grading.
- 591 Seminar in Inorganic Chemistry** 1 May be repeated for credit. Presentation and discussion of topics in inorganic chemistry taken from research in progress or current literature.
- 592 Seminar in Analytical Chemistry** 1 May be repeated for credit; cumulative maximum 6 hours. Presentation and discussion of topics in analytical chemistry taken from research in progress or the current literature.
- 593 Seminar in Physical Chemistry** 1 May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Presentation and discussion of topics in physical chemistry taken from research in progress or current literature.
- 594 Seminar in Organic Chemistry** 1 May be repeated for credit; cumulative maximum 6 hours. Presentation and discussion of topics in physical chemistry taken from research in progress or current literature.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Child, Consumer and Family Studies

(See Human Development)

Civil and Environmental Engineering

Degrees Granted: Master of Science in Civil Engineering, Master of Science in Environmental Engineering; Doctor of Philosophy (Civil Engineering)

GRADUATE FACULTY

D. McLean, Chair; M. E. Barber, D. A. Bender, C. S. Claiborn, W. F. Cofer, D. Dolan, J. D. Hoover, M. A. Hossain, R. H. Hotchkiss, R. Y. Itani, M. G. Katona, R. Khaleel, W. C. Kinsel, B. K. Lamb, F. Loge, E. Masad, D. I. McLean, V. F. Medina, G. H. Mount, B. Muhunthan, Y. Onishi, A. T. Papagiannakis, A. Papanicolaou, D. G. Pollock, A. Rodriguez-Marek, R. J. Watts, H. H. Westberg, M. P. Wolcott, D. R. Yonge

The Department of Civil and Environmental Engineering offers graduate programs leading to the degree of Doctor of Philosophy (Civil Engineering) with specializations in environmental engineering, geotechnical engineering, hydraulic and water resources engineering, structural engineering, wood materials and engineering, traffic engineering, and land use and transportation planning. Considerable flexibility is available to the student in setting up a program of study and research. Usually students entering the doctoral program will have the master's degree from a recognized program in engineering. However, qualified students with a recognized degree in physical or biological sciences may be admitted but will be required to make up some of the important undergraduate engineering and mathematics deficiencies. In addition to the requirements of the Graduate School, the student must meet the following departmental requirements for admission into the PhD program: GPA of 3.0 or better in the undergraduate program and 3.5 or better in the master's program; evidence of ability to integrate and synthesize information; and evidence of ability to communicate effectively in the English language. Students are required to take a qualifying examination within six months after being admitted into the PhD program. The results of the examination are used by the Department to guide and counsel the student about deficiencies and strengths.

At the master's level, the Department offers programs leading to the degrees of Master of Science in Civil Engineering, Master of Science in Environmental Engineering. For the Master of Science degree in Civil Engineering, specializations are available in the areas of hydrology, hydraulics, water resources, hydropower, fisheries engineering, fluid mechanics, structural engineering with emphasis on the static and dynamic analysis and design of steel, concrete, and wood structures, applied engineering transportation systems, planning and land use models for infrastructure planning and design. Available specializations in geotechnical engineering include geohydrology and groundwater, soil and rock mechanics. For the Master of Science in Environmental Engineering, specializations are available in the areas of hazardous materials control and design, water supply and water pollution control, solid waste management, and air quality assessment and control. Normally, as preparation toward any of these master's programs, the entering student will have an undergraduate degree from a recognized program in engineering. However, qualified students holding Bachelor of Science degrees in physical or biological sciences may be admitted but will be required to make up some of the important undergraduate engineering and mathematics deficiencies. At the MS level both thesis and non-thesis options are available. The thesis option is a research-oriented program, and the non-thesis option with a special problem is normally professionally oriented. It is expected that completed thesis be of high enough quality for publication in an appropriate professional journal.

The Department participates also in the interdisciplinary programs leading to the Master of Science in Environmental Science and the Master of Regional Planning. Requirements and further details for these degrees are given elsewhere in the Bulletin under the Environmental Science and Rural Land Use and Regional Planning.

The Department maintains several Windows NT and UNIX computer laboratories for use by certified undergraduate and graduate students. The undergraduate lab consists of 28-Windows NT systems and a net-

work printer. Graduate labs are provided for each of the four major program interests: Geotechnical and Transportation, Environmental and Atmospheric Research, Hydraulics, and Structures. Typically, 2-UNIX workstations, 4-Windows NT systems and a networked printer are provided in each.

Albrook Hydraulics Laboratory provides excellent facilities and equipment for basic research and sufficient space to permit installation of large scale physical models. For structural testing, the Wood Materials and Engineering Laboratory contains a 40 ft by 80 ft strong floor that can be used to test structures ranging from full-scale prototypes to reduced-scale models, is fitted with computer-controlled actuators for imposing loads up to 300 kips. Materials-related research facilities are well-equipped for work in the areas of wood particles, fiber and composite materials. Excellent equipment is available for research in the areas of borehole geophysics and geohydrology for laboratory and field work. The soil and rock mechanics laboratories include state-of-the-art static and dynamic triaxial, direct shear and consolidation machines. Environmental engineering laboratories are well equipped for air and water laboratory and field studies and include gas and high pressure liquid chromatographs, atomic absorption spectrometers, autoanalyzers for many pollutants, three water craft equipped for field limnological and water quality studies, mass spectrometer, environmental growth chambers, photochemical smog chambers, meteorological and turbulence measurement systems.

Civil and Environmental Engineering

C E

- 501 Advanced Topics in Transportation Engineering** V 2-4 May be repeated for credit; cumulative maximum 9 hours. Prereq C E 322; Stat course. Analysis, planning, design, and evaluation of transportation modes and systems. Cooperative course taught jointly by WSU and UI (CE 571).
- 506 Design and Construction of Water Wells** 3 Analysis of geologic and engineering factors important in design, construction, and maintenance of water wells. Cooperative course taught by UI (Hydro 575), open to WSU students.
- 507 Seepage and Earth Dams** 3 Principles of earth-dam design, failures, considerations in construction; principles governing flow of water through soils. Cooperative course taught by the UI (Geol E 535).
- 508 Air Pollution Control Engineering** 3 Prereq graduate standing. Measurement and control of air pollution; engineering design calculations; equipment and process. Graduate level counterpart of C E 408; additional requirements. Credit not granted for both C E 408 and 508.
- 509 Numerical Modeling of Geomaterials** 3 Prereq graduate-geotechnical engineering-related field, or by interview only. Modeling of the response of geomaterials to changes in imposed stresses or strains under both static and dynamic conditions.
- 510 Experimental Methods in Geotechnical Engineering** 3 (1-6) Prereq C E 317. Experimental methods of evaluating geotechnical engineering properties including shear strength, stress/strain behavior, time-dependent behavior, and permeability. Graduate level counterpart of CE 410; additional requirements. Credit not granted for both C E 410 and 510.
- 511 Advanced Topics in Geotechnical Engineering** V 2-4 May be repeated for credit; cumulative maximum 9 hours. Prereq C E 317. Soil dynamics, geotechnical earthquake engineering, theoretical soil mechanics, numerical methods in soil mechanics, and geohydrology, engineering geology, cold regions geoengineering. Cooperative course taught jointly by WSU and UI (C E 569).
- 512 Dynamics of Structures** 3 Behavior of structures under impact, impulse, and seismic loads. Cooperative course taught jointly by WSU and UI (C E 543).
- 514 Advanced Mechanics of Materials** 3 Elastic stress-strain relations, shear center, unsymmetrical bending, curved beams, elastic stability, elastically supported beams, energy methods, thin plates, shells. Cooperative course taught jointly by WSU and UI (C E 510/ME 539).
- 515 Environmental Measurements** 3 (1-6) Prereq C E 341. Theory and laboratory measurement techniques used in analyzing environmental quality parameters. Graduate level counterpart of C E 415; additional requirements. Credit not granted for both C E 415 and 515.
- 516 Unsteady Closed-Conduit Flow** 3 Prereq C E 351. Derivation of governing equations; finite difference methods; methods of characteristics; boundary conditions; computational procedures; transients caused by centrifugal pumps.
- 517 Mechanics of Sediment Transport** 3 Cohesive and non-cohesive sediments; initiation of sediment motion; sediment transport; suspended and bed load entrainment; models of sediment transport for alluvial and gravel bed streams, sediment-flow interaction; river morphology and ecological restoration.
- 518 Hazardous Waste Engineering** 3 or 4 Prereq graduate standing. Hazardous waste properties, chemodynamics, and health effects; introduction to risk assessment and hazardous waste remediation. Graduate level counterpart of C E 418; additional requirements. Credit not granted for both C E 418 and 518.
- 519 Hazardous Waste Treatment** 3 Prereq C E 518. Principles of operation and application of processes in design of technologies used in hazardous waste treatment and remediation. Graduate level counterpart of C E 419; additional requirements. Credit not granted for both C E 419 and 519.
- 521 (550) Fundamentals of Fluid Flow** 3 Prereq CE 315 or M E 303. Fundamental equations of compressible viscous flow, Newtonian viscous-flow equations, laminar boundary layers, stability of laminar flows, incompressible turbulent flow.
- 524 Geotechnical Earthquake Engineering** 3 Faulting and seismicity; site response analysis; influence of soil on ground shaking; soil liquefaction; probabilistic seismic hazard assessment; seismic earth pressures; seismic slope stability. Cooperative course taught by WSU, open to UI students (C E 566).
- 525 Soil and Site Improvement** 3 Prereq CE 317 Compaction theory and methods; deep densification of soils; advanced consolidation theory, preloading, vertical drains, chemical stabilization, grouting. Graduate level counterpart of C E 425; additional requirements. Credit not granted for both C E 425 and 525. Cooperative course taught by WSU, open to UI students (C E 567).
- 527 Advanced Soil Mechanics** 3 Prereq C E 317. Effective stresses and lateral earth pressures; interrelationships of applied stresses, permeability, strain and shear strength of soils. Cooperative course taught by UI (CE 561), open to WSU students.
- 528 Advanced Foundation Engineering** 3 Prereq C E 317. Consolidation theories, bearing capacity, and settlements of foundations, pile group behavior, theory of subgrade reaction, materials foundations, laterally loaded piles. Cooperative course taught by UI (C E 562), open to WSU students.
- 529 Soil Dynamics** 3 Prereq graduate standing. Vibration theory; analysis of machine vibrations; wave propagation through soils; dynamic loading of soils; liquefaction. Cooperative course taught by the UI (C E 565), open to WSU students.
- 531 Probability and Statistical Models in Engineering** 3 Engineering applications of probability and statistics; Monte Carlo simulation; model estimation and testing; probabilistic characterizations of loads and material properties; risk and reliability analyses. Cooperative course taught jointly by WSU and UI (CE 541).
- 532 Finite Elements** 3 Theory of finite elements; applications to general engineering systems considered as assemblages of discrete elements. Cooperative course taught jointly by WSU and UI (C E 546).
- 533 Advanced Reinforced Concrete Design** 3 Prereq C E 433. Composite design; slab design; limit state design; footings; retaining walls; deep beams; brackets and corbels; torsion; seismic design; shear walls. Cooperative course taught by WSU, open to UI students (C E 547).
- 534 Prestressed Concrete Design** 3 Prereq C E 433. Behavior, analysis and design of pretensioned and post-tensioned prestressed concrete structures; flexure, shear, bond, anchorage zone design; prestress losses. Graduate level counterpart of C E 534; additional requirements. Credit not granted for both C E 434 and 534. Cooperative course taught by WSU, open to UI students (C E 442).
- 535 Advanced Finite Elements** 3 Prereq graduate standing. Advanced topics in finite elements. Plate and shell analysis; nonlinear solution methods for finite strain/rotation and nonlinear materials.
- 536 Nondestructive Testing of Structural Materials** 3 Principles of nondestructive testing applied to wood-based materials, steel, con-

- crete, and masonry. Cooperative course taught by WSU, open to UI students (ForP 535).
- 537 Advanced Topics in Structural Engineering** 3 May be repeated for credit; cumulative maximum 6 hours. Elastic stability, plates and shells, other relevant topics. Cooperative course taught by WSU, open to UI students (C E 549).
- 538 Earthquake Engineering** 3 Prereq C E 512. Ground motion characterization, elastic and inelastic structural dynamic response, code procedures, lateral force-resisting systems, detailing for inelastic response.
- 539 Advanced Wood Engineering** 3 Prereq CE 436 or equiv. Engineering properties of wood materials; theory and design of wood composites, connections and load-sharing systems; performance criteria and durability.
- 540 Instrumental Analysis of Environmental Contaminants** 3 (1-6) Prereq C E 415. Theory and methods of analysis of water and water suspensions for contaminants using electrometric, spectrophotometric, and chromatographic techniques. Cooperative course taught by WSU, open to UI students (C E 530).
- 541 Environmental Engineering Unit Operations** 3 Prereq Math 315; C E 442. Theory and design of physical and chemical unit operations of water and wastewater treatment systems. Cooperative course taught jointly by WSU and UI (C E 531).
- 542 Environmental Engineering Unit Processes** 3 Prereq C E 541. Biochemical energetics and kinetics; biological waste treatment processes; nutrient removal; advanced wastewater treatment design. Cooperative course taught jointly by WSU and UI (C E 534).
- 543 Advanced Topics in Environmental Engineering Practice** V 1-4 May be repeated for credit; cumulative maximum 8 hours. Analysis and evaluation of air/water/soil pollution problems, new measurement methods, hazardous waste treatment, global climate change, and water/wastewater treatment.
- 544 Wastewater Treatment System Design** 3 (2-3) Prereq C E 542 or c//. Application of unit operations and processes to design of integrated treatment systems; critical review of designs. Cooperative course taught jointly by WSU and UI (C E 532).
- 545 Industrial Waste Problems** 3 Prereq C E 542 or c//. Evaluation and feasible solutions of industrial waste problems. Cooperative course taught by WSU, open to UI students (C E 551).
- 546 Parameters for Synthesis of Wood Composition Materials** 3 Same as MSE 546.
- 547 Principles of Environmental Engineering** 3 Prereq C E 315, 341; Math 315. Principles of chemistry microbiology, thermodynamics, material and energy balances, and transport phenomena, for environmental engineers.
- 548 Advanced Topics in Water Quality Engineering Systems** V 2-4 May be repeated for credit; cumulative maximum 6 hours. Analysis and evaluation of natural water systems for retention and transport of pollutants and their associated impacts.
- 550 Intermediate Fluid Mechanics** 3 Prereq C E 315. Basic flow equations; Navier-Stokes equations; similitude, potential flow, boundary layers, turbulence, and diffusion; uniform and non-uniform conduit flow; drag and lift. Cooperative course taught by WSU, open to UI students (C E 525).
- 551 Open Channel Flow** 3 Prereq C E 315. Steady, non-uniform flow; controls and transitions in fixed-bed channels. Graduate level counterpart of C E 451; additional requirements. Credit not granted for both C E 451 and 551.
- 552 Advanced Topics in Hydraulic Engineering** V 1-3 May be repeated for credit; cumulative maximum 6 hours. Prereq C E 315. Cavitation, air entrainment, hydraulic machinery, similitude, mixing in rivers and estuaries, hydraulic design. Cooperative course taught by WSU, open to UI students (Hydro 527).
- 556 Numerical Modeling in Fluid Mechanics** 3 Prereq C E 315. Fundamental concepts in development of numerical models for fluid flow with applications to steady and unsteady flows.
- 560 Advanced Hydrology** 3 Prereq C E 351. Components of the hydrologic cycle; conceptual models; watershed characteristics; probability/ statistics in data analysis; hydrographs; computer models; design applications. Graduate level counterpart of CE 460; additional requirements. Credit not granted for both C E 460 and 560.
- 561 Water Resources Systems** 3 Concepts in water development; coordination of development of other natural resources; systems approach and optimization techniques. Cooperative course taught jointly by WSU and UI (CE 523).
- 562 Water Resources Planning** 3 Prereq C E 351. Design and feasibility studies in water supply, power, flood problems, navigation, irrigation, recreation. Cooperative course taught jointly by WSU and UI (CE 524).
- 564 Applied Traffic Operations** 3 Prereq C E 322 or instructor approval. Fundamentals of traffic operations needed to prepare a design or evaluation of a signalized or unsignalized intersection.
- 565 Transportation Planning** 3 Prereq by permission only. Concepts and methods of transportation planning, including network modeling, travel demand forecasting, and systems evaluation of multimodal transportation systems.
- 566 Pavement Management and Rehabilitation** 3 Prereq C E 322. Basics of pavement management systems development and implementation.
- 567 Advanced Characterization of Highway Materials** 3 Basic and advanced level of the fundamentals of material response to static and repeated loading; emphasis on the deformation and fatigue behavior of asphalt mixtures.
- 569 Field Methods in Hydrogeology** 2 (1-3) Same as Geol 569.
- 571 Meteorology** 3 Prereq Math 273, Phys 201 or comparable. Basic meteorology; atmospheric thermodynamics; cloud physics, synoptic meteorology; radiative processes; climate change.
- 572 Advanced Pavement Analysis** 3 Prereq CE 473. Fundamentals of pavement-vehicle interaction and the mechanics of pavement response and damage.
- 573 Air Pollution Abatement and Administration** 2 Air quality management, criteria, and standards; administration of air pollution control agencies; enforcement, inspection and surveillance. Cooperative course taught by WSU, open to UI students (C E 552).
- 576 Dynamics of Groundwater Contamination** 3 Prereq C E 475. Fundamentals of ground water flow, pollutant transport, modelling data analysis, well siting/sampling and interaction of pollutants with sediments/soils.
- 577 Advanced Groundwater Hydraulics** 3 Prereq Geol 475, Math 315. Modeling of subsurface flow in saturated, unsaturated, and multilfluid systems; analytic and numerical solutions techniques; review of statistical geohydrologic methods.
- 579 Groundwater Geochemistry** V 2-4 May be repeated for credit; cumulative maximum 4 hours. Same as Geol 579
- 580 Graduate Seminar** 1 May be repeated for credit; cumulative maximum 2 hours. Lectures and reports on current developments in research and practice.
- 581 Environmental Engineering Analysis** 2 (1-3) Prereq C E 541. Theoretical and laboratory methods for development of design criteria for sanitary engineering systems. Cooperative course taught by WSU, open to UI students (C E 534).
- 583 Engineering Aspects of Environmental Chemistry** V 2-4 Prereq C E 442. Chemical principles as applied to water supply and pollution control engineering. Cooperative course taught by WSU, open to UI students (C E 553).
- 584 Environmental Microbiology** V 2(1-3) or 3 (1-6) Prereq C E 583. Current techniques in environmental engineering and science used to assess the biological quality, structure, and function of ecosystems, and microbial diversity of air, terrestrial, and aquatic environments. Cooperative course taught by WSU, open to UI students (CE 538).
- 585 Aquatic System Restoration** 3 (2-3) Prereq Chem 240 or C E 583; Micro 101 or C E 581. Study of natural and damaged water systems with emphasis on water quality protection and restoration.
- 586 Bioremediation of Hazardous Waste** 3 Prereq C E 584. Applications of bioremediations to in situ subsurface treatment of hazardous waste; subsurface microbial degradation as related to microbial ecology.
- 588 Atmospheric Turbulence and Air Pollution Modeling** 3 Prereq C E 571. Physical aspects of atmospheric turbulence, theoretical developments in atmospheric diffusion, and applied computer modeling with regulatory and research models.
- 589 Atmospheric Chemical and Physical Processes** 3 Processes of removal of pollutants from the atmosphere; radical chain reactions, particle formation, model calculations.

- 590 Spectroscopy and Radiative Transfer of the Atmosphere** 3 Prereq by interview only. Concepts of radiative transfer and molecular spectra in the troposphere and stratosphere with applications to trace gas measurements.
- 592 Broadband Networks** 3 Prereq Cpt S 455 or E E 555. ATM and Broadband ISDN architecture, voice/video traffic modeling, multiplexing, admission and congestion control, bandwidth allocation, ATM switches.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Communication

Degrees Granted: Master of Arts in Communication; Doctor of Philosophy

GRADUATE FACULTY

A. S. Tan, Director, School of Communication; E. Austin, H. J. Ayres, P. Bolls, R. Busselle, D. Demers, J. Drzewiecka, E. Hindeman, E. L. James, E. Krueger, R. Nofsinger, B. Pinkleton, J. Reagan, S. Ross, M. Salvador, P. Sias

Graduate study in Communication at Washington State University is designed to serve the needs of persons intending to pursue communication related careers in business, government, education, research, and the communication industry.

People with a background in the humanities or social sciences may be qualified for admission to our M.A. and Ph.D. programs. However, people without previous training in Communication may be required to complete supplemental coursework. A carefully outlined set of options enables graduate students to pursue a variety of topics in communication studies and/or the mass media. All students in the M.A. program share a common core of courses and choose either to write a thesis or complete an additional nine hours of coursework and pass a comprehensive examination over the coursework. Students in the Ph.D. program pursue a program of study tailored to their interests as those interests are informed by our complex, intercultural society. In addition, all Ph.D. students are expected to teach and take courses in pedagogy. Students enrolled in the Ph.D. program must complete a comprehensive examination and a dissertation.

Communication

Com

- 501 Theory Building in Communications** 3 Relationship of research to theory development; evaluation of current theory and research; planning and executing research within specified theoretical frameworks.
- 504 Instructional Practicum** 1 May be repeated for credit; cumulative maximum 4 hours. S, F grading.
- 509 Quantitative Research** 3 Introduction to quantitative research in communication; hypothesis development, testing; basic statistics, interpretation; field surveys, laboratory and field experiments, content analysis.
- 510 History of Mass Communications** 3 For seniors and graduate students. Credit not granted for both Com 410 and 510.
- 515 Law of Mass Communications** 3 Graduate level counterpart of Com 415; additional requirements. Credit not granted for both Com 415 and 515.
- 517 Health Communication and Social Development** 3 Explores and tests role of mediated communication in the causes of and solutions for health problems, particularly among young people.
- 520 New Communication Technologies** 3 Use of new communication technologies and their impacts on communication processes, access, regulation, and communications in organization/professional contexts. Credit not granted for both Com 420 and 520.

- 522 Intercultural Processes in the Transnational Context** 3 Transnational cultural processes, role of communication in negotiating meanings across borders, identity and difference.
- 524 Criticism of Public Address** 3 Critical analysis of public messages; applications of traditional and contemporary approaches to textual analysis, from classical to postmodern theory. Credit not granted for both Com 524 and ComSt 424.
- 525 Rhetorical Theory** 3 Major theories from classical to contemporary; analysis of symbolic action in public, political discourse.
- 526 Seminar in Classical Rhetoric and its Influences** 3 Same as Engl 509.
- 538 Seminar in Training and Development** 3 May be repeated for credit; cumulative maximum 6 hours. Instructional aspects of training and consultation in organizational communication; team-building, presentational skills, conflict resolution, assessment, leadership, group dynamics.
- 540 Media Ethics** 3 Foundations and frameworks of media ethics; case studies, assessing ethics in media performance. Graduate level counterpart of Com 440; additional requirements. Credit not granted for both Com 440 and 540.
- 550 Mass Media and the First Amendment** 3 Theoretical and philosophical bases of press, individual and government interaction centering on First Amendment. Graduate level counterpart of Com 450; additional requirements. Credit not granted for both Com 450 and 550.
- 560 Mass Media Criticism** 3 Theoretical and philosophical basis for critical analysis of mass communication. Graduate level counterpart of Com 460; additional requirements. Credit not granted for both Com 460 and 560.
- 570 Communication Theory** 3 Relevant theories and research from mass and interpersonal communication.
- 572 Mass Media, Social Control and Social Change** 3 Prereq graduate standing. Study of the "forces" that influence the media's role as an agent of social control or social change.
- 580 Topics in Communication** 3 May be repeated for credit; cumulative maximum 12 hours. Contemporary, specialized, or technical topics in communication.
- 585 Interpersonal and Small Group Communication** 3 Theory and research in interpersonal and small group communication.
- 591 Qualitative Research Methods** 3 Historical, textual and legal methodologies for theory-based evaluative, and discourse studies in communication.
- 599 Seminar in Communication** 3 May be repeated for credit; cumulative maximum 6 hours. Special topics in rhetoric, communication, and public address.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Advertising

Adver

- 580 Advertising Agency Operation and Campaigns** 3 Prereq Adver 381, 382, Mktg 360. Principles and functions of advertising management: campaign planning, execution, presentation and evaluation. Graduate level counterpart of Adv 480; additional requirements. Credit not granted for both Adver 480 and 580.
- 581 Advertising Psychology** 3 Prereq graduate standing. Examination of social and cognitive psychological theories which have contributed to the practice of advertising.
- 582 Advertising Management** 3 Prereq graduate standing. Case method approach to appraising market opportunities for the planning, development, implementation, and administration of advertising programs.

Broadcasting

Bdcst

- 565 Broadcast News Writing, Reporting, and Editing** 3 (2-3) May be repeated for credit; cumulative maximum 6 hours. Prereq Bdcst

365. Writing, reporting, and editing broadcast news; development and production of documentaries. Graduate level counterpart of Bdcst 465; additional requirements. Credit not granted for both Bdcst 465 and 565.

566 Advanced Reporting and Documentary 3 (2-3) Prereq Bdcst 465. Advanced writing and reporting for radio or television; feature-length reporting on news and public affairs topics; documentaries. Graduate level counterpart of Bdcst 466; additional requirements. Credit not granted for both Bdcst 466 and 566.

581 Broadcast Management 3 Graduate level counterpart of Bdcst 481; additional requirements. Credit not granted for both Bdcst 481 and 581.

Communication Studies

ComSt

535 Advanced Organizational Communication 3 Prereq graduate standing. Advanced concepts, models and methods for in-depth analysis of contemporary communication organizations. Graduate level counterpart of ComSt 435; additional requirements. Credit not granted for both ComSt 435 and 535.

551 Readers Theatre for the Classroom 3 Principles of literature selection, scriptwriting and staging of readers theatre for classroom. Graduate level counterpart of ComSt 451; additional requirements. Credit not granted for both ComSt 451 and 551.

573 Avoiding Communication 3 Prereq Com 509. Examines theories about why people avoid communication, data relative to these theories, and extant intervention literature.

588 Structure of Conversation 3 Prereq graduate standing, Com 501. Symbol systems and their interrelation in sequential organization in everyday communication. Graduate level counterpart of ComSt 488; additional requirements. Credit not granted for both ComSt 488 and 588.

Journalism

Jour

525 Reporting of Public Affairs 3 Research leading to publication of journalistic articles. Graduate level counterpart of Jour 425; additional requirements. Credit not granted for both Jour 425 and 525.

581 Newspaper Management 3 Senior standing. Graduate level counterpart of Jour 481; additional requirements. Credit not granted for both Jour 481 and 581.

Public Relations

P R

511 Public Relations Theory and Application 3 Theory and practice of public relations; its function in organizations and its role in society.

512 Public Relations Management and Campaign Design 3 Prereq Com 409, P R 312, Jour 305 or PR 313. Application of public relations principles, management, persuasion theory and research methods to public relations issues. Graduate level counterpart of P R 412; additional requirements. Credit not granted for both P R 412 and 512.

575 Seminar in Public Relations 3 Theory, methods, and applications of communication and campaign management; political communication, health communication, freedom of expression, special audiences. Graduate level counterpart of P R 475; additional requirements.

Community and Rural Sociology

Graduate Faculty hold appointments in other departments including Sociology and Environmental Science and Regional Planning.

The Department of Community and Rural Sociology does not offer a graduate level degree. However, it does offer the graduate courses listed below. Faculty members work closely with graduate students in departments such as Sociology, Environmental Science and Regional Planning, Human Development, Agricultural and Resource Economics, Anthropology, and Natural Resource Science. This work includes serving as chair and member of graduate student committees.

Community and Rural Sociology

CRS

523 Fundamentals of Participatory Research 3 Prereq graduate standing. Principles/methods of involving community/interest group members in knowledge generation to understand local issues while building local capacity. Graduate level counterpart of CRS 423; additional requirements. Credit not granted for both CRS 423 and 523.

535 Resolving Environmental Conflicts 4 (3-1) Prereq graded standing. Introduction to environmental conflict resolution via readings, discussions, simulation role plays and required papers; emphasis on interest-based approaches. Graduate level counterpart of CRS 435; additional requirements. Credit not granted for both CRS 435 and 535.

541 Local Impacts of Global Commodity Systems 3 Prereq graduate standing. Theories of globalization, its social, political and economic dimensions, and its impact on people and communities. Graduate level counterpart of CRS 441; additional requirements. Credit not granted for both CRS 441 and 541.

591 Graduate Special Topics V 1-3 May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Advanced topics in rural sociology or community studies.

600 Special Projects/Independent Study Variable credit. S, F grading.

Computer and Natural Sciences

A Master of Science/Doctor of Philosophy Option in Computer and Natural Sciences has been created to better coordinate and integrate studies and research at the interfaces between computer science and the various natural science disciplines. Students who elect this degree option typically earn an MS in Computer Science while obtaining a PhD in any one of the science, engineering or mathematics specialties offered at WSU. Obtaining a Master of Science in the specialty and a PhD in Computer Science is also possible.

Given the current and projected rate of development of computer hardware, software, and applications in the various science, engineering and mathematics specialties, this degree option offers WSU graduate students a unique opportunity to be well-prepared for the future.

Any student planning to pursue this option should first check with the major department.

Computer Science

(See Electrical Engineering and Computer Science)

Counseling Psychology

(See Education)

Criminal Justice

Degrees Granted: Master of Arts in Criminal Justice

GRADUATE FACULTY

S. D. Stehr, Chair; A. Appleton, D. C. Brody, C. W. Clayton, T. E. Cook, M. L. Cottam, L. Leloup, C. N. Long, N. P. Lovrich, F. E. Lutze, O. Marenin, K. A. Mason, A. G. Mazur, M. A. Newman, D. C. Nice, J. M. Pickerill, T. Pratt, J. T. Preston, D. Stehr, M. Stephan, M. Smith, P. Thiers, E. P. Weber

Program in Criminal Justice. The Program emphasizes a multidisciplinary approach to the understanding of deviant behavior and crime, the nature of law and social control, the organization and management of criminal justice agencies, and the use of research and evaluation for planned change in criminal justice. Graduate education in Criminal Justice reflects the philosophy and orientation of graduate education as offered by Washington State University. Thus, the Program is

tied to the development of new knowledge and research in the field of criminal justice and is designed to accommodate several types of students. It provides additional education for undergraduates in criminal justice who wish to pursue advanced degrees. It provides basic education for students from other fields who may be preparing for new careers. In addition, the Program provides a solid foundation for criminal justice professionals who wish to enhance their capabilities through university education.

The Program in Criminal Justice is administratively located in the Department of Political Science. Faculty are drawn mainly from the Program in Criminal Justice and the Departments of Political Science and Sociology. The Program offers the Master's degree in Criminal Justice. In addition, students who wish to go on with their graduate education can select Criminal Justice/Public Administration/Public Policy as one of their concentrations in the PhD program in Political Science.

Admission to the MA degree program in Criminal Justice is not confined to students who have majored or minored in Criminal Justice as undergraduates. In fact, the Program encourages a variety of backgrounds and perspectives in its graduate students. However, students with fewer than 12 hours of undergraduate course work in Criminal Justice will normally be expected to audit or enroll in some undergraduate courses while/or before being allowed to register in graduate classes. Since the Criminal Justice Program has a strong liberal arts orientation, as well as an applied policy focus, it is recommended that one's undergraduate years be devoted to building a strong background in related fields, including social and natural sciences, arts and humanities, in addition to criminal justice courses. Each candidate will be judged independently and notified at the time of admission of any undergraduate deficiencies that must be removed during a course of study.

Criminal Justice

Crj M

504 Quantitative Methods in Political Science and Criminal Justice 3 Same as Pol S 504.

505 Comparative Criminal Justice 3 Comparative study of crime laws and criminal justice systems in selected foreign countries. Cooperative course taught by WSU, open to UI students (CJ 505).

530 Criminal Justice: Process and Institutions 3 Processes of criminal justice in the context of the social, political, and economic environments. Cooperative course taught by WSU, open to UI students (CJ 530).

539 The Political Science Profession 1 Same as Pol S 539.

540 Seminar in Research Evaluation 3 Interrelationship of ideology, data, policy development, and policy implementation in public policy analysis. Cooperative course taught by WSU, open to UI students (CJ 540).

541 Seminar in Corrections 3 Prereq Stat course. Current issues related to the control, management, and sanctioning of criminal offenders. Cooperative course taught by WSU, open to UI students (CJ 541).

550 Planned Change in Criminal Justice 3 Analysis of change efforts aimed at individuals, organizations, and communities to reduce crime and improve the criminal justice system. Cooperative course taught by WSU, open to UI students (CJ 550).

570 The Police and Society 3 Community and selected social institutional factors as related to their influence on police systems. Cooperative course taught by WSU, open to UI students (CJ 570).

572 Seminar in Comparative Policing 3 Study of the history, organization, and policies of policing systems in selected countries and of transnational policing. Cooperative course taught by WSU, open to UI students (CJ 572).

580 Women and the Criminal Justice System 3 Criminal justice system's treatment of women offenders, victims, and professionals.

590 Criminal Justice Field Practicum V 1-6 May be repeated for credit; cumulative maximum 6 hours. By interview only. Professional internship in selected criminal justice agencies. S, F grading.

591 Seminar in the Administration of Criminal Justice 3 May be repeated for credit; cumulative maximum 6 hours. Current issues, problems, and critical concerns within the field of administration of criminal justice. Cooperative course taught by WSU, open to UI students (CJ 591).

592 Proseminar in Administration, Justice, and Applied Policy Studies 3 Same as Pol S 542.

597 Graduate Internship V 2-12 May be repeated for credit; cumulative maximum 12 hours. On/off campus internship in criminal justice institutions (police, FBI, law firms, etc.) nonprofit or public organizations; written assignments and readings will be required. S, F grading.

600 Special Projects or Independent Study Variable credit. S, F grading.

702 Master's Special Problems, Directed Study, and/or Examination Variable credit. S, F grading.

Crop and Soil Sciences

Degrees Granted: Master of Science in Crop Science and Master of Science in Soil Science; Doctor of Philosophy (Crop Science) and Doctor of Philosophy (Soil Science)

GRADUATE FACULTY

W. L. Pan, Chair; D. F. Bezdicsek, H. Bolton, Jr., A. J. Busacca, K. A. G. Campbell, M. M. Chevalier, C. J. Coyne, J. R. Davenport, M. Flury, B. E. Frazier, J. K. Fredrickson, R. S. Gallagher, G. W. Gee, K. S. Gill, J. B. Harsh, D. R. Huggins, R. C. Johnson, W. J. Johnston, S. S. Jones, A. C. Kennedy, K. K. Kidwell, A. Kleinhofs, S. Kuo, K. E. McPhee, C. F. Morris, F. J. Muehlbauer, F. J. Peryea, J. P. Reganold, W. F. Schillinger, D. Skinner, J. L. Smith, R. G. Stevens, S. E. Ullrich, M. M. Williams III, J. P. Yenish

The Department of Crop and Soil Sciences offers extensive and diversified programs of graduate education and research leading to the Master of Science and Doctor of Philosophy degrees in Crop Science and Soils Science.

Crop Science specialization areas include plant genetics and crop breeding; crop physiology; and crop ecology, management and production. While students may elect to specialize in one area, excellent opportunities are available for the development of graduate research projects integrating two or more areas.

Plant breeding and genetics research programs include improvement of wheat, barley, pea, lentil, and other legumes with: isozyme, aneuploid, RFLP and RAPD facilitated genome mapping; cloning and molecular analysis. Current research focuses on the genetics and physiology of water and nitrogen use efficiency, grain end use quality, seed germination and dormancy, pathogen resistance and herbicide resistance. Crop production research includes investigation of weed control and ecology, seed production and technology, and turf management.

Crop or Soil Science degree programs can be developed to study sustainability of alternative cropping systems such as organic, site-specific, biointensive and direct-seed systems that focus on crop productivity, economic stability, biodiversity, natural resource conservation, and environmental protection.

Soils may be studied either as natural bodies or as a medium for chemical and biochemical interactions for transport of water, solutes and heat, and for plant growth. Washington State University is located in one of the best geographical areas in the world for the study of soils as naturally occurring bodies. Graduate programs are usually designed to specialize in the physical chemical, biological, mineralogical, geomorphological, or fertility aspects of the soil system.

Current soil science research programs in which graduate students are participating include: unsaturated water flow; soil-plant relationships; stability of minerals and controls on heavy metal levels; nutrient budgets of cropping systems; movement and transformation of pesticides and xenobiotic chemicals; microbial ecology; fate of engineered microorganisms; phytotoxicity and crop residue management; no-till soil and crop management; fertility and mineral nutrition; soil interpretations for land use and development; benchmark soils; agricultural and urban waste recycling. Faculty members in Soil Science also participate in the interdepartmental Department of Biochemistry/Biophysics and the Program in Environmental Science at Washington State University, and cooperate with the University of Idaho in teaching graduate courses.

The laboratory and field facilities in the Department of Crop and Soil Sciences are well-equipped for graduate study and research. Greenhouses, growth chambers, mass spectrometry, controlled temperature germinators, low temperature storage facilities, seed technology labora-

atories, tissue culture laboratories, and equipment and facilities for histological, cytological, biochemical, physiological and molecular investigations are available for use by graduate students. In addition, the Department has both dryland and irrigated field laboratories and advanced field equipment. Extensive and unique facilities for radiation and chemical mutagenesis are available on the Washington State University campus.

Undergraduates who anticipate graduate study in Crop or Soil Science at Washington State University are advised to obtain a background in natural sciences including botany, geology, genetics, chemistry, mathematics, physics, statistics, and plant and soil sciences. In addition to the Graduate School admission requirements, the Department of Crop and Soil Sciences requires a personal statement of the applicant's educational goals and professional expectations. Acceptance of qualified applicants is generally dependent upon availability of research support and a suitable advisor.

Students may choose thesis or nonthesis options at the master's level. Most students are encouraged to pursue the thesis option. However, students who are not interested in research and who wish to pursue a Master of Science in Crop or Soil Science as a terminal degree may select the nonthesis option. Both options require appropriate coursework, participation in the project work of the advisor, individual research and preparation of a thesis or report based on the research.

Doctoral programs are designed to educate crop and soil scientists to a high degree in a specialized area, while developing a broad working knowledge of other areas of crop and soil sciences and related disciplines. In addition to Graduate School requirements and to the coursework and research or special problem, presentation of a seminar summarizing research findings is required at the completion of each graduate program. The average number of course credits, including graded courses and research credits, earned beyond the baccalaureate is 30 to 40 for master's students and 72-80 for PhD candidates.

Crop Science

CropS

- 503 Advanced Cropping Systems** 3 Prereq graduate standing. Understanding the management of constraints to crop production and quality; biological, physical, and chemical approaches to crop health management. Field trips required. Graduate level counterpart of CropS 403; additional requirements. Credit not granted for both CropS 403 and 503. Cooperative course taught by WSU, open to UI students. (PI Sc 512).
- 504 Plant Transmission Genetics** 3 Prereq GenCB 301. Transmission of genes across generations; detailed study of the basic laws of genetics to predict and describe inheritance. Cooperative course taught by WSU, open to UI students (PISc 507).
- 505 Advanced Classical and Molecular Genetics** 3 Prereq Bot 320 or BC/BP 364; CropS 445. Characterization and principles of improving crop quality and adaptation traits with emphasis on molecular breeding strategies. Cooperative course taught by WSU, open to UI students (PISc 515).
- 508 Advanced Crop Physiology I** 3 Prereq BC/BP 364. Physiological responses of crops to light, water and temperature; physiology of seed germination and root and shoot development. Cooperative course taught by WSU, open to UI students (PISc 508).
- 510 Seminar** 1 May be repeated for credit. Literature review; preparation and presentation of reports in crop science.
- 512 Topics in Crop Science** V 1-2 May be repeated for credit. Concepts of plant breeding, seed physiology, and technology; crop physiology and management.
- 513 Biology of Weeds** 3 Prereq Bot 320 Biology, ecology and physiology of weeds; crop and weed interaction and interference. Graduate level counterpart of CropS 413; additional requirements. Credit not granted for both CropS 413 and 513.
- 520 Plant Cytogenetic Techniques** 3 (1-6) Prereq GenCB 301. Plant genes and chromosomes. Cooperative course taught by the University of Idaho (PISc 520), open to WSU students.
- 527 Experimental Methods in Weed Science** 2 (1-3) Prereq Bot 320. Hands-on exposure to methods and instrumentation commonly used in weed science research; emphasis on laboratory techniques with herbicides. Cooperative course taught by WSU, open to UI students (PISc 527)).
- 533 Plant Tissue, Cell and Organ Culture** 3 (1-6) Same as Hort 533.

- 536 Plant Genetic Engineering Laboratory 2** (0-6) Prereq Bot 325. Experiments, synthesis and cloning of a gene, expression of a heterologous protein in yeast and barley. (SS)
- 539 Herbicide Fate and Mode of Action** 4 Prereq CropS 305, Bot 320, BC/BP 364. Fate of herbicides in plants, soil, and water; physiological and biochemical mode of herbicide action; mechanisms of herbicide resistance. Cooperative course taught jointly by WSU and UI (PISc 539).
- 546 Plant Breeding** 3 Prereq GenCB 301. Principles and practices of genetic plant improvement. Cooperative course taught by UI (PISc 546), open to WSU students.
- 547 Biometrics for Plant Scientists** 3 Prereq CropS 101 and Stat 212 Biometrical techniques in research with particular emphasis in designing, analyzing, and interpreting agricultural and biological experiments. Cooperative course taught by UI (PISc 547), open to WSU students.
- 556 Insecticides: Toxicology and Mode of Action** 1 Same as Entom 556.
- 557 Herbicides: Toxicology and Mode of Action** 1 Same as Entom 557.
- 558 Pesticide Topics** 1 Same as Entom 558.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis and/or Examination** Variable credit. S, F grading
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation and/or Examination** Variable credit. S, F grading.

Soil Science

Soil S

- 501 Seminar** 1 May be repeated for credit. Presentation of research information.
- 502 Advanced Topics in Soils** V 1-3 May be repeated for credit; cumulative maximum 6 hours. Interpretation, presentation, and discussion of current research on soils, uses, and management.
- 503 Advanced Soil Analysis** V 1-3 May be repeated for credit; cumulative maximum 6 hours. By interview only. Soil research techniques; application of modern instrumentation to soil analysis.
- 504 Research Presentation Techniques** 1 Preparation of visual aids and oral presentation of research findings. S, F grading.
- 505 Teaching Practicum** 1 May be repeated for credit; cumulative maximum 4 hours. Supervised experience in classroom teaching; classroom preparation for lectures, discussions, laboratories; preparation and grading of exams. S, F grading.
- 513 Models for Vadose Zone Transport** 2 Prereq Soils 413. Numerical methods and computer models for water, heat, vapor, and solute transport in soils; measuring spatial and temporal variability. Cooperative course taught by WSU, open to UI students (Soils 513).
- 514 Environmental Biophysics** 2 Physical environment of living organisms (temperature, humidity, radiation, wind); heat and mass exchange and balance in plant and animal systems. Graduate level counterpart of Soil S 414; additional requirements. Credit not granted for both Soil S 414 and 514. Cooperative course taught by WSU, open to UI students (Bot 435).
- 515 Environmental Biophysics Laboratory** 1 (0-3) Prereq Soil S 414 or c//. Experimental methods and procedures in environmental measurements; temperature, wind, radiation, and humidity measurements in biological environments. Graduate level counterpart of Soil S 415; additional requirements. Credit not granted for both Soil S 415 and 515.
- 517 Fate and Effects of Environmental Contaminants** 3 Same as ES/RP 517.
- 521 Environmental Soil Chemistry** 3 Soil constituents; soil solutions; mineral equilibria; absorption reactions; acid/base reactions; oxidation-reduction; soil contaminants. Graduate-level counterpart of Soil S 421; additional requirements. Credit not granted for both Soil S 421 and 521.
- 526 Soil Mineralogy** 2 (1-3) Prereq Soils 421 or 422; 454 or 551. Distribution and significance of soil minerals; weathering and reactivity of mineral structures; techniques of mineral identification; X-ray diffrac-

tion, chemical dissolution, optical and electron microscopy. Cooperative course taught by UI (Soils 526), open to WSU students.

- 531 Advanced Soil Biochemistry and Microbiology 2** May be repeated for credit; cumulative maximum 4 hours. Prereq Soils 421, 431; BC/BP 364. Biochemical and microbiological processes in soil-water environments; nutrient cycling; pesticide behavior; agricultural waste disposal; nitrogen fixation; advanced techniques. Cooperative course taught by WSU, open to UI students (Soils 531).
- 537 Soil Biochemistry 3** Prereq Micro 201; BC/BP 364; Soils 421. Enzyme activity; microbial activity/biomass; rhizosphere; carbon, nitrogen, phosphorus, sulfur, and micronutrient cycles. Cooperative course taught by UI (Soils 537).
- 541 Soil-Plant-Microbial Interactions 3** Prereq Soils 421, 431, or 441. Soil-plant microbial relationships to plant nutrition, plant health, and environmental cleanup; rhizosphere chemistry and microbial ecology. Cooperative course taught by WSU, open to UI students (Soils 541).
- 547 Soil Fertility Management 3** Prereq Soils 441. Philosophy of fertilizer recommendations based on soil and plant tissue testing. Principles of fertilizer manufacture, placement and use. Cooperative course taught by UI (Soils 547), open to WSU students.
- 551 Advanced Pedology 3** Prereq Soils 451. Origin and development of soil; geochemical and biochemical weathering processes; dynamics of organic matter; soil development cycles. Cooperative course taught by WSU, open to UI students (Soils 551).
- 557 Advanced Soil Genesis and Classification 3 (2-3)** Prereq Soils 451. Genesis, classification and interpretation of soils, including field investigation emphasizing existing interrelationships. Cooperative course taught by UI (Soils 557), open to WSU students.
- 562 Systems in Integrated Crop Management 3 (2-3)** Same as Entom 562. Credit not granted for both Soils 462 and 562.
- 574 Advanced Remote Sensing 3 (1-4)** Digital image processing theory and geographic information systems applied to landscape analysis. Cooperative course taught jointly by WSU and UI (For 572).
- 575 Seminar in Remote Sensing 1** Presentation of research results and ideas on subjects relating to remote sensing.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Economics

Degrees Granted: Master of Arts in Economics; Doctor of Philosophy

GRADUATE FACULTY

R. E. Rosenman, Chair; R. G. Batina, C. Clark, R. D. Fort, W. S. Hallagan, S. Y. He, F. S. Inaba, W. H. Joerding, J. Krautkraemer, D. E. Leigh, T. C. Lowinger, AKM Mahbub Morshed, M. T. Nziramasanga

The Department of Economics at Washington State University offers graduate programs leading to the degrees of Master of Arts in Economics and Doctor of Philosophy. Students are required to complete a broadly based, well-balanced program. The study of economic theory, mathematics, and statistics equips students for economics analysis as well as providing them with the fundamentals necessary for specialization in applied fields. Seven fields of study are offered: Mathematical and Quantitative Methods; Monetary and Public Economics; International and Development Economics; Health, Education, Labor, and Demographic Economics; Markets and Industrial Organization; Resource and Production Economics; and Financial Economics.

The Department of Economics offers a Ph.D. under a program that is coordinated with the Ph.D. offered by the Department of Agricultural and Resource Economics. It is taught by the faculty of both departments and from the Department of Finance, which fully participates as a partner in the program, although it offers its degree within the Business Ph.D. program. The coordinated Ph.D. program draws on the complementary

strengths of the Ag Econ and Econ departments in economic theory and quantitative research methods. Participation by the Department of Finance adds to the applied fields offered by the departments of Agricultural and Resource Economics and Economics. The doctoral degree is designed to prepare students for careers as professional economists. The core curriculum insures that each Ph.D. student in the joint program receives advanced training in economic theory and quantitative methods. Field courses assure that students receive additional preparation to apply economic theory and quantitative methods to real world problems in at least two areas of specialization. Total requirements for the Ph.D. degree include a minimum of 72 credits beyond the baccalaureate, including at least 37 credits of coursework from the core and field courses and 20 credits of doctoral research.

The core requirements include five courses in economic theory, one course in statistics for economists, and two courses in econometrics. Selections among field courses allow students to tailor their graduate program to specific interests and to interact with faculty working in their area. Advanced topics are taught in a variable-credit, repeatable topics course in each of these areas. Students must take a minimum of six credits in one field, a minimum of three credits in a second field, and a minimum of 12 credits overall in field courses. Beyond the core requirements, individual programs of study are determined jointly by the student and his/her doctoral committee. Coursework for the Ph.D. degree is usually completed within three years. Students who arrive at WSU with an MA in economics and transfer credit from a recognized graduate school may be able to complete the coursework in two years. The length of time required to complete the dissertation varies greatly but diligent students can complete the entire program, including the dissertation, in four to five years. The first year of study in the doctoral program is tightly structured. During the first year of the joint Ph.D. program, full-time students take four core theory courses as well as a core course in statistics for economists and one core econometrics course. Additional core courses are taken in the fall semester of the second year. Field courses are taken in the second and (possibly) third years.

The fourth, and generally a fifth, year of study is devoted to dissertation research. The doctoral student is expected to complete a dissertation proposal and pass a preliminary oral examination by the end of the seventh semester of study. A final oral examination is scheduled upon completion of the dissertation, with the approval of the dissertation committee. The time taken to complete the dissertation research and to write the dissertation varies widely. A few students have completed the degree in four years, most take five years, and some take longer. Courses in theory and econometrics, and 500-level courses in the student's fields of specialization are usually repeated at WSU. Graduate level field course work may be transferred to partly satisfy the "supporting fields or minor" requirement, subject to approval of the student's advisory committee. A core theory examination by the fourth semester, a preliminary examination on the thesis proposal, and final doctoral examination defending the thesis are required for the PhD.

Two master's degree options are offered in Economics. A degree with thesis provides specialization and research experience appropriate for a professional career in business or government, and for some staff positions with trade and professional organizations, labor unions and private research organizations. A non-thesis degree provides training for similar positions but includes a broader background of course work and a smaller research project. The non-thesis option can be tailored as an applied degree. Students with adequate preparation who start the program in the fall semester can generally expect to complete the master's degree in three semesters. A student with a teaching assistantship will need two years to complete the degree. Requirements for the degree with thesis include a minimum of 30 semester hours of graduate course work, including 6 hours in economic theory (Econ 500, 501) and 3 hours in econometrics (Econ 411 or 511), 6 hours in a field of specialization, 9 hours of electives (6 of which must be at the 500 level), and 6 hours of thesis credit. A maximum of 9 hours of course work outside the department is allowed. A maximum of 6 semester hours earned at recognized graduate schools may be transferred and applied, subject to the approval of the appropriate faculty. A comprehensive oral examination relating to thesis project is required for the master's thesis option.

Requirements for the non-thesis master's degree include a minimum of 30 semester hours of graduate coursework, including 6 hours of theory (Econ 500, 501), 3 hours of econometrics (Econ 411 or 511), 18 hours of electives (12 of which must be at the 500 level), and 4 hours of

research credit. A maximum of 10 hours of course work outside the department is allowed. A maximum of 8 semester hours earned at recognized graduate schools may be transferred and applied, subject to the approval of the appropriate faculty. Completion of a research project under the direction of a faculty member in the department and comprehensive oral examination relating to the research project.

Within the constructs of the non-thesis MA the department offers a Professional Masters Option that is intended to prepare graduates for positions in private corporations and government service. Examples of such positions include management specialist, policy or project analyst, forecaster, economic consultant, budget officers, and trade or labor specialists. The Professional Master's option is intended as a terminal degree rather than a stepping-stone to the Ph.D. in economics, although many of the courses would transfer as supporting work. In addition to providing a strong foundation in economic analysis, managerial economics and quantitative analysis, it provides a background in business topics so that graduates can communicate more effectively with business managers. The option is designed as a three-semester program, so self-financing students can minimize their costs. Some supporting work may be offered during summers, assuming sufficient demand, so that it may be possible to complete the Professional Master's option in one calendar year. Details for this program can be found on our website at <http://www.wsu.edu/~econdept/>

Applicants to any of the graduate programs in Economics must hold a bachelor's degree from an accredited 4-year institution and must have earned a 3.0 cumulative GPA (based on a 4.0 scale) over the final two years of their undergraduate work (or graduate work if applicable). Adequate scores on the Graduate Record Examination (GRE) are required, including a score on the quantitative segment of the GRE in the 60th percentile or better. Applicants must also have taken one semester of intermediate microeconomic theory and one semester of intermediate macroeconomic theory, and should have an adequate math background, including two semesters of calculus, one semester of linear algebra, and one semester of statistics.

Some 400 and all 500 level courses carry graduate credit. There are two "versions" of many of the 500-level field courses offering different subject matter. These courses may be repeated for additional credit. Econ 401 and 408 may not be applied to the graduate degree program.

Economics

Econ

- 500 Economic Theory I** 3 Prereq Econ 401, 408 Introduction to dynamics, growth and investment, overlapping generations models, Ramsey model, consumption and investment. Cooperative course taught by WSU, open to UI students (Econ 522).
- 501 Economic Theory II** 3 Prereq Econ 301, 408, one year calculus or c// in Econ 408. Microeconomic theory, multivariate optimization, consumer and producer theory, competitive partial equilibrium, introduction to imperfect competition.
- 502 Economic Theory III** 3 Prereq Econ 500. Macroeconomic theory, short-run fluctuations and nominal rigidities, monetary economics and inflation, real business cycle models, unemployment international macroeconomics.
- 503 Economic Theory IV** 3 Prereq Econ 501. General equilibrium, welfare economics and social choice, market failure, game theory, economics of information.
- 504 Economic Theory V** 3 Same as Ag Ec 504.
- 508 Microeconomic Analysis** 3 Prereq Econ 302. Masters level calculus-based producer and consumer theory with selected managerial economics topics. Cooperative course taught by WSU, open to UI students (Ag Ec/Econ 510).
- 510 Statistics for Economists** 4 Same as Ag Ec 510.
- 511 Econometrics I** 3 Prereq Econ 510. Single equation linear and nonlinear models; estimation, inference, finite and asymptotic properties, effects and mitigation of violations of classical assumptions.
- 512 Econometrics II** 3 Same as Ag Ec 512.
- 520 Seminar in Monetary Economics** 3 May be repeated for credit; cumulative maximum 6 hours. Prereq Econ 501, 502. Analysis of money demand models, money supply models, and the role of money in a modern economy.
- 530 Economic History** 3 May be repeated for credit; cumulative maximum 6 hours. Prereq Econ 411 or 511. Rec Econ 501. Changes in the American economy; introduction to the new economic history.

- 540 Advanced Public Finance** 3 May be repeated for credit; cumulative maximum 6 hours. Prereq Econ 503. Positive effects of government policy, optimal tax theory; public goods; social choice theory; cost-benefit analysis.
- 552 Labor Theory** 3 May be repeated for credit; cumulative maximum 6 hours. Developments in labor theory; wage theory and recent journal literature.
- 555 (592) Managerial Economics for Decision Making** 3 Prereq Econ 101, 102, Math 202. Optimal economic decision-making for business in a global environment. Not available for credit for economics graduate students.
- 560 Seminar in Industrial Organization** 3 May be repeated for credit; cumulative maximum 6 hours. Prereq Econ 460. Industrial organization, market conduct, and performance; appraisal of antitrust legislation.
- 570 International Factor Movement** 3 Prereq Econ 470, 501. The basic nonmonetary theory; new theories of international trade; tariffs and commercial policy; effects of economic integration; international movements factor.
- 571 Monetary Aspects of International Economics** 3 Prereq Econ 470, 500. Balance-of-payments; adjustment to payments imbalance; the foreign exchange market; open economy macroeconomic models and macroeconomic policy coordination, international monetary institutions.
- 572 Theoretical and Institutional Aspects of Economic Development** 3 May be repeated for credit; cumulative maximum 6 hours. Prereq Econ 500. Selected topics in the political economy of developing nations.
- 590 Advanced Topics in Mathematical and Quantitative Methods V** 1-6 Same as Ag Ec 590.
- 591 Advanced Topics in Monetary and Public Economics V** 1-6 May be repeated for credit; cumulative maximum 12 hours. Prereq Econ 500 and 501 or permission of instructor. Topics may include money supply monetary policy, public policy and analysis, taxations, externalities, public goods, public finance, open economy macroeconomics.
- 592 Advanced Topics in International and Development Economics V** 1-6 May be repeated for credit; cumulative maximum 12 hours. Prereq Econ 500 and 501 or permission of instructor. Topics may include international trade theory, trade policy, trade and environment, economic integration, open economies, economic development analysis.
- 593 Advanced Topics in Health, Education, Labor, and Demographic Economics V** 1-6 May be repeated for credit; cumulative maximum 12 hours. Prereq Econ 500 and 501 or permission of instructor. Topics may include labor analysis, human capital investment, personnel economics, health care markets, life and health risk valuation, immigration economics.
- 594 Advanced Topics in Markets and Industrial Organization V** 1-6 Same as Ag Ec 594.
- 595 Advanced Topics in Resource and Production Economics V** 1-6 Same as Ag Ec 595.
- 596 Advanced Topics in Financial Economics V** 1-6 Same as Fin 596.
- 599 (590) Special Topics in Economics** 3 Prereq graduate standing. May be repeated for credit; cumulative maximum 6 hours.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Education

Degrees Granted: Master of Arts in Education; Master of Education; Master in Teaching; Doctor of Philosophy (Education); Doctor of Education.

GRADUATE FACULTY

Educational Leadership and Counseling Psychology

P. Erdman, Chair; A. F. Barabasz, M. Barabasz, S. S. Bauman, J. Bel-ler, L. D. Bruya, A. T. Church, C. L. Claussen, S. M. Durrant, G. C. Furman, W. J. Heggins III, B. W. McNeill, F. W. Parkay, D. M. Pavel, D. B. Reed, M. S. Trevisan, D. A. Warner

Teaching and Learning

E. A. Helmstetter, Chair; T. Akmal, V. L. Akerson, S. R. Banks, A. E. Campbell, J. L. Egbert, G. Ernst-Slavit, S. Finley, P. Groves-Price, D. Gruenewald, M. Hayes, J. Kendall, M. D. Kleene, A. Laguardia, N. E. Marchand-Martella, G. H. Maring, R. Martella, L. Maybry, A. McDuffie, D. E. Miller, J. N. Mitchell, M. F. Roe, B. Romanish, R. D. Sawyer, D. Shinew, D. Slavitt, M. K. Swan, G. Tan, T. A. Young

Graduate programs in the College of Education offer advanced course work, field experience, and research preparation for leadership personnel in education and related human services areas. Several professional certification programs are available at the graduate level. Doctoral programs focus on preparation of educational administrators, counselors, teacher educators, and educational researchers. Graduate programs stress scholarship as a basis for all professional endeavors.

Educational Leadership and Counseling Psychology

This Department consists of the following programs:

Educational and Counseling Psychology Programs: The Master of Education and Master of Arts in Education, with specialization in school counseling, prepare persons to work as counselors in the public schools leading to initial certification as a school counselor in the State of Washington. The program consists of a minimum of 41 graded hours plus two supervised practicum experiences in school counseling and a written comprehensive examination. The Master of Arts also requires a thesis. The Department of Educational Leadership and Counseling Psychology at Washington State University participates with school districts in southeastern and central Washington in the WSU Professional Educational Advisory Board in Counseling, a body empowered by the State Superintendent of Public Instruction to recommend the granting of counselor certification. The Master of Arts and Master of Education degrees in agency counseling prepare students to function as counselors in community and educational settings. The Master of Arts requires a thesis. The Master of Education requires a comprehensive examination. These programs also prepare students for later doctoral work.

The Master of Education and Master of Arts in Education, with specialization in educational psychology, are appropriate degrees for individuals who intend to work as curriculum evaluators, child development specialists, or teachers of exceptional children. Several areas of concentration are offered within the educational psychology emphasis: measurement and evaluation, exceptionalities, child development, and general/predoctoral study. While all students at the master's level in the educational psychology specialization complete a common core of courses, a substantial portion of each master's degree program is composed of courses selected by the student and his/her advisor to tailor the program of study around the student's personal interests and professional aspirations.

The Doctor of Philosophy in Education, with a specialization in counseling, is designed to prepare graduates to function as counseling psychologists in diverse academic and service delivery settings. The doctoral specialization in counseling psychology is designed for full-time study and is accredited by the American Psychological Association. Courses are arranged in five areas: (a) professional core courses in counseling psychology; (b) supervised practica in counseling psychology; (c) courses in statistics, research design, and educational and psychological measurement; (d) courses in psychological foundations; and (e) selected electives in the student's chosen area of study.

The Doctor of Philosophy and Doctor of Education with specialization in educational psychology is intended for persons who desire to become university instructors, program evaluators, or directors of assessment programs in public school systems. Students may elect to concentrate

their studies in educational measurement and evaluation, or they may combine course work in the Department of Educational Leadership and Counseling Psychology with courses in the Department of Psychology and/or the Department of Human Development to emphasize general educational psychology. Each area of concentration requires a substantial component in statistics and research design.

The Department of Educational Leadership and Counseling Psychology provides course work leading to initial and continuing certification in school counseling in the State of Washington. The initial level training constitutes the Master of Arts and Master of Education. The continuing level program is coordinated by the University representative to the Washington State University Professional Educational Advisory Board in Counseling. These programs are individualized and include advanced training in such areas as supervision, group research methods, and professional problems, etc.

Admission to the graduate programs in the Department of Educational Leadership and Counseling Psychology is determined by past academic and professional record of achievement and scores on the Graduate Record Examination. Applicants must submit the following to the Program Coordinator: 1) a letter of application describing professional objectives, 2) a completed departmental application form, 3) scores on the Graduate Record Examination (Aptitude), 4) transcripts of all previous college work and, 5) three letters of recommendation from persons qualified to comment on the applicant's academic and professional abilities.

All programs in counseling consider applications for admission only once each year. Persons applying for admission must have the above materials to the Program Coordinator by February 1, in order to be considered for fall admission.

Master and doctoral programs are offered in the areas of Educational Leadership and Higher Education. Administrators, teachers, and other educational specialists may undertake graduate studies leading to advanced degrees at the master's or doctoral levels. For the master's and doctoral degrees, students may specialize in one of the following areas: administration, curriculum and instruction, higher education, student affairs in higher education or athletic administration. The master's degree programs require a minimum of 35 credit hours while the doctoral program requires a minimum of 72 credit hours. Each area of specialization has a required core of courses.

Information on the specific requirements for each degree is available from the Department of Educational Leadership and Counseling Psychology.

Admission to the graduate programs in Educational Leadership will be determined as soon as the departmental graduate application form, three letters of recommendation, GRE scores, and all transcripts of past academic work are received and evaluated, and the Departmental Recommendation Form is received from the Graduate School. Qualifications of students to continue in a program will be reviewed after the completion of nine hours of graded course work. There is a requirement of teaching or related experience for the Doctor of Education.

Graduate programs are offered which lead to the degree of Doctor of Education or the Doctor of Philosophy. Programs of study for the doctoral degree must include a common core of required courses plus a major emphasis in one area of specialization. A minor in a second area of specialization is required for the EdD. The following areas of specialization are approved: administration and curriculum and instruction. Each area of specialization requires a specific cluster of courses. The doctoral program may include courses outside the Department of Educational Leadership and Counseling Psychology or a cluster of supportive courses. Additional information is available from the Department.

Doctoral students will be considered for candidacy after they successfully complete the major portion of their coursework and pass a written comprehensive examination. A scholarly dissertation is required of all doctoral students.

A student pursuing a program leading to the Doctor of Philosophy degree is required to fulfill a research competency requirement.

The Master of Education degree program requires at least 35 semester hours of approved graduate credit of which 33 hours will be in graded coursework. Of the 33 hours, a minimum of 20 hours will be taken in the College of Education. Coursework above the 20 hours may be taken outside of the College of Education. In addition the program must include 2 semester hours of 702, which will consist of a final written examination. There is no final oral examination.

The Master of Arts in Education degree program is recommended for students who plan to continue work toward the doctoral level. A thesis is required for the degree, and the program and thesis topic are designed to advance the career goals and professional aspirations of the candidate.

The Department of Educational Leadership and Counseling Psychology offers certification programs for the initial and continuing certificates for the superintendency, principalship and program administrator. Candidates for administration certification must comply with the following requirements: (1) All candidates for certification must apply to the Graduate School and be formally admitted to the University as specified in the current University Graduate Bulletin. Admission will be considered after transcripts have been received from the institution which granted the baccalaureate degree as well as from institutions which have granted post-graduate credit. (2) All candidates for certification must submit an Application for Administrative Certification and three completed Administrative Reference Forms and the Certificate Checklist form. (3) Admission to a certification program is granted only after the WSU Professional Education Advisory Board reviews a complete application.

Superintendent and principal certification course work is also offered throughout the state of Washington at centers in Spokane, Tri-Cities, Vancouver, and internationally in the Far East as well as on the WSU campus in Pullman.

Counseling Psychology

CoPsy

- 501 Historical and Philosophical Foundations of Counseling Psychology** 3 Prereq admission to Counseling Psychology PhD program. History of counseling psychology; philosophical and psychological systems; current identity of counseling psychology as an academic discipline and a profession.
- 511 Theories, Research, and Techniques in Counseling Psychology I** 3 or 4 Philosophical assumptions, theory of personality, counseling process, techniques, and relevant research in the major theories of counseling and personality.
- 512 Theories, Research, and Techniques in Counseling Psychology II** V 3 or 4 Prereq CoPsy 511. Advanced study of process techniques and outcome research in the field of counseling and psychotherapy; nonspecific process skills are presented and integrated into specific, empirically validated interventions.
- 513 Career Development** 3 or 4 Theories, concepts, methods, and findings in career development; vocational assessment and prediction, career counseling intervention outcomes.
- 515 Ethics and Professional Problems in Counseling Psychology** 4 Professional problems; ethical, legal, and training issues; professional practices, and new professional issues.
- 518 Theoretical Foundations of Group Counseling** 3 Prereq CoPsy 512 or c//. History, philosophy and theoretical foundations; the group counselor, members, and issues in group counseling.
- 522 Introduction to Family Counseling** 3 Counseling in the family context; intervention strategies, theoretical models, and professional ethics and issues.
- 523 Topics in Counseling Psychology** V 1-4 May be repeated for credit; cumulative maximum 8 hours. Recent research, developments, issues, and/or applications in selected areas of counseling psychology.
- 525 Counseling Diverse Populations** Prereq CoPsy 512. Research and theories regarding the influence of culture, gender, and lifestyle on counseling processes; applications of appropriate assessment/treatment strategies.
- 527 Individual Appraisal I** 3 or 4 Prereq EdPsy 508, 509. Theoretical background and practical skills needed to administer, score, and interpret individual intelligence and structured personality tests; integration of nontest data.
- 528 Individual Appraisal II** 4 Prereq CoPsy 527. Theoretical and empirical bases, psychometric properties, administration, scoring, and interpretation of major projective techniques; emphasis on Rorschach and TAT.
- 529 Counselor Supervision: Theory, Research, and Practice** 3 or 4 Prereq admission to Counseling Psychology Ph.D. program. Survey of major theoretical approaches, techniques, and research in models of counselor supervision and training.
- 531 Current Issues in School Counseling** 3 Prereq CoPsy 512, 518. Issues of immediate concern to school counselors: drug abuse, family violence, adolescent suicide, sexual orientations, crisis intervention, consultation and referral.
- 532 Current Issues in School Counseling II** 3 Prereq CoPsy 531. Additional coverage of contemporary issues of concern to school counselors; comprehensive developmental school programs, school community dynamics, parental involvement, consultation.
- 533 Master's Internship in Agency Counseling** V 4-8 May be repeated for credit; cumulative maximum 8 hours. Prereq CoPsy 512; 513; 515; 527 or c//; or by interview. Supervised experience in the application of counseling theory and techniques in an agency setting. S, F grading.
- 534 Study Skills and Content Area Instruction** 2 or 3 Same as T & L 534.
- 535 Master's Internship in School Counseling** V 4-8 May be repeated for credit; cumulative maximum 8 hours. Prereq CoPsy 512, 513, 518; 515 or c//, 527 or c//; or by interview. Supervised experience in the application of guidance and counseling theory and techniques in a school setting. S, F grading.
- 537 Professional Development in Counseling Psychology** 3 NBCC requirements; growth and development, social and cultural foundations, the helping relationship, group dynamics, career, appraisal and research.
- 541 Clinical and Experimental Hypnosis Seminar** 4 Prereq Ph.D. student in counseling, educational, experimental, or clinical psychology. Clinical and experimental hypnosis, emphasizing applied research and clinical methods.
- 542 Cross-Cultural Research in Counseling and Assessment** 4 Cross-cultural research methods, concepts, and findings in counseling and assessment.
- 551 Doctoral Practicum in Counseling Psychology I** 4 (2-6) Prereq CoPsy 512, 513, 515, by interview only. Supervised experiences in the application of counseling psychology theory and techniques. S, F grading.
- 552 Doctoral Practicum in Counseling Psychology II** 4 (2-6) Prereq CoPsy 551, by interview only. Supervised experiences in the application of counseling psychology theory and techniques. S, F grading.
- 553 Doctoral Practicum in Counseling Psychology III** V 2 (1-3) to 4 (2-6) May be repeated for credit; cumulative maximum 12 hours. Prereq CoPsy 552, by interview only. Supervised experiences in the application of counseling psychology theory and techniques. S, F grading.
- 557 Chicano/Latino Psychology** 3 Graduate level counterpart of CAC 457; additional requirements. Credit not granted for both CAC 457 and CoPsy 557.
- 561 Continuing Counseling ESA Certification** V 3-6 May be repeated for credit; cumulative maximum 6 hours. Prereq Initial Counselor Certification; equivalent of 180 full days of school counselor experience. Peer review requirements for continuing level ESA Counselor Certification.
- 562 Advanced Hypnosis and Therapy** 4 Prereq CoPsy 512 or equivalent, or permission of instructor. Advanced training emphasizing mind-body therapies and primary health care including hypnosis, biofeedback, and ego-state therapy.
- 578 Career Services and Programs for Persons with Disabilities** 3 Career development concepts, services, and programs for the disabled with an emphasis on interagency collaboration with the public schools. Credit not granted for both CoPsy 478 and 578.
- 590 Seminar in Research in Counseling Psychology** 4 By interview only. Recent developments in counseling psychology research and design applied to PhD dissertation proposals. S, F grading.
- 597 Counseling Psychology Internship** V 2-4 May be repeated for credit; cumulative maximum 8 hours. Supervised internship experience, individual and group counseling, evaluation, assessment, supervision, and teaching. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Educational Administration

Ed Ad

- 501 Philosophy of Education** 3 Development of American educational philosophy.
- 503 Values and Ethics for Educational Leaders** 3 Study of ethical theories, the moral dilemmas of public schooling, and the skills of ethical reasoning; professional code of ethics.
- 506 Social Context of Education** 2 The interpretation of social context issues including historical, legal and cultural factors as these influence policies and practice in education.
- 507 Social Foundations of Education** 3 Educational adaptations to the economic and social trends and forces.
- 510 Improvement of Instruction** 3 Rec teaching experience. Analysis and evaluation of instructional models with emphasis on information processing; implications for changing teaching style.
- 511 Models of Teaching** 2 Theoretical models and strategies of teaching in classrooms; relationships between specific models and curriculum priorities.
- 514 Basic Principles of Curriculum Design** 2 or 3 Rec teaching experience. The application of theoretical concepts and approaches in the planning and design of curricula.
- 515 Curriculum Implementation** 3 Rec teaching experience. Research and practice; innovation and change in curricular organization emphasizing implementation.
- 516 Instructional and Curricular Leadership** 2 or 3 Rec teaching experience. Theory, research, and practice of providing instructional and curricular leadership in schools and other educational settings.
- 517 In-Service Programs** 3 Research, theory, and practice in staff development in K-12, higher education, and non-school settings. For administrators, teachers, and other staff.
- 518 Educational Technology** 3 Rec T & L 445 or 446. Relates research and theory of communication to instructional resources and current educational technology; problems of planning and administering programs.
- 520 Seminar in Curriculum and Instruction** 2 or 3 Rec teaching experience. Contemporary issues, analyses, and developments of educational programs.
- 521 Doctoral Dissertation Preparation** 3 Seminar to assist graduate students in research proposal writing, dissertation preparation, and scholarly publications.
- 522 Topics in Education** V 1-4 May be repeated for credit; cumulative maximum 6 hours. Recent research, developments, issues, and/or applications in selected areas of education.
- 530 Special Topics May be repeated for credit; cumulative maximum** 3 hours. Topical issues in education responding to shifting demands and skills needed by parents, teachers, school administrators and community leaders.
- 531 Special Topics** 1 May be repeated for credit; cumulative maximum 3 hours. Topical issues in education responding to shifting demands and skills needed by parents, teachers, school administrators and community leaders.
- 532 Special Topics** 1 May be repeated for credit; cumulative maximum 3 hours. Topical issues in education responding to shifting demands and skills needed by parents, teachers, school administrators and community leaders.
- 533 Special Topics** 1 May be repeated for credit; cumulative maximum 3 hours. Topical issues in education responding to shifting demands and skills needed by parents, teachers, school administrators and community leaders.
- 534 Special Topics** 1 May be repeated for credit; cumulative maximum 3 hours. Topical issues in education responding to shifting demands and skills needed by parents, teachers, school administrators and community leaders.
- 535 Special Topics** 1 May be repeated for credit; cumulative maximum 3 hours. Topical issues in education responding to shifting demands and skills needed by parents, teachers, school administrators and community leaders.
- 536 Introduction to Qualitative Research in Education** 3 Introduction to the theory and methods of qualitative research; field relations, da-

ta collections, data analysis, hypothesis development, and theory generation.

- 537 Advanced Qualitative Research in Education** 3 Prereq Ed Ad 536. Advanced theory and methods of qualitative research; theoretical foundations, data collection and analysis, and reporting.
- 538 Special Topics in Qualitative Research in Education** V 1-3 Prereq Ed Ad 536. May be repeated for credit; cumulative maximum 6 hours.
- 540 Current Issues in Sports** 3 Current issues and problems in sports, and their effect on the administration of sport programs.
- 560 Student Personnel Services in Higher Education** 2 or 3 Philosophy, structure, functions, and organization of student personnel services.
- 561 Student Development Theory, Research, and Application** 3 Student development theory, related research and the application of theory to practice in student affairs work.
- 562 Professional Problems in Student Affairs** 3 Prereq Ed Ad 560, 561. The organization, programs and professional issues related to selected student affairs programs and units.
- 563 Models of College Student Social Identity** 3 Prereq Ed Ad 561. Critique and understand college social identity models as they relate to teaching, advising, and working with diverse student populations.
- 564 Seminar in Student Affairs** 3 Prereq graduate standing. Contemporary issues, analyses, and development of student affairs programs and institutions.
- 565 Master's Practicum in Student Affairs** 3 (0-9) Prereq graduate student with 15 hours of completed course work in education. Selected supervised experiences in professional student affairs settings which provide for the investigation/application of theory/methods gained through formal course work.
- 567 Organizational leadership of Multicultural Change** 3 Prereq graduate standing. Reflection on experience and examination of the theory of practice of organizational leadership in the context of diversity.
- 568 Finance and Budgeting in Higher Education** 3 Prereq undergraduate macro and microeconomics or by permission of instructor, graduate standing. Exposes students to the fundamentals of higher education budgeting and finance.
- 570 Community and Technical Colleges** 3 For teachers and administrators. Development and function of community and technical colleges.
- 571 Undergraduate and Community Technical College Teaching** 3 Rec Ed Ad 570 or 572. Concepts, principles, issues, and procedures in undergraduate curriculum development; goal oriented educational strategies and delivery systems.
- 572 The American College and University** 3 History, philosophy, objectives, and issues of colleges and universities as social institutions.
- 573 Issues in Higher Education** 3 Selected contemporary issues in higher education.
- 574 Finance and Budget in Higher Education** V 1-3 May be repeated for credit; cumulative maximum 6 hours. Contemporary issues, analyses and developments of higher education programs and institutions.
- 575 Administrative Concepts for Physical Education, Sport and Athletics** 3 Administration focusing on democratic human behavior in organizations with specific attention to the leader, the setting, and the process.
- 576 Promotions and Management of Sport Programs** 3 Public relation, promotions, assessment and fiscal management of sport programs.
- 577 Sport Law** 3 Graduate level counterpart of SpMgt 477; additional requirements. Credit not allowed for both SpMgt 477 and Ed Ad 577.
- 578 Higher Education and Ethics** 3 Legal and ethical aspects of higher education with special reference to administrators, faculty, and students in higher education institutions.
- 579 Administration of Higher Education** 3 Organization, administration, and leadership of universities, colleges, and community colleges.
- 580 School Organization and Administration** 3 Rec teaching experience. Readings and discussions on the theories and practices of

school organization and administration. Cooperative course taught jointly by WSU and UI (Educ 509)

- 581 Politics in Education** 4 Prereq graduate standing. Examining the intrapersonal, organizational politics and political dilemma particularly as they pertain to marginalized groups.
- 582 Policy Formation and Analysis in Education** 3 Political and organizational policy formation processes in educational organizations; policy analysis in education.
- 583 Community and Communications** 3 Social, political, and economic relationships between education and the community; methods of public polling and campaign strategy techniques.
- 584 Human Resource Management** 3 Human relations in education; problems involved and practical solutions considered.
- 585 Financial Management in Education** 3 Economics and financing of education; financial planning, budget development, investment analysis, bonding, cost effectiveness; current trends in educational finance. Cooperative course taught jointly by WSU and UI (EdAd 535).
- 586 Management of Facility Planning** 3 Principles and procedures in the development of educational specifications, conducting needs assessment, forecasting; selecting an architect.
- 587 Seminar in School Administration** V 1-6 May be repeated for credit; cumulative maximum 6 hours. Interdisciplinary seminars; related studies; discussions in several areas by specialists.
- 588 The Law and Education** 3 Fundamental legal principles within which public education functions; applicable school codes of Washington and other states; review important court cases.
- 589 Leadership Development Seminar** 3 Improving knowledge and skills in strategic planning, decision making, leadership issues, conflict, motivation, staff development, productivity, and stress.
- 590 Internship** 3 or 6 May be repeated for credit; cumulative maximum 12 hours. By interview only. Internship in professional positions. S, F grading.
- 594 Educational Internship** V 2-9 May be repeated for credit; cumulative maximum 9 hours. Same as KIN 594.
- 596 Preparing Grant Proposals** 3 Identification of funding sources; analysis, evaluation, and production of grant proposals.
- 599 Superintendent Institute** 1 May be repeated for credit; cumulative maximum 4 hours. By interview only. Current concepts and practices in the superintendency; policy, planning and implementation techniques. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Educational Psychology

EdPsy

- 501 Scholarly Analysis and Writing for Educators** 3 Prereq graduate standing. Develop advanced information literacy to identify information resources; critically analyze education research; analyze and construct oral and written scholarly arguments.
- 502 Theoretical Foundations of Learning and Instruction** 3 Historical and contemporary theories of learning and instruction; application of theory in counseling and teaching settings.
- 503 Advanced Educational Psychology** 2 Theories of learning and development as applied to education.
- 504 Classroom-Focused Research Methods** 2 Methods, design, implementation, and application of results in classroom context.
- 505 Research Methods I** 3 Research methods; literature review, design, implementation, and interpretation of results.
- 508 Educational Statistics** 4 Descriptive statistics: central tendency, variability, correlations, and regressions; introduction of tests of significance; reporting and interpreting educational research data. Cooperative course taught jointly by WSU and UI (EdAd 507).
- 509 Educational Measurements: Test Development and Assessment** 2 or 3 Rec EdPsy 508. Theory and use of standardized educational measurement instruments; intelligence, aptitude, and achievement tests; measurement of outcomes.

511 Large Scale Educational Assessment and Testing 3 Prereq EdPsy 508, 509. Large-scale educational assessment and test development and evaluation; history and policy uses of achievement tests.

510 Assessment of Learning 3 Prereq graduate standing. Assessment of student learning, school and district evaluation; particularly appropriate for school administrators.

519 Practicum in College Instruction 1 (0-3) May be repeated for credit; cumulative maximum 4 hours. By interview only. Supervised experience in college teaching. S, F grading.

521 Topics in Educational Psychology V 1-4 May be repeated for credit; cumulative maximum 6 hours. Recent research, developments, issues, and/or applications in selected areas of educational psychology.

565 Advanced Educational Statistics 3 Prereq EdPsy 508 Applications of inferential statistics in educational research and evaluation.

568 Research Methods II 3 Prereq EdPsy 505, 565. Integration and application of research skills in writing proposals, dissertations, papers for publication; interpreting, critiquing, and synthesizing research studies.

569 Seminar in Quantitative Techniques in Education 2 or 3 May be repeated for credit; cumulative maximum 6 hours. Prereq EdPsy 565. Application of parametric and non-parametric statistics, data processing using computer packages in educational research.

570 Introduction to Program Evaluation 3 Prereq EdPsy 505. Introduction to strategies and techniques for evaluation of educational and social programs.

571 Advanced Program Evaluation 3 Prereq EdPsy 570. Advanced methods and techniques of program evaluation.

597 Educational Psychology Internship V 2-4 May be repeated for credit; cumulative maximum 8 hours. Supervised internship experience in educational psychology, measurement and evaluation. S, F grading.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis, and/or Examination Variable credit. S, F grading.

702 Master's Special Problems, Directed Study, and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Kinesiology

Kin

501 Trends and Issues in Kinesiology 3 May be repeated for credit; cumulative maximum 6 hours. Exploration of trends and issues in kinesiology.

551 Assessment and Evaluation of Motor Dysfunction 3 Principles of assessment/evaluation of motor dysfunction; tools and techniques; administration, interpretation and translation into program plans. Cooperative course taught by WSU, open to UI students (PE 551).

552 Neurological Impairment and Motor Behavior 3 Neurophysiological components of normal and abnormal motor behavior as a result of neurological impairments/dysfunction in children through the aged. Cooperative course taught by WSU, open to UI students (PE 552).

553 Programming in Adapted Physical Activity Programming 3 Intensive experiences in planning and implementing physical activity programs to include disabled individuals in urban, rural, integrated and segregated settings. Cooperative course taught by WSU, open to UI students (PE 553).

554 Sport and Individuals with Disabilities 3 Issues and opportunities in sport for individual disabilities. (SS) Cooperative course taught by WSU, open to UI students (PE 554).

560 Epidemiology, Exercise and Health 3 Prereq graduate standing. Epidemiological approach to the study of health benefits/risks of exercise in youth, adults, women and ethnic groups.

562 Pediatric Exercise Physiology 3 (2-3) Prereq Kin 463. Influences of physical exercise on immune response and consequent impact on host susceptibility to disease and infection.

564 Mechanical Analysis of Motor Activity 3 Prereq Kin 362 Fundamental laws of mechanics applied to motor activities. Cooperative course taught by WSU, open to UI students (PE 564).

- 566 Biomechanics** 3 Prereq Kin 564. Biological and mechanical aspects of human movement. Cooperative course taught by WSU, open to UI students (PE 566).
- 573 Philosophical Perspectives of Sport and Physical Activity** 3 Ontological, ethical, aesthetic views of physical activity. (a/y)
- 574 Social and Cultural Issues of Physical Activity and Sport** 3 Exploration, analysis, and understanding of human movement in the context of the individual, cultural, and physical environments.
- 578 Sports in Society** 3 The social significance of sports; sociology of sport research. (a/y)
- 579 Psychology and Physical Activity** 3 Current research findings in psychology pertinent to the teaching and coaching of physical activities.
- 581 Concepts Analysis of Motor Skill Performance** 3 (2-3) Application of motor learning concepts to the observation and analysis of motor skill performance.
- 582 Observation and Analysis of Teaching Physical Activity** 3 (2-3) Systematic approach to observation/analysis of teaching physical activity; evaluation of instructional process.
- 583 Teaching Strategies in Physical Activity** 3 Research, materials and methods related to effective teaching in physical education.
- 585 Curriculum Development in K-12 Physical Education** 3 Principles of curriculum construction and the process of curriculum development. Cooperative course taught by WSU and UI (PE 544).
- 586 Methods of Health and Physical Education** 2 Physical activity and health promotion for school programs K-8.
- 591 Motor Learning** 3 Learning theory, learning models, and experimental evidence related to learning of perceptual-motor skills.
- 592 Perceptual-Motor Development** 3 Physical growth and perceptual-motor development. (a/y)
- 594 Educational Internship** V 2-9 May be repeated for credit; cumulative maximum 9 hours. Internship in educational setting; direct participation in tasks, research, planning, activity controlling and reporting. S, F grading.
- 597 College Teaching: Physical Education** 1 (0-3) By interview only. May be repeated for credit; cumulative maximum 4 hours. Supervised experience in college teaching. S, F grading.
- 598 Methods of Research** 3 Application of the scientific approach to research in physical education, sport and leisure.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Teaching and Learning

The Department of Teaching and Learning offers the Master of Arts, Master of Education, and Master In Teaching degree as well as the Doctor of Philosophy and Doctor of Education degrees.

For the Master of Education or Master of Arts in Education, students may specialize in one of the following areas: elementary education, secondary education, diverse learners or literacy education. The Master of Arts degree is a thesis or special project degree. The thesis option emphasizes research and is primarily for those planning to pursue doctoral studies. The special project option is practitioner-research focused. The Master of Arts program requires a minimum of 30 semester credit hours, including the thesis or special project. The Master of Education is a practitioner's degree which requires 33 semester credit hours of graded course work plus 2 credits consisting of a final written examination for a total program of 35 credits. Each area of specialization has a required core of courses. The Master In Teaching is a 51 semester hour degree leading to teacher certification. Information on the specific requirements for each degree and specialization is available from the Department of Teaching and Learning.

The Department offers doctoral programs for individuals interested in college and university faculty and research positions, and for those seeking leadership positions such as curriculum directors and specialists in K-12 school districts. The Doctor of Philosophy degree focuses on research with course work and supervised research experience integrated throughout the student's graduate program. Major emphasis is in an area of specialization with a supporting cognate study. The Doctor of Education degree includes a core of required courses as well as an area of specialization and a minor. Both degrees require a minimum of 72 semester hours beyond the baccalaureate. Additional information re-

garding these programs is available from the Department of Teaching and Learning.

Students wishing to be admitted to the graduate programs must satisfy the minimum requirements of the Graduate School and the College of Education. Verbal and quantitative scores of the Graduate Record Exam General Test must be submitted along with application forms and transcripts. Doctoral students must submit three letters of recommendation from persons who can evaluate the applicant's professional work and potential for success in advanced study.

Teaching and Learning

T & L

- 501 Practicum in Bilingual Education /ESL** 3 May be repeated for credit; cumulative maximum 6 hours. Prereq one course in bilingual/ESL or by interview only. Work with students from diverse linguistic and cultural backgrounds in educational settings.
- 502 Assessment for Teaching and Learning** V 1-3 Designed to provide instruction in sound assessment practices for preservice and inservice graduate students.
- 503 Topics in Developing Literacy in Bilingual Education** 3 Compare and contrast first and second language development with implications for emergent literacy.
- 504 Early Childhood Programs for Children at Risk** 1 (1-0) Identification of children at risk; their needs, appropriate curriculum, and program evaluation; description of parent-teacher community relationship and outreach.
- 505 ESL Methods for General Educators** 2 For preservice general education K-12 teachers addressing researched-based ESL strategies and methods.
- 506 Multicultural Classroom Instruction and Management** 4 Instructional and management strategies for maximizing students' opportunities to learn in a multicultural setting.
- 507 Developing Literacy in a Multicultural Setting I** 3 Theoretical foundations of language arts in a multicultural setting.
- 508 Teaching Literacy in a Multicultural Setting II** 3 Prereq T & L 507. Applying research-based assumptions to teaching language arts in a multicultural setting.
- 509 Research in Curriculum and Assessment for Bilingual ESL Education** 3 Prereq T & L 510 or 514; graduate standing. Research in curriculum development for and assessment of language minority students.
- 510 Theoretical Foundations of Bilingual/ESL Education** 3 Theoretical foundations related to research and instructional strategies for effective schooling of language minority students. Credit not granted for both T & L 410 and 510.
- 511 Teaching Poetry to Children and Young People** 3 Prereq T & L 303 or 307 or teaching experience. Elements and forms of poetry for children and young people; selection and utilization in the school curriculum.
- 512 Language and Cultural Factors in Mathematics** 3 Prereq T & L 352 or teaching experience. Research and instructional strategies related to linguistic and cultural influences on learning math. Credit not granted for both T & L 412 and 512.
- 513 Seminar in Middle School Education** 3 Prereq teaching experience. Curriculum patterns and recent research regarding instruction and materials in the contemporary middle school.
- 514 ESL Across Content Areas** 3 Research and instructional methods related to English language acquisition across content areas. Credit not granted for both T & L 414 and 514.
- 515 The Education of Language Minority Students** 2 Prereq K-12 teaching experience. Issues in the education of language minority students.
- 516 Advanced Study in Computer-Assisted Language Learning** 3 Prereq T & L 510 or 549 or permission of instructor; graduate standing. Research, theory, and practice in computer-assisted language learning.
- 518 Integrating Technology Into The Curriculum** 3 Examination and articulation of the potential for new technologies to expand learning opportunities.
- 519 Instructional Media production I** 3 Instructional media development, emphasizing the theory and methods of instructional design, digital media production and evaluation.

- 520 Topics in Special Student Populations V** 1-4 May be repeated for credit; cumulative maximum 6 hours. Knowledge of special student populations and guidance in developing appropriate curricula. Co-operative course taught jointly by WSU and UI (EDTE 504).
- 521 Topics in Education V** 1-4 May be repeated for credit; cumulative maximum 6 hours. Recent research, developments, issues, and/or applications in selected areas of education.
- 522 Topics in Education V** 1-3 May be repeated for credit; cumulative maximum 6 hours. Recent research, development, issues, and/or applications in selected areas of education.
- 523 Topics in Education V** 1-3 May be repeated for credit; cumulative maximum 6 hours. Recent research, development, issues, and/or applications in selected areas of education.
- 524 Topics in Education V** 1-3 May be repeated for credit; cumulative maximum 6 hours. Recent research, development, issues, and/or applications in selected areas of education.
- 525 Classroom Management Seminar** 2 or 3 Contemporary issues in management of elementary, middle school, and secondary classrooms.
- 526 Research in Multicultural Education** 3 Prereq T & L 515 or teaching experience. Research and instructional practices focusing on multicultural education.
- 527 Seminar in Teacher Education Instruction** 1 May be repeated for credit; cumulative maximum 4 hours. Teacher preparation program components and rationale, university teaching strategies, and evaluation methods. S, F grading.
- 528 Content Area Reading Instruction: Theory and Practice** 3 For teachers, supervisors, and administrators in elementary, middle, and secondary schools; influence of research on the design of reading strategies.
- 530 Innovations in Reading** 2 Aspects of teaching reading beyond basic methods course; individual diagnosis; current programs and trends; activities and materials for enrichment. Credit not granted for both T & L 430 and 530.
- 532 Children's Literature in the Curriculum** 2 Prereq T & L 320 or teaching experience. Theory and classroom applications for selecting and using literature and storytelling in content areas; reading, writing, language development, the arts. Credit not granted for both T & L 432/433 and 532.
- 534 Study Skills and Content Area Instruction** 2 or 3 Research and practices related to time management, concentration and memory, note-taking, listening, comprehension and thinking skills; applications in subject-matter instruction.
- 537 Seminar in Language, Literacy, and Culture** 2 or 3 Prereq graduate standing, T & L 411. Interrelationships between schools, literacy, and student cultural background.
- 538 Writing Across the Curriculum** 3 Writing for learning at grade levels K-12.
- 539 Innovations in Language Arts** 3 Prereq T & L 303 or 320 or teaching experience. The most recent developments in language arts instruction for pre-service and in-service teachers K-12.
- 540 Elementary School Social Studies** 3 Prereq teaching experience. Elementary structures of various social sciences; research findings related to instruction; classroom applications and materials.
- 541 Professional Assessment Seminar V** 1-3 May be repeated for credit; cumulative maximum 6 hours. Prereq admission to PCP. Focus on knowledge and skills in educational research to assess professional practice.
- 542 Professional Education Seminar V** 1-3 May be repeated for credit; cumulative maximum of 6 hours. Analysis of contemporary and/or classic educational issues.
- 543 Advanced Professional Education Seminar V** 1-3 May be repeated for credit; cumulative maximum 6 hours. Prereq admission to PCP; T & L 541. Provides professional educators opportunities to complete portfolio of subject matter knowledge and skills and analyze research.
- 544 Advanced Children's Literature** 3 Prereq T & L 307; teaching experience. Trends, issues, and research in children's literature.
- 545 Oral Language Development: Roots of Literacy** 3 Prereq teaching experience. Research on children's oral language development; applications to elementary school reading and writing.
- 546 Teaching Written Expression in Elementary School** 3 Prereq teaching experience. Research on children's written language development; application to elementary school classroom.
- 547 Teaching Folk Literature to Children and Adolescents** 3 Prereq T & L 307 or teaching experience. Folk literature as a genre in child and adolescent literature; curriculum applications; reading, language development, social studies, creative expression.
- 548 Teaching Adolescent Literature** 3 Prereq T & L 307 or teaching experience. Evaluating, selecting, and using literature for middle school and teenage students.
- 549 Communicating in a Multilingual Society** 3 Prereq T & L 333, 335 or graduate standing. Study of language in social and educational contexts and its relation to cultural and linguistic diversity.
- 551 Psychology of Reading** 2 or 3 Prereq T & L 320 or 450/451; teaching experience. Psychological, perceptual, motivational, developmental and physiological aspects of reading.
- 552 Literacy Development I** 3 Review of current research and approaches to instruction in the development of literacy in elementary and middle grades.
- 553 Diagnosis and Treatment of Reading Disabilities** 4(3-3) Prereq T & L 320/321 or 450/451. Remedial techniques for experienced teachers, remedial reading teachers, and reading consultants; causes of disability, testing, diagnosis, and remediation; tutoring.
- 554 Elementary School Reading** 2 Theory and strategies of teaching reading in elementary school.
- 555 Seminar in Literacy Development** 3 May be repeated for credit; cumulative maximum 6 hours. Current and historical research in reading/language arts, infancy through college and adult years; papers presented by faculty, invited speakers, and students.
- 556 Literacy Development II** 3 Review of current research and approaches to instruction in the development of literacy in elementary and middle grades.
- 557 Research in Reading** 2 or 3 Prereq T & L 551; EdPsy 505; teaching experience. Reading research, theoretical and applied, related to the teaching of reading.
- 558 Improving Comprehension Through Literature** 3 Prereq teaching experience. Key theoretical concepts and their implications for improved comprehension instruction, using children's literature.
- 560 Research in Teaching** 3 May be repeated for credit; cumulative maximum 6 hrs. Prereq teaching experience. Recent developments in research on teaching; both quantitative and qualitative research methodologies emphasized.
- 561 Elementary School Mathematics** 3 Prereq T & L 352; Math 252; teaching experience. Research on curriculum and instruction issues in elementary school mathematics.
- 562 Secondary School Mathematics** 3 Prereq EdPsy 301; teaching experience. Research on curriculum and instruction issues in secondary school mathematics.
- 563 Seminar in Precollege Mathematics Education** 3 Prereq T & L 542 or 562. May be repeated for credit; cumulative maximum 6 hours. Research on curriculum and instruction in mathematics education in grades K-12.
- 564 Elementary School Mathematics Methods** 3 Introduction to research, theory, and methods of teaching K-8 mathematics; emphasis on integrating theory and practice.
- 571 Elementary School Science** 3 Prereq T & L 371; teaching experience. Theories and research underlying science programs with classroom implications.
- 572 Elementary School Science Methods** 3 Theoretical base to design and implement appropriate standards-based elementary science instruction.
- 573 Children's Literature and Hands-On Science** 3 Prereq graduate standing. Students learn how to bring together language arts and science curricula to instill in children a curiosity about the world around them.
- 574 Science for All: An Individual and Multicultural Perspective** 3 Prereq teaching experience. Implications of cultural and individual diversity for understanding western scientific and mathematical thought; an activity-based, educational perspective.
- 577 The At-Risk Learner** 2 Strategies for working with at-risk students.
- 578 School and Community Interventions for At-Risk Students** 2 How schools and communities work together to meet the at-risk challenge.

- 580 Multicultural Education in a Global Society** 3 Examination of multicultural and multilingual education from a global perspective; development of multicultural curriculum. Credit not granted for both T & L 480 and 580.
- 582 Multicultural and Global Perspectives in Education** 2 Concepts, theories and applications of multicultural and global perspectives in teaching and learning. Credit not granted for more than one of T & L 480, 580, 582.
- 583 Problem Solving in Elementary and Middle Level Education** 3 Prereq admission to MIT program. Integration of knowledge and skills to address complex cases in teaching and learning.
- 586 Issues in At-Risk Education** 2 or 3 School and community resources to assist at-risk students and families.
- 588 Action Research: Teachers as Researchers** 3 Prereq teaching experience. Theoretical concepts, research, issues, models, and strategies for implementation of action research.
- 590 Internship** V 2-6 May be repeated for credit; cumulative maximum 12 hours. By interview only. Internship in professional positions. S, F grading.
- 593 Pre-Internship and Seminar** 2 (1-3) Instructional practice in diverse classroom settings and reflection on that practice. S, F grading.
- 594 Art and Music Education** 2 Instruction covering the theory and classroom practice of art and music.
- 595 Internship and Seminar** 10 (1-27) Instructional practice in classroom settings and reflection on practice. S, F grading.
- 597 Topics in In-Service Education** V 1-3 May be repeated for credit; cumulative maximum 9 hours. New developments and applications on selected in-service and staff development topics. Credit not granted for both T&L 497 and 597.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Special Education

Sp Ed

- 501 Teaching Students with Disabilities** 3 Prereq c// in Sp Ed 590 for 2 credits. Credit not granted for both Sp Ed 401 and 501. Additional requirements.
- 502 Assessment and Curriculum for Students with Disabilities** 4 Credit not granted for both Sp Ed 402 and 502. Additional requirements.
- 503 Secondary Education for Students with Disabilities** 3 Credit not granted for both Sp Ed 403 and 503. Additional requirements.
- 504 Professional Skills in Special Education** 3 Prereq Sp Ed 301 and certified major or graduate standing. Communication, problem solving, liability, record keeping, professional development, legal issues, and program evaluation. Credit not granted for both Sp Ed 404 and 504.
- 509 Early Childhood Special Education** 3 Assessment, curriculum, and instructional techniques for teaching young children with handicaps and their families in a variety of settings. Credit not granted for both Sp Ed 409 and 509.
- 520 Teaching in Inclusive Classrooms** 3 Credit not granted for both Sp Ed 420 and 520. Additional requirements.
- 521 Inclusion Strategies for Special Education Teachers** 3 Prereq Sp Ed 501. Roles and responsibilities of special education professionals in inclusion programs, including legal aspects and collaboration. Graduate level counterpart of Sp Ed 421; additional requirements. Credit not granted for both Sp Ed 421 and 521.
- 522 Topics in Special Education** V 1-4 May be repeated for credit; cumulative maximum 8 hours. Recent research developments, issues and/or applications in selected areas of special education.
- 540 Methods in Intensive Educational Supports** 3 Credit not granted for both Sp Ed 440 and 540. Additional requirements.
- 578 Career Services and Programs for Persons with Disabilities** 3 Same as COPSY 578.

- 590 Practicum in Special Education** V 1-4 May be repeated for credit; cumulative maximum 8 hours. Supervised field experiences in the application of theories and practices in special education. S, F grading.
- 597 Special Education Internship** V 2-4 May be repeated for credit; cumulative maximum 6 hours. Supervised internship experience in domestic and international settings. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.

Electrical Engineering and Computer Science

Degrees Granted: Master of Science in Electrical Engineering, Master of Science in Computer Science, Doctor of Philosophy (Electrical and Computer Engineering), Doctor of Philosophy (Computer Science)

GRADUATE FACULTY

T. R. Fischer, Director; A. Andrews, U. Axen, D. E. Bakken, V. Beiu, B. J. Belzer, D. B. Benson, A. Bose, S. L. Broschat, W. Cochran, H. D. Collins, N. B. Corrigan, Z. Dang, J. Delgado, C. Dyreson, K. Fitz, C. Hauser, S. Hudson, G. La Rue, R. R. Lewis, D. J. Lynch, M. Medidi, S. Medidi, J. Miller, M. S. Mortz, J. Nyathi, R. G. Olsen, M. A. Osman, P. D. Pedrow, J. A. Ringo, A. Saberi, P. Schimpf, J. B. Schneider, K. Sivakumar, A. Stoorvogel, R. F. Tinder, K. Tomsovic, M. V. Venkatasubramanian, K. C. Wang

The School of Electrical Engineering and Computer Science offers graduate study programs leading to the degrees of Master of Science in Electrical Engineering, Master of Science in Computer Science, Doctor of Philosophy (Electrical and Computer Engineering) and Doctor of Philosophy (Computer Science). Both thesis and non-thesis options are available to master's degree students. The non-thesis option is a courses-only program and requires passing a comprehensive exam.

Electrical Engineering

The requirements for all degree programs in Electrical Engineering can be found on the School's web site: www.eecs.wsu.edu. Doctoral-level programs are designed to increase the student's knowledge of electrical engineering and associate fields and their ability to apply that knowledge to engineering problems. An important objective is the development of a capacity for independent creative work. Each candidate for the PhD degree is required to conduct research and prepare an acceptable thesis. The thesis must constitute an original contribution to the field of electrical and computer engineering and must conform to the specifications of the Graduate School. The student will be expected to publish the results of the thesis in refereed journals.

Research areas in which current emphasis is being placed include:

- 1) Computer engineering—microprocessing applications, computer architecture, image processing, design of large digital systems, VLSI, ultra high-speed digital circuits, parallel computing, computer networking.
- 2) Systems (control, communications, and signal processing) – Control systems theory and applications, including linear and nonlinear robust control, nonlinear systems, large-scale systems, and flight control; Communications theory and applications including digital communications, data compression, speech, image, and video coding, wireless communications; Digital signal processing including speech and image processing, robust filtering and estimation, image restoration, acoustic imaging, computer music, sound computation, data-driven sound and data sonification.
- 3) Power engineering—power systems analysis, stability, and control, application of digital techniques in power system protection, fault location, measurements, signal processing, energy conservation and power line environments.
- 4) Applied electromagnetics—electromagnetic compatibility and interference, numerical methods, electromagnetic scattering, non-destructive evaluation of metals, optic fiber transmission, wideband microwave am-

plifiers, plasma processing as it relates to the synthesis of submicron films for microelectronic applications.

5) Circuits and solid state electronics--RF analog and mixed signal circuit design of SiGe and SOI devices, III-V compounds, bulk crystals, epilayers and superlattices, ultra-high speed devices, diamond-like carbon films, computer modeling of interfacial traps, microwave devices.

The School supports a wide variety of programming and development hardware and software that includes: Intel P3, P4, and Xeon based core servers, HP9000 series 2-way servers, a Sun Enterprise 880, and a high-availability Network Attached Storage system. The school also supports a large number of general-use workstations, including Intel P2 through P4 systems, various HP RISC systems, high-end Sun Ultrasparc systems, and Sun Ray diskless terminals. The school supports Windows NT, 2000, and XP, Linux, HP/UX 10.20 - 11, and Solaris 8. We support a large range of industry standard software including MatLab, Mathematica, Cadence, Mentor Graphics, Pspice, Xilinx Toolkit, and many others. Also, through the Microsoft Academic Alliance, the school can make most Microsoft applications available for students to install on their own personal computers. Other facilities specifically for graduate students include labs supporting computational arrays, VHDL design, microprocessor development, microwave, high voltage power systems / plasma, microelectronics, and micro-tech manufacturing. There are also a number of small special-purpose labs and general electronics and measurement facilities.

The normal undergraduate preparation for graduate study in electrical and computer engineering at WSU is a baccalaureate degree in electrical or computer engineering from a recognized college or university. Students with undergraduate degrees in other fields, particularly mathematics, computer science or physics, are also accepted for graduate study. Requirements for additional undergraduate work are evaluated on an individual basis.

The Program requirements for admission include GRE test scores. Placement of graduates has been essentially 100 percent with the majority taking jobs in the electrical, electronics or computer industry.

Electrical Engineering

E E

- 501 Linear System Theory** 3 Prereq E E 489. Dynamic systems from the state variable approach; observability, controllability, stability, and sensitivity of differential and non-differential systems. Cooperative course taught jointly by WSU and Idaho (E E 572).
- 502 Linear Multivariable Control** 3 Prereq E E 501. Optimal linear feedback control, optimal stochastic observers, LQG/LTR design methodology, modern Wiener-Hopf design, robust controllers. Cooperative course taught jointly by WSU and UI (E E 574).
- 504 Modern Optics** 3 Prereq E E 341, 351, Stat 443. Diffraction theory, Fourier transforming and imaging properties of lenses, spatial filtering, holography, temporal and spatial coherence, imaging through random media.
- 505 Nonlinear System Theory** 3 Prereq E E 501. Overview of nonlinear phenomena, Lyapunov stability, input-output stability, periodic orbits, singular perturbation, differential geometric methods, bifurcations and complex behaviors.
- 507 Random Processes in Engineering** 3 Prereq Stat 443. Functions of random variable; random sequences; stochastic processes; mean-square stochastic calculus; ergodicity; spectral density; linear transformations, filtering, dynamic systems. Cooperative course taught jointly by WSU and UI (E E 570).
- 508 Estimation Theory for Signal Processing, Communications, and Control** 3 Prereq E E 501, 507, or equivalent. Principles of statistical estimation; LLSE; Kalman filtering; smoothing; prediction; maximum-likelihood and Bayesian estimation.
- 509 Adaptive Control** 3 Prereq E E 501. Model reference adaptive systems (MRAS), adaptive observers, adaptive control, on line identification, robustness issues, self-tuning regulators.
- 511 Protection of Power Systems II** 3 Prereq E E 491 or c//. Protection of electrical equipment as related to electric power systems with emphasis on digital algorithms. Cooperative course taught jointly by WSU and UI (E E 526).
- 512 Active Network Synthesis** 3 Prereq E E 341. Devices and classical network synthesis, two-port network theory, filters, active filters.

516 Wave Propagation and Scattering 3 Prereq E E 351. Rough surface scattering; scattering in random media; scattering by random discrete scatterers; applications in areas of current interest. Cooperative course taught by WSU, open to UI students (E E 536).

517 Numerical Solutions to EM Problems 3 Prereq graduate standing. Numerical solutions to EM problems including the moment method; finite element method; finite difference method, numerical integration, and matrix operations. Graduate level counterpart of E E 417; additional requirements. Credit not granted for both E E 417 and 517.

518 Advanced Electromagnetic Theory I 3 Prereq E E 351. Electromagnetic waves, electromagnetic theorems and concepts, solutions to the wave equation in rectangular, cylindrical and spherical coordinates. Cooperative course taught by WSU, open to UI students (EE 530).

519 Advanced Electromagnetic Theory II 3 Prereq E E 518. Exact solutions to canonical electromagnetic diffraction problems, high and low frequency limits, foundations of numerical solutions to electromagnetic scattering problems. Cooperative course taught by WSU, open to UI (E E 531).

520 Plasma Engineering 3 Prereq E E 351, Phys 342 or by interview. Electromagnetics, kinetic theory, and fluid mechanics of plasmas in space, arcs, plasma processing, coronas, and fusion reactors.

521 Analysis of Power Systems 3 Prereq E E 491. Concepts and practices of modern power engineering including steady-state and dynamic analysis, economics and control design.

522 High Voltage Engineering 3 Prereq E E 331. High voltage-high power phenomena; design and measurements associated with electrical transmission, current interruption, insulation, transformation, lightning, and corona.

524 Advanced Computer Architecture 3 Prereq E E 424. Instruction set architectures, pipelining and super pipelining, instruction level parallelism, superscalar and VLIW processors, cache memory, thread-level parallelism and VLSI.

526 Introduction to Electromagnetic Compatibility 3 Prereq graduate standing. Electromagnetic compatibility requirements and principles, nonideal component behavior, conducted and radiated emissions and susceptibility, crosstalk, shielding, system design. Graduate level counterpart of E E 426; additional requirements. Credit not granted for both E E 426 and 526.

527 Antenna Theory and Design 3 Prereq E E 351. Antenna fundamentals, analytical techniques, characteristics and design procedures for selected types of wire, broadband, and aperture antennas. (a/y) Cooperative course taught jointly by WSU and UI (E E 532).

528 Advanced Topics in Electromagnetics 3 May be repeated for credit; cumulative maximum 6 hours. Prereq E E 351. Advanced topics of current interest in wave propagation (electromagnetics, acoustics, or optics).

530 Digital Signal Processing II 3 Prereq E E 341, 464. Frequency selective digital filtering, least-squares filtering, adaptive filtering, multirate signal processing.

531 Energy Management and Planning 3 Available energy resources; energy issues; economic analysis of energy alternatives; energy future.

534 High Performance Computing 3 Prereq E E 324. Development, current state and future of high speed computing; application of existing commercial supercomputers to engineering problems. Cooperative course taught by UI (E E ID504), open to WSU students.

538 EM Simulation 3 Prereq by interview only. Computer simulation of electromagnetics using the finite-difference time-domain (FDTD) method; theory of finite-difference simulation, techniques for modeling EM propagation in lossy and dispersive media, boundary conditions for time-domain simulation. Cooperative course taught by UI (EE 538), open to WSU students.

541 Digital Control Systems II 3 Prereq E E 441. State space approach, SISO, optimal control, State estimators, stochastic systems, state estimation in the presence of noise.

543 Signal Theory 3 Prereq E E 341. Theory of signals; signal spaces; basis sets; signal representations projection theorem; Fourier Transform; optimum signal design.

544 Neural Computation 3 Same as Cpt S 544.

- 545 Data Compression** 3 Prereq E E 507, 543. Source coding with a fidelity criterion; quantization theory; predictive, transform, and sub-band coding; noiseless source codes.
- 548 Information Theory and Channel Coding** 3 Prereq E E 451, 507. Information theory; entropy, mutual information, source and channel coding theorems, channel capacity, Gaussian channels; channel coding; block and convolutional codes.
- 551 Data Communication Systems** 3 Prereq E E 341, 507. Digital communications; multi-amplitude/phase signal constellations; probability of error performance; cutoff rate; Viterbi algorithm; trellis coded modulation.
- 554 Asynchronous Digital Systems** 3 Prereq E E 414. Analysis and design of high speed asynchronous state machines, timing defect analysis, modular elements, arbiters, programmable sequences, system level design. Cooperative course taught jointly by WSU and UI (E E 540).
- 555 Computer Communication Networks** 3 Prereq Stat 443. Packet switching networks; multi-access and local-area networks; delay models in data networks; routing and low control.
- 562 Fault Tolerant Computer Systems** 3 Same as Cpt S 562.
- 564 Advanced Signal Processing** 3 Prereq Stat 443. Signal processing and communication theory aspects of frequency domain analysis of continuous and discrete random signals.
- 574 Optoelectronics** 3 Prereq E E 496 or Phys 463. Methods of modulating, generating, and detecting light; display techniques; display devices; fiber optics.
- 576 Analog Integrated Circuits** 3 Prereq graduate standing. Analysis and design of analog integrated circuits in CMOS and BiCMOS technologies; current mirrors, gain stages, operational amplifiers, frequency response, and compensation. Graduate level counterpart of E E 476; additional requirements. Credit not granted for both E E 476 and 576.
- 578 Microelectronic Fabrication** 3 Semiconductors, photolithography, dry and wet oxidation, diffusion, thin film deposition, clean rooms, fabrication and testing of diodes and MOS capacitors. Graduate level counterpart of E E 478. Additional requirements. Credit not granted for both 478 and 578.
- 581 Advanced Topics in Power Systems** V 2-3 May be repeated for credit; cumulative maximum 6 hours. Prereq E E 491, 521. Power systems operations including AGC, economic dispatch and security; power system dynamics; intelligent systems applications. Cooperative course taught jointly by WSU and UI (E E 504).
- 582 Advanced Topics** V 1-3 May be repeated for credit.
- 584 Parallel Processing: Systems and Applications** 3 Same as Cpt S 584.
- 586 VLSI Systems Design** 3 Prereq E E 464. VLSI models, layout algorithms, design methodologies, simulation and layout tools, algorithm design for VLSI implementation.
- 595 Directed Study in Electrical Engineering** V 1-3 May be repeated for credit. Current topics in electrical engineering.
- 596 Advanced Analog Integrated Circuits** 3 Prereq E E 476, 477. MOS and BiCMOS technologies; MOS and BiCMOS operational amplifiers; A/D, D/A converters; switched-capacitor filters; continuous-time filters. Cooperative course taught by WSU, open to UI students (E E 515).
- 598 High Speed Semiconductor Devices** 3 Prereq E E 496. Transit-time effects, negative resistance devices; ballistic transport in high electric fields; GUNN effect devices; resonant tunneling, IMPATTs, HEMTs, HBTs.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Computer Science

The course of study for the Master of Science degree is designed to prepare students for professional careers in the field of computing and

information processing or for further graduate study and research. Students may elect either a thesis or non-thesis option.

The Doctor of Philosophy degree is research-oriented and designed for students to develop a capacity for independent thinking and creative work. Specific requirements may be obtained at the EECS web site at www.eecs.wsu.edu. Each candidate for the PhD degree is required to conduct research and prepare an acceptable thesis. The thesis must constitute an original contribution to the field of computer science and must conform to the specifications of the Graduate School. The student will be expected to publish the results of the thesis in refereed journals.

Research areas in which current emphasis is placed include:

1) Computer Graphics and Scientific Computation—computational geometry and topology, scientific visualization, numerical analysis, computer simulation, application languages, complexity of numerical algorithms.

2) Computer Networks and Distributed Systems—wireless networking, optical networking, computer systems performance evaluation, distributed systems, fault tolerance, quality of service, embedded systems middleware, power grid middleware.

3) Database Systems and Knowledge Discovery—temporal databases, incomplete information in databases, world-wide-web and databases, data mining.

4) Software Engineering—software design, software testing, software metrics, formal aspects, embedded systems software, verification and validation of dependable systems.

5) Theory—category theory, programming languages.

Special facilities available for research by graduate students include: Intel P3, P4, and Xeon based core servers, HP9000 series 2-way servers, a Sun Enterprise 880, and a high-availability Network Attached Storage system. The School also provides a large number of general-use workstations, including Intel P2 through P4 systems, various HP RISC systems, high-end Sun Ultrasparc systems, and Sun Ray diskless terminals. The school supports Windows NT, 2000, and XP, Linux, HP/UX 10.20 - 11, and Solaris 8. A wide range of industry standard software is available including MatLab, Mathematica, Microsoft Visual Studio, Borland Turbo C++, Sun Microsystems Forte, Alias|Wavefront Maya, and many others. Also, through the Microsoft Academic Alliance, the school can make most Microsoft applications available for students to install on their own personal computers. Other facilities specifically for graduate students include labs supporting computational arrays, computer animation, as well as a number of small special-purpose labs and general electronics and measurement facilities.

The normal undergraduate preparation for graduate study in computer science at WSU is a baccalaureate degree in computer science from a recognized college or university. Students with undergraduate degrees in other fields, particularly electrical and computer engineering and mathematics, will also be considered for graduate study. Requirements for additional undergraduate work are evaluated on an individual basis.

The Program requirements for admission include GRE test scores. Placement of graduates has been essentially 100 percent with the majority taking jobs in the electrical, electronics or computer industry.

Computer Science

Cpt S

500 Proseminar 1 Faculty research interests, departmental computer systems, research in computer science, report preparation. S, F grading.

511 Computational Structures 3 Prereq Cpt S 317 or Math 421; graduate standing. Categories as theories; formal approaches to specifications and homeomorphisms of computational structures.

516 Algorithmics 3 Prereq Cpt S 450. Discrete structures, automata, formal languages, recursive functions, algorithms, and computability.

518 Programming Language Theory 3 Prereq Cpt S 516 or Math 421. Syntax; operational and denotational semantics. Cooperative course taught by WSU, open to UI students (CS 510).

519 Introduction to Computational Geometry 3 Prereq Cpt S 450, graduate standing. Introduction to computational geometry; data structures and algorithms, with motivating applications.

521 Software Engineering Analysis 3 Prereq Cpt S 350. Introduction to research in software engineering; strong emphasis on application of quantitative techniques in the software life cycle; students will develop a command of current software engineering literature; explo-

- ration of techniques of mathematical modeling and solutions to software engineering problems. Cooperative course taught by UI (CS 581), open to WSU students.
- 522 Software Reuse** 3 Prereq Cpt S 422. Basic principles of software reuse, compositional and generative reuse, with specific topics selected from current literature, reverse engineering.
- 523 Software Engineering Measurement** 3 Prereq Cpt S 521. Measurement methodology is the foundation of the emerging discipline of software engineering; software products are constructed by people engaged in a software development process in a development environment; focus on learning to measure the attributes of these four measurement domains; examples of software measurement and the applications of these measurements; using these techniques as the basis for the design of software engineering experiments; application of the scientific method in evaluation of programming methods and models; extension of the measurement concepts into the area of statistical modeling. Cooperative course taught by UI (CS 583), open to WSU students.
- 524 Software Specification and Analysis** 3 Graduate-level counterpart of Cpt 424; additional requirements. Credit not granted for both Cpt 424 and 524. Cooperative course taught by UI (CS 586), open to WSU students.
- 526 Experimental Software Engineering** 3 Prereq CptS 322, CptS 422, graduate standing. Experimental strategies to assess and understand software processes and artifacts (experiments, case studies, field observations, surveys).
- 527 Computer Security** 3 Computer security concepts, models and mechanism; encryption technology, formal models, policy and ethical implications. Graduate level counterpart of Cpt S 427; additional requirements. Credit not granted for both Cpt S 427 and 527.
- 530 Numerical Analysis** 3 Prereq graduate standing. Same as Math 548. Graduate level counterpart of Cpt S 430. additional requirements. Credit not granted for both Cpt S 430 and 530.
- 531 Computational Linear Algebra** 3 Same as Math 544.
- 532 Advanced Numerical Analysis** 3 Same as Math 545.
- 533 Numerical Analysis of Elliptic PDEs** 3 Same as Math 546.
- 534 Neural Network Design and Application** 3 Prereq graduate standing. Hands-on experience with neural network modeling of nonlinear phenomena; application to classification, forecasting, identification and control. Graduate level counterpart of Cpt S 434; additional requirements. Credit not granted for both Cpt S 434 and 534.
- 541 Artificial Intelligence** 3 Prereq Cpt S 440. Intelligent computer programs; simulation of cognitive processes.
- 542 Computer Graphics** 3 Prereq graduate standing. Raster operations; transformations and viewing; geometric modeling; visibility and shading; color. Graduate level counterpart of Cpt S 442; additional requirements. Credit not granted for both Cpt S 442 and 542.
- 543 Multimedia System** 3 Prereq CptS 455,460. Survey of recent advances in multimedia systems: applications, authoring tools, information retrieval, network and operating system support, and data management.
- 544 Neural Computation** 3 Prereq Math 315, Stat 443. Parallel processing inspired by natural neural systems; neural computer architecture, supervised and unsupervised learning, generalization, implementation, and application; neurophysiology basis.
- 546 Computer Animation** 3 May be repeated for credit; cumulative maximum 9 hours. Prereq Arch 446 or Cpt S 446; by interview only. Advanced computer animation techniques; advanced specialization in building/design simulation, dynamic modeling and visualization, engineering animation.
- 548 Advanced Computer Graphics** 3 Prereq Cpt S 442. Solid modeling, visual realism, light and color models, advanced surface generation techniques.
- 549 Genetic Algorithms** 3 Prereq Cpt S 250, Math 216, 360. Basic concepts, fundamental theories, and techniques of genetic algorithms; applications.
- 550 Parallel Computation** 3 Prereq Cpt S 450. Parallel machine models, principles for the design of parallel algorithms, interconnection networks, systolic arrays, computational aspects to VLSI.
- 551 Database Systems** 3 Prereq Cpt S 451. Data models: file organization and searching; database system design.
- 553 Graph Theory** 3 Prereq graduate standing. Same as Math 553. Graduate level counterpart of Cpt S 452; additional requirements. Credit not granted for both Cpt S 453 and 553.
- 555 Computer Communication Networks** 3 Same as E E 555.
- 556 Secure Wireless Networks** 3 Prereq Cpt S/EE 455 or permission. Mobile wireless networks; mobile IP, mobile and ad hoc networks, wireless ATM, threat models, authentication, detection mechanisms for security attacks.
- 557 Advanced Computer Networks** 3 Prereq Cpt S 455 or 555. ATM networks, optical WDM networks, and wireless/mobile networks; access, transport, and routing protocols.
- 559 Mobile Computing in Wireless Networks** 3 Prereq graduate standing. BSM, CDMA, Mobile-IP, MANET, WATM; routing, mobility management, authentication, naming, address resolution; transport layer and security issues due to mobility.
- 595 Directed Study in Computer Science** V 1-3 Current topics in computer science.
- 560 Operating Systems** 3 Prereq Cpt S 460. Structure of multiprogramming and multiprocessing; efficient allocation of systems resources; design implementation and performance measurement.
- 561 Computer Architecture** 3 Prereq E E 424. Instruction set architectures, instruction level parallelism, static and dynamic branch prediction, superscalar and VLIW processors, cache memory and thread-level parallelism.
- 562 Fault Tolerant Computer Systems** 3 Prereq Cpt S 460; Cpt S 464 or 564. Fault tolerance aspects involved in design and evaluation of systems; methods of detection and recovery; multicast, middleware, and reconfiguration.
- 564 Distributed Systems Concepts and Programming** 3 Prereq Cpt S 360. Graduate-level counterpart of Cpt S 464; additional requirements. Credit not granted for both Cpt S 464 and 564. Cooperative course taught by WSU, open to UI students (CS 404/504).
- 565 Advanced Distributed Systems** 3 Prereq Cpt S 460; Cpt S 464 or 564. Advanced topics and programming in distributed systems; topics vary and may include middleware, scalability, naming, and distributed system management.
- 566 Embedded Systems** 3 (2-3) Prereq graduate standing. Graduate level counterpart of Cpt S 466; additional requirements. Credit not granted for both Cpt S 466 and 566.
- 570 Machine Learning** 3 Prereq Cpt S 250; graduate standing. Introduction to building computer systems that learn from their experience; classification and regression problems; unsupervised and reinforcement learning.
- 580 Advanced Topics in Computer Science** 3 May be repeated for credit.
- 596 Computer Science Seminar** 1 May be repeated for credit; cumulative maximum 3 hours.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Elementary and Secondary Education

(See Education)

Engineering Management

Degree Granted: Master of Engineering Management.

GRADUATE FACULTY

J. A. Ringo, Director; D. A. Bender, W. J. Gray, J. R. Holt, D. V. Hutton, R. Y. Itani, S. Jayaram, E. R. Ladd, C. P. Morgan, H. A. Rumsey

Engineering Management is an innovative program offered at Spokane, Tri-Cities, Vancouver, several learning centers, and to Boeing employees in the Puget Sound and to engineers and managers of technology around the world via video streaming and the Internet. It provides a unique opportunity to acquire or enhance those skills required by engineers in the 21st century. Courses are offered at times convenient for the working adult. The program is administered by the College of Engineering and Architecture.

The key to success in this new millennium, and prudent preparation for coming future, will require a global understanding of a competitive economy, scarce resources; and effective management of technical people and technology. The engineering management program addresses these issues in its core requirements and electives. The curriculum is both balanced and flexible to meet the needs of a broad spectrum of engineers. Twelve semester hours of electives allow students to tailor the program to meet individual career goals. The master's program with a nonthesis option consists of 32-34 credit hours including a minimum of 30 credit hours of approved course work and a minimum of 2-4 credit hours of Master's Special Problems. Students with an undergraduate degree in engineering will follow the engineering curriculum. Students with a background in business or other technical areas will follow the Technology Management option. Both programs of study lead to a Master of Engineering Management. Five certificates are available for those who do not wish to earn a full Master's degree.

Students who apply to the Master of Engineering Management Program, engineering option should have earned a Bachelor of Science in engineering or technology from an accredited school or program with a minimum GPA of 3.0. Students with undergraduate degrees in mathematics, physics, or other physical sciences, and those with a business background who work in industry or technology may be accepted for this program's Technology management option. Requirements for additional undergraduate work for non-engineering majors are evaluated on an individual basis. Prospective students should submit the following to the Director of Engineering Management: 1) Graduate Management Admission Test (GMAT) scores of 500 or above; 2) three letters of recommendation from individuals who can attest to the individual's ability to succeed in graduate school, 3) a personal statement which describes in detail their background and interest in the field of engineering management; and 4) a resume detailing significant engineering experience. For further information contact the Coordinator of Engineering Management, Pullman, WA 99164-2700, via email pelshafi@wsu.edu, or the Office of Admissions on the appropriate campus. Interested students should review the program's home web page url <http://www.cea.wsu.edu/engrmtg/>

Engineering Management

E M

- 501 Management of Organizations** 3 Exploration of issues related to individual behavior in work organizations, including motivation, leadership, team-building, and team management skills.
- 505 Financial Management for Engineers** 3 Time value of money, capital budgeting, accounting principles, cost valuation, risk, cost accounting and sensitivity analyses; concepts for engineering decision-making.
- 517 Simulation Modeling of Engineering Systems** 3 Rec Stat 430; experience with computer programming. Analyzing and developing representative models for complex systems such as project or operations management using a variety of simulation styles.
- 526 Constraints Management** 3 Graduate-level counterpart of E M 426; additional requirements. Credit not granted for both E M 426 and 526.
- 530 Applications of Constraints Management** 3 Graduate-level counterpart of E M 430; additional requirements. Credit not granted for both E M 430 and 530.
- 540 Operations Research for Managers** 3 Rec Math 273. Applying linear, integer, goal programming; network optimization; queuing analysis; dynamic programming; simulation; markov analysis; and forecasting to engineering management decisions.
- 545 Decision Analysis for Engineering** 3 Structured discipline for describing, analyzing, and finalizing decisions involving uncertainty.
- 560 Integrated Supply Chain Management** 3 How technical managers analyze and manage the flow of materials, services, and information for products from inception to final customer.

564 Project Management 3 Rec basic statistics course. Planning, organizing, scheduling and controlling major projects; human dimensions, PERT and CPM scheduling models, resource allocation, and cost controls.

565 Systems Engineering Management 3 Prereq graduate standing. Design manufacture, operation of complex system development for engineering managers; project planning, organizing, and controlling tools for engineering system constraints.

570 Quality Management 3 Overview of the total field of quality, including strategic quality management programs, quality assurance, quality control, and product design reliability. Credit not granted for both E M 470 and 570.

575 Performance Management in Technical Organizations 3 Rec Mgt 501 or c//. Management of high technology organizations; planning, measurement, and human factors in improving high technology organizations; productivity, motivation and performance systems.

580 Quality Control and Reliability Design 3 Prereq Stat 430. Quality improvement analysis for process and product quality; statistical process control, capability studies; acceptance sampling concepts; reliability models for prediction and testing. Credit not granted for both E M 480 and 580.

585 Quality Engineering Using Experimental Design 3 Prereq Stat 430. Design of quality into products and processes using design of experiments including robust/parameter design and tolerance design techniques. Credit not granted for both E M 485 and 585.

590 Design for Manufacturability (DFM) 3 Tools and techniques which can be used for the improvement of the design of products, processes, and services. .

591 Strategic Management of Technology and Innovations in Engineering 3 Rec final year. Management of innovation and technological innovation, integrating technological strategy, new product development, and corporate entrepreneurship and innovation.

595 Advanced Topics in Engineering Management I V 1-3 May be repeated for credit; cumulative maximum in E M 595 and 596, 9 hours. A wide range of current high-interest engineering management topics.

596 Advanced Topics in Engineering Management II 3 May be repeated for credit; cumulative maximum in E M 595 and 596, 9 hours. A wide range of current high-interest engineering management topics.

600 Special Projects or Independent Study Variable credit. S, F grading.

702 Master's Special Problems, Directed Study, and/or Examination Variable credit. S, F grading.

Engineering Science/Engineering

Degrees Granted: Master of Science in Engineering; Doctor of Philosophy (Engineering Science)

GRADUATE FACULTY

G. V. Barbosa-Canovas, G. Bledsoe, R. Cavaliere, S. Chen, D. C. Davis, G. M. Hyde, L. James, W. Johns, R. Jones, D. Lin, D. K. McCool, J. N. Petersen, M. J. Pitts, C. O. Stockle, J. Tang, A. Vasavada, J. Wu

The College of Engineering and Architecture offers interdisciplinary programs of study in engineering science leading to the degree of Master of Science in Engineering or Doctor of Philosophy (Engineering Science). Both programs are administered through the Office Dean of the College of Engineering and Architecture.

Normally, students entering the program will have an undergraduate degree from a recognized program in Engineering. Students with a non-engineering undergraduate degree, such as mathematics or the physical and life sciences, will need to complete a central core of undergraduate engineering study focused on their area of interest. The interdisciplinary nature of these degrees provides considerable flexibility in designing programs of study tailored to the specialized needs of each student. Examples of areas of specialization include, but are not limited to, agri-

cultural engineering, atmospheric research, materials science and engineering and bioengineering.

Students wishing to be admitted to the program must satisfy the minimum requirements of the Graduate School and the College of Engineering and Architecture. Degree requirements must satisfy the requirements of the Graduate School with both thesis and nonthesis options available in the MS Engineering degree program. Admission to these degree programs is through the Office of the Dean, College of Engineering and Architecture.

English

Degrees Granted: Master of Arts in English; Doctor of Philosophy.

GRADUATE FACULTY

V. Villanueva, Chair; P. E. Brians, J. S. Burbick, P. Chilson, W. F. Condon, B. Couture, R. Eddy, T. C. Faulkner, S. Fowler, L. M. Gordon, W. Hamlin, A. L. Hammond, M. G. Hanly, D. Hellegers, V. M. Hyde, W. D. Johnson, M. Kendrick, G. E. Kennedy, R. G. Law, D. Lee, B. Monroe, R. Ong, L. Orr, T. V. Reed, C. Roman, C. R. Siegel, B. M. Sitko, A. von Frank, M. F. Wack

The Department of English offers graduate programs leading to the degrees of Master of Arts in English and Doctor of Philosophy. In conjunction with the Department of History and with formal participation of the Graduate Faculty in various other departments, it sponsors the Program in American Studies leading to the degrees of Master of Arts and Doctor of Philosophy. All candidates for advanced degrees in English are required to obtain credit for English 598, Teaching Apprenticeship. The amount of credit and the mode by which it is obtained vary in accordance with the teaching experience of each candidate.

The basic option in the program leading to the Master of Arts in English emphasizes the history, criticism, and theory of English and American Literature. Graduates are prepared for teaching in secondary schools and community colleges; most degree options include a year or more of practical experience in teaching composition. The MA degree is also a strong foundation for professional training in such areas as law, divinity, journalism, and business, as well as for doctoral programs in English or American literature, American studies, or comparative literature. A reading of one foreign language (French, German, Spanish, Italian, Latin, or ancient Greek) is required, at a level of competence representing that expected at the end of second-year college level studies. The candidate may elect a thesis or non-thesis program.

Another Master of Arts in English option emphasizes the teaching of English. This option is designed for persons who have a year or more of teaching experience and wish to return to elementary or secondary schools. Depending upon the needs discovered by the candidate during field experience, the option offers opportunities to strengthen areas of literary study, to update training in linguistics or grammar, to broaden critical perspectives, and to improve competence in teaching writing. Supporting work in cooperating departments may deal with such areas as directing plays or coaching debate, advising student publications, handling learning resources media, or developing public relations for an institutional system. Language capability requirements are based on the candidate's expected needs and may be met by linguistic or other language studies. A non-thesis option, this Master of Arts degree is parallel with other MA degrees in the Department.

A third option for the Master of Arts in English emphasizes the teaching of composition. This option is designed to provide rigorous training, along with practical experience, in the theory, methodology, and pedagogy of composition, including the use of computer word processing. Such a program responds to the present needs of the profession, since over 80 percent of advertised two-year college positions and many four-year college positions require specialized training in composition teaching. This degree is designed to prepare candidates for positions in two- and four-year colleges or for English doctoral programs with specializations in composition. Language capability requirements are based on the candidates' expected needs and may be met by linguistic or other language studies.

The program in English for the degree of Doctor of Philosophy is designed to prepare advanced students to become knowledgeable, effec-

tive scholars and teachers at the university or college level. The PhD candidate course of study is not designed to confront the student with every significant piece of writing in the respective field (English and American literature, or rhetoric/composition). Rather, the coursework aims to produce mature critics and scholars who are widely read, knowledgeable about theory and the methods of systematic scholarship, and competent to function professionally, not only in the modern university, but also in related research institutions (e.g., historical societies, museums, and publishing firms).

The residence requirement for the Doctor of Philosophy is three years beyond the baccalaureate degree. At least two of these must be spent at Washington State University, and a minimum of two regular semesters must be continuous. Except under unusual circumstances, only those English courses numbered 500 and above may be applied as credit toward an advanced degree in English. (Supplementary work in other departments may be done in approved courses in the 400-series.) Before the end of the third semester in residence the student must have demonstrated competence in one foreign language, (French, German, Spanish, Italian, Latin or ancient Greek)--a level of competence equivalent to that attained by successful completion of a fourth-year, college-level course in the literature of that language--or alternatively, reading-level competence in two languages.

The principal sources of study and research reside in the University Library's collection of literature, periodicals, critical reviews, and rare books, and in its holdings of microfilm, microcards, and primary source documents. Special collections include the personal libraries of Leonard and Virginia Woolf, letters and papers of the Sitwell family, nineteenth-century periodicals, twentieth-century British literature generally, and women writers. Moreover, the Library's archives contain a unique collection of regional materials which provide excellent resources for research in certain aspects of American literature and the American Studies Program.

The Humanities Research Center is located in facilities adjacent to the English Department. A resource and reference center for research in the humanities, the facility features advanced word-processing systems, microfilm equipment, and reference materials; video display terminals and hardcopy printers provide access to computer-based bibliographies and to central text-editing systems maintained by the University. The facility provides opportunities for graduate students to gain experience, either through course work or research assistantships, in applying computer technology to literary study in such areas as textual editing, preparation of concordances and bibliographies, and feature analysis of poetry.

Four scholarly journals are edited within the English Department: *Poe Studies*, *ESQ: A Journal of the American Renaissance*, *Cauda Pavonis: Studies in Hermeticism*, and *Nuclear Texts and Contexts*. Opportunities are available for independent graduate study with the editors in the procedures of editing scholarly publications.

Undergraduates planning to pursue graduate study in the Department should obtain a bachelor's degree with approximately 30 semester hours, or the equivalent, in English and American literature and related fields. They should also have studied at least one foreign language before undertaking graduate work. In addition to minimum Graduate School admission requirements, the Department of English requires several specific items: three letters of recommendation from persons in a position to know of the applicant's potential as a teacher and scholar, Graduate Record Examination scores (both general and advanced), an upper-division or seminar paper, and an individual statement of the applicant's aims in advanced studies, especially as these interests and aims may be furthered by study at Washington State University.

English

Engl

500 Introduction to Graduate level Writing for ESL Students 3 Pre-req graduate standing. Introduction to the linguistic and rhetorical conventions of graduate level writing, including the preparation of master's theses and dissertations.

501 Seminar in the Teaching of Writing: Methodology of Composition 3 Development of a workable definition of the methods of composing through a review of relevant research and problem-solving exercises.

- 502 Seminar in the Teaching of Writing: Contemporary Theories 3** Contemporary theories of composition and their application to the classroom.
- 503 Old English: Anglo-Saxon 3** Old English language and its literature, with emphasis on short lyrics and prose.
- 504 Old English: Beowulf 3** Prereq Engl 503. Advanced study of Old English language and literature with focus on the epic Beowulf.
- 506 Seminar in 16th-Century English Literature 3** May be repeated for credit; cumulative maximum 6 hours.
- 507 Shakespeare 3** Plays, poems, criticism, and background materials.
- 508 Seminar in Assessment of Writing 3** Problems involved in the diagnosis and assessment of student writing.
- 509 Seminar in Classical Rhetoric and Its Influences 3** Study of Greek and Roman rhetorical theories and their influence.
- 510 Backgrounds of American Literature 3** Studies of American writing in cultural contexts.
- 511 Seminar in 17th- and 18th-Century American Literature 3**
- 512 Introduction to Graduate Study 3**
- 513 Theory and Method in American Studies 3** Major theories and methods currently used by American Studies scholars; key concepts in cultural analysis.
- 514 Seminar in 20th-Century American Literature 3** May be repeated for credit; cumulative maximum 6 hours.
- 515 Contemporary Theories of Rhetoric 3** Contemporary critical theory and cultural studies and reconsiderations of suasive discursive practices.
- 516 Rhetorical Theory 3** Same as Com 525.
- 521 Seminar in British Romantic Literature 3** May be repeated for credit; cumulative maximum 6 hours.
- 522 Seminar in Victorian Literature 3** May be repeated for credit; cumulative maximum 6 hours.
- 525 Seminar in English Literature of the 17th Century 3** May be repeated for credit; cumulative maximum 6 hours.
- 527 Seminar in English Literature of the Restoration and 18th Century 3** May be repeated for credit; cumulative maximum 6 hours.
- 529 Seminar in 19th-Century American Literature 3** May be repeated for credit; cumulative maximum 6 hours.
- 531 Administering A Writing Lab 3** Prereq Engl 501 or 502, or consent of writing lab director. Combining theory and practice in writing lab supervision and management. Interns will work under direct faculty supervision.
- 532 Teaching Writing to Nontraditional Students 3** Prereq Engl 501, 502 or by interview only. Theory and practice of the teaching of basic writers.
- 534 Theories and Methods of the Teaching of Technical and Professional Writing 3** Historical and theoretical bases for production of scientific discourse; training in its practical applications.
- 537 Seminar in English Literature 3** May be repeated for credit; cumulative maximum 12 hours. Major topics and figures.
- 541 Seminar in TESOL and Linguistics 3** May be repeated for credit; cumulative maximum 6 hours. Cooperative course taught by UI (Eng 510), open to WSU students.
- 543 Problems in English Linguistics: Syntax and Phonology 3** May be repeated for credit; cumulative maximum 6 hours. Credit not granted for both Engl 443 and 543.
- 544 TESOL: Theory and Methods 3** May be repeated for credit; cumulative maximum 6 hours. Theoretical issues and practical experience in ESL, classroom situations. Cooperative course taught by WSU, open to UI students (Engl 514).
- 547 Literary Criticism 3** Theories of literature from Plato and Aristotle to the present.
- 548 Seminar in Literary Theory 3** May be repeated for credit; cumulative maximum 6 hours. Problems in the theory and practice of literary criticism.
- 549 Seminar in 20th-Century British Literature 3** May be repeated for credit; cumulative maximum 6 hours.
- 550 Seminar in Poetry or Non-Fiction Prose 3** May be repeated for credit; cumulative maximum 6 hours. Historical and generic studies in poetry and non-fiction prose.
- 554 History of the English Language 3**
- 555 Seminar in Middle English Literature 3** May be repeated for credit; cumulative maximum 6 hours.
- 560 Seminar in Drama 3** Historical and generic studies in dramatic literature. May be repeated for credit; cumulative maximum 6 hours.
- 567 Seminar in Prose Fiction 3** May be repeated for credit; cumulative maximum 6 hours. Historical and generic studies of prose fiction.
- 573 Seminar in American Literature 3** May be repeated for credit; cumulative maximum 12 hours. Major topics and figures.
- 580 Seminar in Medieval Literature 3** May be repeated for credit; cumulative maximum 6 hours. The literature of western Europe from 450 to 1500.
- 590 Research in English Studies V 1-3** May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Directed reading and interpretive problems in English studies.
- 591 The Teaching of Literature 3** Prereq two semesters full-time graduate enrollment or consent of adviser. The theory and practice of designing and teaching courses in literature. Cooperative course taught jointly by WSU and UI (ED 558).
- 592 Language Arts: Methods of Composition 3** Methods of composition and relevant research in language arts.
- 593 Language Arts: Theories of Composition 3** Contemporary theories of composition and their application to the language arts classroom.
- 595 Topics in English 3** May be repeated for credit; cumulative maximum 6 hours. Language, English pedagogy, or literature of special or current interest; reading theories, teaching of writing, current literary theories.
- 596 Topics in American Studies 3** May be repeated for credit; cumulative maximum 9 hours. American Studies Summer Institute. Credit not granted for both Engl 496 and 596.
- 597 Topics in Composition and Rhetoric 3** May be repeated for credit; cumulative maximum 6 hours. Rhetoric and composition theory and praxis.
- 598 Teaching Apprenticeship 1** May be repeated for credit. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Entomology

Degrees Granted: Master of Science in Entomology; Doctor of Philosophy

GRADUATE FACULTY

J. J. Brown, Chair; E. Beers, A. A. Berryman, J. F. Brunner, S. L. Clement, J. E. Dunley, A. Felsot, D. James, V. Jones, P. J. Landolt, K. S. Pike, G. L. Piper, C. A. Sheppard, W. S. Sheppard, W. E. Snyder, J. D. Stark, L. K. Tanigoshi, W. J. Turner, D. Walsh, R. S. Zack

The Department of Entomology offers programs leading to the degrees of Master of Science in Entomology and Doctor of Philosophy. General areas in which degrees are earned include taxonomy, medical entomology, physiology and insect biochemistry, behavior, ecology and forest entomology, and various aspects of economic entomology such as toxicology, bee research, and integrated pest management. Specialized equipment and laboratories for biochemical, physiological, and molecular techniques, computer facilities, and an electron microscope laboratory help support entomological research on the Pullman campus; similar facilities, and field plots for studying insect associations on various crops are used to conduct research at Research and Extension Centers and urban campuses throughout Washington. Comprehensive library support is the result of a long tradition of entomological research at the University. The Entomology Department has one of the most extensive insect collections on the West Coast, with over a million specimens, that supports research and advanced teaching. There is also a teaching collection.

The degree of Master of Science in Entomology includes formal courses in entomology and supporting areas, seminars, and a thesis based on independent research and a final oral examination. A non-thesis master's option is also available.

The degree of Doctor of Philosophy includes additional formal coursework, seminars, adequate training in a variety of supporting areas, preparation and defense of a research proposal, and successful completion of the departmental written qualifying examination, an oral preliminary examination, a sufficiently scholarly research dissertation and a final examination in defense of the dissertation. The Ph.D. student must have course background in insect physiology, taxonomy, ecology, and agricultural entomology, plus biometry, botany, and general biochemistry. A teaching requirement for PhD candidates may be met by holding a partial teaching appointment or by bearing responsibility for formal lectures or laboratory sessions. This requirement may be accomplished by other means through departmental faculty action.

The Department cooperates closely with research laboratories and programs of the Agricultural Research Service and Forest Service of the USDA and the U.S. Public Health Service within the Northwest. Such cooperation may allow students to acquire research experience with these agencies.

Students entering graduate study in Entomology at Washington State University are expected to have completed general entomology, genetics, animal/plant or cell physiology, ecology, physical sciences, and organic chemistry; ideally, undergraduate preparation also includes one modern foreign language, and a broad background of courses within the biological sciences.

Entomology

Entom

511 Principles of Systematic Biology 3 (2-3) Same as Zool 511.

526 Population Analysis 1 Same as NATRS 526.

529 Principles of Population Dynamics 1 Same as NATRS 529.

539 Taxonomic Entomology 2 or 4 (2-6) Identification of insect orders and families. Insect collection required. Graduate level counterpart of Entom 439; additional requirements. Credit not granted for both Entom 439 and 539.

540 Taxonomy of Immature Insects 2 or 4 (2-6) Graduate level counterpart of Entom 440; additional requirements. Credit not granted for both Entom 440 and 540.

541 Advanced Insect Ecology 3 (2-3) Prereq Entom 343; general ecology course. Graduate-level counterpart of Entom 441; additional requirements. Credit not allowed for both Entom 441 and 541. Field trips required. Cooperative course taught by UI (Ent 541), open to WSU students.

542 Insect Behavior 3 Prereq one year biology or entomology. Principles of the behavior of insects. Cooperative course taught by WSU, open to UI students.

543 Predator-Prey Dynamics 1 Prereq calculus; general ecology; statistics. Dynamical consequences of interactions between predators and their prey at the population community and ecosystem level.

545 Insect-Plant Interactions: Mechanisms of Resistance to Arthropods 3 (2-3) Graduate-level counterpart of Entom 445; additional requirements. Credit not granted for both Entom 445 and 545. Cooperative course taught by UI (Ent 549), open to WSU students.

546 Host Plant Resistance 3 Prereq graduate standing. Principles and methods of screening and developing crop cultivars resistant to arthropods. Graduate level counterpart of Entom 446; additional requirements. Credit not granted for both Entom 446 and 546. Cooperative course taught by UI (Ent 546), open to WSU students.

547 Introduction to Biological Control 3 (2-3) Graduate level counterpart of Entom 447; additional requirements. Credit not granted for both Entom 447 and 547.

550 Insect Physiology 4 (3-3) Prereq Chem 240, Zool 352; Zool 322, or Entom 340 or 343. General principles of insect physiology; the mechanisms of vital processes in insects; organ, cellular, subcellular, chemical and physical levels. Cooperative course taught by WSU, open to UI students (Ent 550).

551 Biological Control of Weeds 1 Prereq general ecology. Principles, methodologies, and implementation of biological control of weeds in noncropland environments. Cooperative course taught by WSU, open to UI students (Ent 451/J551).

556 Insecticides: Toxicology and Mode of Action 1 Prereq biochemistry, organic chemistry, physiology, plant or animal physiology. Insecticides in terms of historical perspective, classification, synthesis, toxicity, mode of action, and metabolism.

557 Herbicides: Toxicology and Mode of Action 1 Prereq biochemistry, organic chemistry, physiology, plant or animal physiology. Herbicides in terms of historical perspective, classification, synthesis, toxicity, mode of action, and metabolism.

558 Pesticide Topics 1 Prereq biochemistry, organic chemistry, physiology, plant or animal physiology. Current issues concerning pesticides in terms of toxicity, mode of action, and metabolism.

562 Systems in Integrated Crop Management 3 (2-3) Prereq one semester calculus. Evaluate and use computer models to make decisions for managing pests, diseases, and crop productivity. Credit not granted for both Entom 462 and 562.

565 Integrated Biological Control 3 Prereq Entom 340 or 343. Study of importance of incorporating biological control into integrated pest management problems in agricultural and urban ecosystems.

572 Aquatic Entomology 3 (2-3) Graduate-level counterpart of Entom 472; additional requirements. Credit not granted for both Entom 472 and 572. Cooperative course taught by UI (Ent 572), open to WSU students.

583 Physiological Interactions in Predator-Prey Relationships 1 Prereq Bio S 102. Rec general ecology. Intricate physiological and behavioral adaptations that have evolved in predator/prey relationships.

590 Special Topics in Entomology V 1-4 May be repeated for credit: cum max 10 hours. Current areas of special interest within entomology. Credit not granted for both 490 and 590. Cooperative course taught by WSU, open to UI students (Ent 490/590).

593 Seminar 1 Prereq 20 hrs biology. May be repeated for credit. Reporting and discussing problems and research in entomology.

595 Noncropland Weed Biological Control Internship V 1-3 May be repeated for credit, cumulative maximum 6 hours. Prereq graduate standing, by interview only. Supervised individual practicum in noncropland weed biological control; professionally related field interaction. Cooperative course taught by WSU, open to UI students (Ent 595). S, F grading.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis, and/or Examination Variable credit. S, F grading.

702 Master's Special Problems, Directed Study, and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Integrated Pest Management

IPM

552 Pesticides and the Environment 2 Intermediate and prolonged effects of pesticides on man and other animals; legal and moral repercussions of pesticide use. Graduate level counterpart of IPM 452; additional requirements. Credit not granted for both IPM 452 and 552.

562 Systems of Integrated Pest Management 3 (2-3) Utilization of the systems approach in agricultural pest management; design, implementation, and analysis of IPM programs for selected crops.

Environmental Science and Regional Planning

Degrees Granted: Master of Science in Environmental Science; Master of Regional Planning; Doctor of Philosophy (Environmental and Natural Resource Sciences)

GRADUATE FACULTY

W. W. Budd, Chair; T. J. Bartuska, A. A. Berryman, D. F. Bezdicek, J. Bishop, E. J. Brook, A. L. Brooks, A. J. Busacca, M. S. Carroll, C. S. Claiborn, J. L. Conca, J. W. Crane, D. R. Fisher, E. P. Fiske, F. A. Ford, E. H. Franz, B. E. Frazier, H. L. Freese, R. Gill, S. D. Hacker, L. H. Hardesty, W. G. Hendrix, R. G. Huffaker, M. F. Jarvis, T. T. Jarvis, C. K.

Keller, J. A. Krautkraemer, G. E. Long, V. S. Manoranjan, E. B. Moore, F. O. Ndubisi, W. L. Pan, E. A. Rosa, E. Rykiel, R. G. Schreckhise, C. B. Schultz, R. L. Shew, J. D. Stark, C. O. Stockle, J. A. Strand, D. J. Strom, B. Tissot, E. P. Weber, C. D. Whiteman, J. Wise, J. V. Wright

The Program in Environmental Science and Regional Planning offers courses of study leading to the degrees of Master of Science in Environmental Science, Master of Regional Planning, and PhD in Environmental and Natural Resource Sciences (PhD offered jointly with Department of Natural Resource Sciences).

The Program is closely associated with the Environmental Research Center, the Laboratory for Atmospheric Research, the Water Research Center, the International Program Development Office and other University research units.

Environmental science involves the study of natural and modified environments and their interactions with biotic (including human) systems. Environmental science emphasizes comprehensive understanding of the environmental/ecological context of decision-making, assessment of beneficial and disruptive impacts, and methodologies to analyze, integrate and manage these complex systems.

The course of study for each student is flexibly designed in a unique multi-optional, interdisciplinary context. Environmental science majors can choose options in eight areas: agricultural ecology, biological science, human ecology, environmental education, environmental quality control, hazardous waste management, natural resource management or systems.

General requirements for the degree of Master of Science in Environmental Science include upper division or graduate level courses in physical, biological, social, or applied science; ecology; mathematics, statistics, or computer sciences; environmental impact assessment; graduate seminar and advanced topics in Environmental Science; an option with a minimum of 10 credit hours of courses; and a thesis or special project. A minimum of 32 hours of graduate credit is required. The Program has been successful in placing master's graduates in a variety of positions with federal, state, and local agencies, industry and academia, as environmental and resource management specialists.

Before applying for admission to the master's program, a student should have completed an undergraduate curriculum that included examination of a physical, biological, or social system in sufficient depth to serve as background for advanced investigation of one or more of these systems in an ecological context, and a minimum GPA of 3.0. Previous course work also is required in sociology or cultural anthropology, environmental science overview, biological science, chemistry or physics, and calculus or statistics.

Regional Planning comprises the study of basic issues and methods in planning with special emphasis on ecological planning, land-use planning, geographic analysis and assessment (e.g., GIS), and planning and environmental policy. Regional Planning emphasizes professional preparation for practice with special sensitivity to the opportunities for public and private sector planning in the western states and in developing countries. Students in both fields acquire the holistic and interdisciplinary perspectives and the ecological understanding necessary to prepare for a variety of roles in the study and management of resources and the environment.

The course of study for each student is flexibly designed in a unique multi-optional, interdisciplinary context. Regional Planning majors complete a core curriculum and then specialize in a variety of areas including environmental, land-use, rural, and international development planning.

Students entering the Master of Regional Planning program are required to complete not less than 35 graduate credit hours, including core planning courses (principles and practices of planning, environmental planning, land inventory analysis, community and economic development and environmental impact assessment), 6 hours of thesis or 4 hours of project credit and electives related to a specialization. The philosophy of the program is oriented towards preparing graduates for practice in public or tribal agencies or as consultants in the private sector.

Students entering the regional planning program have a wide variety of backgrounds in the natural and social sciences as well as the design disciplines. Specific prerequisite course requirements include economics; sociology, cultural anthropology, or political science; natural science; quantitative skills (mathematics, computer science, or statistics); and communication skills. Applicants are expected to have a minimum GPA

of 3.0 in their undergraduate field. Prior work experience in planning or related fields is considered in evaluating applicants.

Course work and research collaboration with leading scholars on the ES/RP Graduate Faculties ensure that options and specializations continually shift emphasis to reflect current advances in environmental science and regional planning. Recent developments, for example, have included an emphasis on ecosystem management and geographic information systems. The opportunity to develop such emphases in response to new developments is a distinguishing feature of the Program.

The PhD degree in Environmental and Natural Resource Sciences, sponsored jointly by the Program in Environmental Science and Regional Planning and the Department of Natural Resource Sciences, emphasizes coursework and research relevant to understanding and managing environmental and natural resource science issues. General requirements for completing the PhD degree include advanced courses in the areas of ecosystems, statistics, modeling, issues and ethics, and the specialized subject area of the dissertation. A minimum of 72 credits, including an acceptable dissertation, is required. Prerequisites for admission include the general requirements of the Graduate School, ten semester credits in basic biological and/or physical sciences, and acceptance of the student by a faculty advisor. Deadlines for initial consideration for admission to the PhD degree program are February 15 for fall semester and October 15 for spring semester.

Three letters of recommendation, transcripts from colleges attended, GRE scores, and a statement of goals are required in addition to the application for graduate school. Applications for Teaching and Research Assistantships and Fellowships are available upon request. A TOEFL score of at least 580 is required for students whose first language is not English.

Environmental Science and Regional Planning

ES/RP

502 Human Health and the Environment 3 Problem-solving approach to adverse effects on human health caused by contamination of environmental media or anthropogenic changes in ecosystems. Graduate level counterpart of ES/RP 402; additional requirements. Credit not granted for both ES/RP 402 and 502.

503 Natural Resource Planning 3 Same as NATRS 503.

504 Ecosystem Management 3 Analysis of ecosystem processes; dual emphasis on ecological principles and development of methods and concepts to evaluate policies for management.

509 Applied Radiological Physics 3 (2-3) Prereq calculus course; Phys course; Rec ES/RP 406. Production, interactions and measurement of radiation, with application to radiological health protection concerns. Credit not granted for both ES/RP 409 and 509.

510 Applied Radiation Dosimetry 3 (2-3) Prereq ES/RP 409/509 or course in radiological physics. Determination of exposure and doses from external and internal sources of radiation, with applications to environmental, occupational and medical protection.

511 Legal Process 3 Rec ES/RP 444. Legal process in general and role of the judiciary in natural resource management. Cooperative course taught jointly by WSU and UI (Law 511).

513 Environmental Epidemiology 3 Prereq Stat 412; Rec Micro 420, Stat 422. Environmental epidemiologic methods to investigate environmental problems and familiarity with relevant scientific literature.

514 Environmental Biophysics 2 Graduate level counterpart of ES/RP 414; additional requirements. Physical environment of living organisms (temperature, humidity, radiation, wind); heat and mass exchange and balance in plant and animal systems. Credit not granted for both ES/RP 414 and 514. Cooperative course taught by WSU, open to UI students (Bot 532).

516 Radiation Biology 4 (3-3) Prereq introductory radiological physics, or one course each in biology, and radiological physics; Rec ES/RP 406. Effects of ionizing radiation at the molecular, cellular, organ and organism level. Credit not granted for both ES/RP 416 and 516.

517 Fate and Effects of Environmental Contaminants 3 Prereq graduate standing. Rec biochemistry, organic chemistry. Rationale perspective on the environmental behavior and biological, effects of contaminants.

519 International Development and Human Resources 3 Same as Anth 519.

524 Environmental Health Assessment 2 Prereq one course each in biology, calculus, chemistry, general ecology and physics. Rec

- ES/RP 406. Environmental transport, fate and effects of radioactive and hazardous materials. Credit not granted for both ES/RP 424 and 524.
- 526 Population Analysis 1** Same as NATRS 526. Credit not granted for both ES/RP 426 and 526.
- 527 Environmental Chemistry 2** Natural water chemistry, organic processes, kinetics, thermodynamics, modeling in lake, river and sea water. Graduate level counterpart of ES/RP 427; additional requirements. Credit not granted for both ES/RP 427 and 527.
- 528 Environmental Management Systems 3 (2-3)** Introduction to EMS standards; procedures and requirements for EMS certification; creations and auditing of an EMS.
- 529 Population Theory 1** Development of the theory of population dynamics from Malthus to the present. Graduate level counterpart of ES/RP 429; additional requirements. Credit not granted for both ES/RP 429 and 529.
- 530 Fundamentals of Industrial Safety 2** Prereq graduate standing or by interview only. Fundamentals for recognizing and controlling hazards and losses to protect the safety and health of workers.
- 531 Fundamentals of Environmental Toxicology 3** Prereq BC/BP 364, Chem 240, Zool 353. Fundamentals of toxicology; environmental fate and biological deposition and effects of natural products, drugs, food chemicals, and pollutants.
- 532 Applied Environmental Toxicology 3** Prereq ES/RP 531 or P/T 505. Overview of the field of environmental toxicology; interactions of xenobiotics with natural systems.
- 534 Industrial Ecology: Theory and Practice 3** Complex relationships and interactions among industrial activities, the environment, and society and the need for a sustainable system.
- 535 Resolving Environmental Conflicts 4 (3-3)** Same as R S 535. Graduate-level counterpart of ES/RP 435; additional requirements. Credit not granted for both ES/RP 435 and 535.
- 544 Environmental Assessment 4** Rec Bio S 372. Analysis of environmental impact statements and their legal framework; methods of environmental assessment and team development of an impact statement. Credit not granted for both Env S 444 and 544. Cooperative course taught by WSU, open to UI students (Geog 544).
- 545 Hazardous Waste Management 3** Graduate level counterpart of ES/RP 445. Environmental, technical, and political aspects of hazardous waste management; evaluative methods, risk assessment, and current management requirements. Credit not granted for both ES/RP 445 and 545. Cooperative course taught by WSU, open to UI students (EnvS 545).
- 548 Environmental Law 3** By interview only. Environmental planning and protection, regulation of air and water pollution, waste disposal, use of pesticides and other toxic chemicals, and remedies for environmental injury. Cooperative course taught by UI (Law 947), open to WSU students.
- 549 Public Land Law 3** History of public lands, special problems arising from ownership of land by government, legal issues incident various uses of public land including land sales, mineral extraction, livestock grazing, timber harvest, recreation, wildlife protection and preservation. Cooperative course taught by UI (Law 948), open to WSU students.
- 550 System Dynamics Models of Environmental Systems 3** Prereq graduate standing. Analysis of environmental system dynamics; development and use of simulation models using the Stella software on Macintosh. Cooperative course taught by WSU, open to UI students (EnvS 550).
- 551 Energy Production and the Environment 2** Prereq biology course; ecology course; Rec ES/RP 406. Evaluation of the impacts of nuclear and other forms of energy production on humans and the environment. Credit not granted for both ES/RP 451 and 551.
- 552 Environmental Microbiology 3** Same as Micro 552. Credit not granted for both ES/RP 452 and 552.
- 555 Environmental Planning 3** State, local and federal approaches to environmental planning and their interactions in private and public land use and development decisions.
- 556 Insecticides: Toxicology and Mode of Action 1** Same as Entom 556.
- 557 Herbicides: Toxicology and Mode of Action 1** Same as Entom 557.
- 558 Pesticide Topics 1** Same as Entom 558.
- 565 Biogeochemistry and Global Change 4 (3-1)** Survey of how life affects the chemistry of the surface of earth. Same as GEOL 565.
- 560 Watershed Management 3** Same as NATRS 560.
- 567 Advanced Applications in GIS 4 (1-6)** Advanced applications in GIS will provide an opportunity to develop understanding of GIS concepts using ARC/INFO geographic information systems.
- 571 Meteorology 3** Same as C E 571. Credit not granted for both ES/RP 471 and 571.
- 573 Engineering Risk Assessment for Hazardous Waste Evaluations 3** Graduate level counterpart of ES/RP 473; additional requirements. Quantitative and qualitative approaches to assessing risks to public health and environment from chemical contaminants; toxicology, exposure assessment, risk characterization and environmental modeling; critical reviews of specific toxins and actual waste site studies. Credit not granted for both ES/RP 473 and 573. Cooperative course taught by UI (ChE 580), open to WSU students.
- 575 Geographic Information Systems 3** Prereq ES/RP 385. Computerized management of data organized on regional geographic bases; preparation overlays, coding, and manipulation of data for regional planners and land managers. Cooperative course taught by UI (Geog 475), open to WSU students.
- 584 Engineering Aspects of Aquatic Biology 4 (3-3)** Same as C E 584.
- 585 Aquatic System Restoration 3 (2-3)** Same as C E 585.
- 586 Introduction to Geographic Information Systems 4 (2-6)** Rec DOS knowledge. Geographic information systems technology. Graduate level counterpart of ES/RP 486; additional requirements. Credit not granted for both ES/RP 486 and 586.
- 590 Special Topics 2** May be repeated for credit; cumulative maximum 6 hours. Cooperative course taught by WSU, open to UI students (Geog 590).
- 591 Special Topics 2** May be repeated for credit; cumulative maximum 4 hours.
- 592 Special Topics V 1-4** May be repeated for credit; cumulative maximum 4 hours.
- 593 Seminar in Environmental Science and Regional Planning 1** May be repeated for credit; cumulative maximum 8 hours. Seminar with student, faculty and outside speakers
- 594 Environmental and Natural Resources Issues and Ethics 2 or 3** Same as NATRS 594
- 595 Graduate Internship V 2-5** By interview only. Practical work experience in appropriate agencies; for graduate career students. S, F grading.
- 596 Cooperative Education Internship V 2-5** May be repeated for credit; cumulative maximum 5 hours. By interview only. Practical experience in appropriate agencies; for career graduate students in environmental science and regional planning. S, F grading.
- 597 Technical and Public Communications in Environmental Science 2** Prereq technical writing course; Rec public speaking course. Development of written and oral communication skills for practical application in the field of environmental science.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Exercise Science

Degree granted: Graduate Certificate in Exercise Science and Master of Science in Exercise Science

GRADUATE FACULTY

S. Blank, C. Johnson

Graduate course work leading to a Graduate Certificate in Exercise Science and a Master of Science in Exercise Science is offered through the Clinical and Experimental Exercise Science Graduate Program. The

Exercise Science graduate program is located in the Health Sciences Building at Washington State University Spokane at the Riverpoint campus. The Health Sciences Building has 144,000 gross square feet of classrooms, clinics, and faculty offices. Exercise Science human exercise physiology and research laboratories are among the full-scale state-of-the-art laboratories supporting research in molecular biology, tissue culture, infectious disease, clinical study, and biochemistry.

Students entering the Clinical and Experimental Exercise Science graduate program will identify a specialization in either clinical physiology or in experimental physiology. Clinical physiology (thesis or non-thesis option) provides graduate education in exercise prescription and delivery of preventive/rehabilitative exercise programs for different populations. Experimental exercise physiology (thesis option) provides graduate education in scientific and research techniques that prepares students to study the biological mechanisms underlying the body's response to exercise.

The core curriculum establishes that each student in the Exercise Science program receives advanced course work in exercise physiology with primary emphasis in muscle physiology and exercise bioenergetics (Ex Sci 565), cardiopulmonary exercise physiology (Ex Sci 567), and exercise immunology (Ex Sci 563). These courses have foundations in cellular mechanisms that regulate physiological responses to exercise. Each of these courses will also provide students with applicable content in molecular mechanisms that govern cellular responses, as elucidated by the current literature in the field of exercise biology. Courses in research methods and statistics assure that students receive preparatory study in research design and analysis for future project/thesis work.

Clinical Physiology (non-thesis option) - Students who specialize in clinical physiology (non-thesis option) must complete additional course work in advanced physiology and pathophysiology (NURS 581 & 582) and in cardiopulmonary clinical assessment and exercise prescription (Ex Sci 568). The nursing courses emphasize health care as it relates to cellular and systemic physiological responses in individuals in clinical populations. Students in the non-thesis option must complete at least four semester hours of seminar (Ex Sci 596), an on-site supervised clinical internship of no less than 225 hours (Ex Sci 590), and a written/oral defense of a graduate project relating to the clinical specialization. The minimum total credit requirement for this degree option is 37 credits.

Clinical or Experimental Physiology (thesis option) - Students who specialize in clinical or experimental physiology (thesis option) must complete advanced course work in statistics (Stat 512). Students in the clinical physiology specialization will take Ex Sci 568, Assessment and Prescription; whereas, students in the experimental physiology specialization will take Ex Sci 589, Research Techniques. Students who are academically deficient in biochemistry will be encouraged to choose electives in MBIOS 304 (laboratory course) and MBIOS 413. Students with undergraduate competency in biochemistry will choose two elective courses from the following: MBIOS 513, 514, NURS 581, NURS 582, MBIOS 401/501, 503, 504, 506, 540, 545, 549, FSHN 501, 531, 561, or other course work acceptable to the student's graduate committee. Students in the thesis option must complete at least four semester hours of seminar (Ex Sci 596), and a research thesis (Ex Sci 700). The minimum total credit requirement for this degree option is 36-37 credits.

The certificate in Exercise Science consists of 11 credits. Fulfillment of the certificate requires 2 credits in Ex Sci 596 (seminar), and the choice of 9 credits from the following courses: Ex Sci 563 (3 cr.), Ex Sci 565 (3 cr.), Ex Sci 567 (3 cr.), Ex Sci 568 (3 cr.). These courses provide a strong foundation for graduate studies in Exercise Science with emphasis in cellular and molecular mechanisms. Students completing the certificate may use 9 of the 11 credits toward a graduate degree in Exercise Science. Most likely, students will use non-seminar course work toward their degree program.

Applicants should have a bachelor's degree in exercise science, or in a related field with a GPA of 3.00 or better during the last half of undergraduate work.

Prerequisite course work for the M.S. degree and Graduate Certificate in Exercise Science includes undergraduate course work in exercise physiology; exercise prescription, exercise techniques/assessment, biomechanics (recommended), human anatomy, physiology, inorganic chemistry, organic chemistry, physics, and biochemistry (recommended). It is strongly recommended that applicants have earned a "B" grade or better in their prerequisite course work. Academic course deficiencies

will require additional course work prior to enrollment in graduate courses in exercise science.

Applicants to the M.S. degree must submit a letter of application stating their professional goals, three letters of recommendation from academic professors and/or clinical supervisors, and official transcripts from all colleges or universities attended. GRE scores are preferred, but not required.

Applicants seeking appointments as graduate assistants must submit a written request to the Academic Coordinator, Academic Affairs, WSU Spokane.

Exercise Science

Ex Sci

563 (Kin) Exercise and Immune Response 3 Rec Kin 463. Influence of physical exercise on immune response and consequent impact on host susceptibility to disease and infection.

565 (Kin) Muscle Physiology and Exercise Bioenergetics 3 Rec Kin 463. Bioenergetic, striated muscle metabolic, and neuroendocrine responses to exercise and training.

567 (Kin) Cardiopulmonary Exercise Physiology 3 Rec Kin 463. Pulmonary, circulatory, thermoregulatory, fluid balance, and physiological system integration responses to exercise and training.

568 (Kin) Clinical Assessment and Prescription 3 (2-2) Prereq Kin 463. Development of skills in testing analysis, and prescription for health-related fitness. Cooperative course taught by UI (PE 593), open to WSU students.

589 (Kin) Research Techniques 2 (1-3) or 3 (2-3) Application and use of research techniques and tools in physiology of exercise.

590 (Kin) Internship V 2-12 May be repeated for credit; cumulative maximum 12 hours. By interview only. Internship in educational, industrial, municipal or private sports or recreational setting; direct participation in tasks, research and reporting activities. S, F grading.

596 (Kin) Seminar 1 or 2 May be repeated for credit.

600 (Kin) Special Projects or Independent Study Variable credit. S, F grading.

700 (Kin) Master's Research, Thesis, and/or Examination Variable credit. S, F grading.

702 (Kin) Master's Special Problems, Directed Study, and/or Examination Variable credit. S, F grading.

Fine Arts

Degree Granted: Master of Fine Arts

GRADUATE FACULTY

C. S. Ivory, Chair; A. Christenson, J. R. Dollhausen, M. Forsyth, K. Haas, F. Ho, P. W. Siler, C. Watts

The Fine Arts Department offers the degree Master of Fine Arts. Since this is the terminal degree for student artists, students are required to complete from 52-60 hours in fine arts. Included in that total are 24-30 hours in the major area; 6-9 hours in a minor; 4 hours in art history; 6 hours in seminar and/or independent study (minimum of 2 hours in seminar) and 12 hours in thesis. The major consists of a coherent program of related courses within the area of either two-dimensional or three-dimensional art. Two-dimensional courses include drawing, printmaking, photography, electronic imaging, and painting. Three-dimensional courses include ceramics and sculpture. Unorthodox majors involving unusual media are subject to departmental approval. Facilities include: complete woodshop, foundry, oxy-acetylene and tig welding, wood and metal lathes, centrifugal casting, darkroom with a 32" Colex RA-4 color processor, etching and litho presses, Macintosh G3 Computer lab scanners, large format inkjet printers, three Olsen updraft kilns, salt kiln and Solder clay maker.

Admission material required by the Fine Arts Department includes a portfolio of 15 slides of the applicant's work, a complete set of official transcripts, and a statement indicating which area within the two- or three-dimensional group the student intends to specialize—i.e., sculpture, ceramics, painting, etc. Those applying for a teaching assistantship must furnish three letters of recommendation and also indicate in which

areas they are by training and experience most qualified to assist or teach. Accepted students are provided with private studios.

The Fine Arts Department selects students for admission into the MFA program once each year, in March. Applicants must complete their application to Graduate School by February 1. All application material must reach the Fine Arts Department no later than February 15. Financial aid in addition to teaching assistantships is available.

Students who wish to prepare for study leading to the Master of Fine Arts should have an undergraduate art major with 40 or more semester hours in art.

Of those applicants who meet the minimum requirements for admission to Graduate School approximately 20-25 percent are selected for admission into the Master of Fine Arts program.

Art History

F A

500 Graduate Art History 2 May be repeated for credit; cumulative maximum 6 hours. Prereq 9 hrs undergraduate art history.

Drawing

F A

510 Graduate Drawing 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

511 Graduate Drawing 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

512 Graduate Drawing 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

Painting

F A

520 Graduate Painting 3(0-6) May be repeated for credit; cumulative maximum 9 hours.

521 Graduate Painting 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

522 Graduate Painting 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

Electronic Imaging

F A

530 Graduate Electronic Imaging 3 (0-6) May be repeated for credit; cumulative maximum 9 hours. Application of image/text, electronic drawing, Internet projects, multimedia other aspects of electronic tools.

531 Graduate Electronic Imaging 3 (0-6) May be repeated for credit; cumulative maximum 9 hours. Advanced research in projects relating to electronic tools.

532 Graduate Electronic Imaging 3 (0-6) May be repeated for credit; cumulative maximum 9 hours. Exploration of experimental techniques, concepts and studies using electronic technology.

Ceramics

F A

540 Graduate Ceramics 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

541 Graduate Ceramics 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

542 Graduate Ceramics 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

Sculpture

F A

550 Graduate Sculpture 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

551 Graduate Sculpture 3(0-6) May be repeated for credit; cumulative maximum 9 hours.

552 Graduate Sculpture 3(0-6) May be repeated for credit; cumulative maximum 9 hours.

Printmaking

F A

570 Graduate Printmaking 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

571 Graduate Printmaking 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

572 Graduate Printmaking 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

Photography

F A

580 Graduate Photography 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

581 Graduate Photography 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

582 Graduate Photography 3 (0-6) May be repeated for credit; cumulative maximum 9 hours.

Special Topics, Seminars and Thesis

F A

598 Graduate Seminar V 1-2 May be repeated for credit; cumulative maximum 6 hours. Topics in contemporary issues theory and criticism.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis and/or Examination Variable credit. S, F grading.

Food Science and Human Nutrition

Degrees Granted: Master of Science in Food Science; Master of Science in Human Nutrition, Doctor of Philosophy (Food Science)
(For information about the PhD in Nutrition, see section on 'Nutrition')

GRADUATE FACULTY

T. D. Shultz, Chair; B. K. Baik, K. A. Beerman, S. N. Butkus, S. Clark, R. H. Dougherty, M. Edlefsen, C. G. Edwards, V. N. Hillers, D. Kang, L. K. Massey, A. R. McCurdy, M. K. McGuire, J. R. Powers, B. Rasco, J. A. Shultz, S. E. Spayd, B. J. Swanson

The Department of Food Science and Human Nutrition offers graduate programs leading to the degrees Master of Science in Food Science, Master of Science in Human Nutrition, and the Doctor of Philosophy (Food Science). The Department also participates in the graduate program in Nutrition (PhD in Nutrition). Graduate programs are developed to meet individual goals and prepare students for their chosen profession.

Central research facilities at Washington State University provide opportunities to become competent in statistics, computer science, ionizing radiation, state-of-the-art instrumentation, laboratory nutrition, and the practical aspects of food service systems, and the processing of dairy, cereal, fruit and vegetable products. Modern departmental research laboratories are well equipped for chemical, physical and microbiological analyses, and for human metabolic studies.

Graduate work towards an MS or PhD degree in Food Science utilizes conceptual knowledge and an understanding of mathematics, engineering principles, biological and physical sciences in research of the handling, processing, preservation, quality assurance, and marketing of foods and provides opportunities for the food scientist to develop the ability to formulate creative ideas and generate new information.

Food Science students may prepare themselves for basic and applied food research, food product technology, production design and development, quality assurance, sensory evaluation, business management, marketing, technical sales, and creative technical writing positions in the food industry, academic institutions or regulatory and consumer service agencies.

Undergraduate training in quantitative and organic chemistry, biochemistry, microbiology, physics, mathematics, and human nutrition is recommended for prospective students. Knowledge of the agricultural sciences, economics and business management or engineering may be desirable for graduate students entering food science programs.

For students interested in the MS and PhD degrees in Food Science, and are residents of one of the following states (Alaska, Arizona, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, South Dakota, Oregon, Utah, Washington, and Wyoming), please con-

tact the department for in-state tuition opportunities through the Western Interstate Commission for Higher Education (WICHE) program.

The requirements of the Master of Science in Human Nutrition include formal coursework in foods and nutrition, as well as appropriate courses from other departments. Courses and research may emphasize one of three areas: foods, human nutrition or food systems management. The nature of the research may vary. There is laboratory research emphasizing the physical and biological sciences. Studies related to community nutrition, public health, and nutrition education are also possible. While these latter kinds of research are based on sound nutritional information, social science courses may be taken as supporting coursework.

Persons holding a bachelor's degree in nutrition or a related field can pursue graduate study with an emphasis in foods and nutrition. Prerequisites for graduate work will be related to the area of emphasis in which the student is interested.

Students applying for admission should submit WSU application, official transcripts, Graduate Record Examination (GRE) scores, TOEFL score of 550+ for those whose English is not their native language, three letters of recommendation, and a letter of interest. The program web address is <http://fshn.wsu.edu/>.

Food Science and Human Nutrition

FSHN

- 501 Topics in Food Science and Human Nutrition** V 1-3 May be repeated for credit; cumulative maximum 6 hours. Selected topics in food science and technology. Credit not granted for both FSHN 401 and 501.
- 504 Advanced Human Nutrition** 4 Prereq graduate standing. Scientific basis of human nutrient requirements, dietary allowances and assessment techniques. Cooperative course taught by WSU, open to UI students (FCS 514).
- 508 Seminar—Written** 2 May be repeated for credit. Planning, writing, reporting, reviewing and evaluating current food related research.
- 509 Seminar—Oral** 1 May be repeated for credit. Development of skills and communication tools and techniques for oral presentations of current food science and human nutrition research.
- 510 Advanced Food Chemistry** 3 Rec biochemistry, food chemistry. Chemical, physical, and toxicological properties of water, vitamins, pigments, synthetic colors, minerals, miscellaneous food additives, and natural toxicants. Cooperative course taught by WSU, open to UI students (FST 510).
- 511 Food Carbohydrates, and Lipids** 3 Rec biochemistry, food chemistry. Occurrence structure, chemical and physical properties, and functions of carbohydrates and lipids, in foods. Cooperative course taught by WSU, open to UI students (FST 512).
- 512 Food Proteins and Enzymes** 2 Rec biochemistry, food chemistry (FSHN 460). Chemistry/biochemistry of proteins/enzymes applied to food research and industry; protein functionality/enzyme technology application to industry. Cooperative course taught by WSU, open to UI students (FST 513).
- 513 Mineral and Vitamin Metabolism** 4 Same as A S 513.
- 520 Research Methods in Behavioral Nutrition** 3 Prereq FSHN 130 or 233; Rec FSHN 426 or 436; statistics course. The application of behavioral theories and qualitative/quantitative methods of data collection to behavioral nutrition research. Cooperative course taught by WSU, open to UI students (FCS 520).
- 521 Research Techniques in Human Nutrition** 3 (1-6) Rec 6 hrs upper-division nutrition. Methods of conducting field, applied and metabolic studies in human nutrition.
- 526 Advanced Community Nutrition** 3 Prereq 300-400 level nutrition course; by interview only. Components of community nutrition programs-needs assessment, planning, intervention, evaluation; application of concepts to case studies. Cooperative course taught by WSU, open to UI students (FCS 526).
- 530 Prenatal, Infant and Child Nutrition** 2 Prereq graduate standing. Nutrition of the mother and fetus during pregnancy and of the child from infancy through childhood.
- 531 Nutrition and Aging** 2 Rec 300-400 level nutrition course. Assessment, evaluation, and treatment of nutritional problems of the aged.

533 Pathophysiology of Human Nutrition 3 Prereq BC/BP 364; FSHN 435. Protein, fat, carbohydrate and other nutrient pathophysiology in the development and treatment of major human diseases.

538 Readings in Foods and Nutrition 2 Prereq FSHN 480 or c//. Reports, discussions and reviews of recent scientific literature and development in foods and food systems management. Credit not granted for both FSHN 438 and 538.

540 Advanced Clinical Practice 3 (0-9) Prereq FSHN 435, 437; instructor's permission. Application of diet therapy principles to development of nutrition interventions and care plans in a clinical practice setting.

561 Sports Nutrition 3 By interview only. Macronutrient and selected micronutrient utilization during exercise and restoration after feeding, dietary surveys of athletes, dietary ergogenic aids and discussion of the origins of dietary recommendations for athletes. Cooperative course taught by UI (FCS 561), open to WSU students.

570 Advanced Food Technology 3 Prereq FS 416,433 or c//. Physical principles of food preservation and recent advances in food technology. Credit not granted for both FSHN 470 and 570. Cooperative course taught by WSU, open to UI students (FST 570).

575 Supervised Practice V 2-18 May be repeated for credit; cumulative maximum 18 hours. Rec by interview only. Professional supervised experience in administrative, clinical, and community dietetics; meets American Dietetic Association requirements for registration eligibility. S, F grading.

582 Food Process Engineering Design 3 Same as BSysE 582.

583 Advances in Cereal Science and Technology 2 Prereq BC/BP 364. Background information; review of recent advances; relation to processing; use properties and marketing.

598 Foods/Nutrition Practicum V 1 (0-3) to 4 (0-12) May be repeated for credit; cumulative maximum 4 hours. By interview only. Professional level supervised field experience in food and/or nutrition. S, F grading.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis, and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Foreign Languages and Cultures

Degree Granted: Master of Arts in Foreign Languages and Literatures

Graduate Faculty

E. R. Gonzalez, Chair; Z. Dong, J. Grenier-Winther, R. J. Halverson, E. F. Hartman, B. M. Ingemanson, F. Manzo-Robledo, A. M. Rodriguez-Vivaldi

The Department of Foreign Languages and Cultures offers a graduate program leading to the degree of Master of Arts in Foreign Languages and Cultures, with emphasis in Spanish.

The Department offers a non-thesis program for the master's degree. Language, literature, culture and pedagogy are stressed. Undergraduates with majors in foreign languages (or equivalent preparation) will be admitted to the program if they meet the minimum requirements of the Graduate School. Candidates are required to take advanced courses in their field and to show ability to do scholarly research. A minimum of 30 credit hours must be earned by candidates for the master's degree. Teaching assistants on two-year appointments (maximum allowed) will average 48 credit hours. Graduates have been successful as doctoral candidates at major universities throughout the United States, as teachers in secondary schools and colleges, and as advisers to international programs. Many students find an advantage in combining graduate training in a foreign language with training in another field, such as education, library science, business or law.

Graduate students may be selected to participate for a semester in an exchange program with the Universidad de las Americas in Puebla, Mexico. Scholarships support participation in professional conferences, training workshops and other professional opportunities.

Foreign Language

For L

- 540 (Methods of Teaching Foreign Languages 3** Prereq two years foreign language. Survey of current methodology with emphasis on practical application in the classroom. Credit not granted for both For L 440 and 540.
- 541 Research Methods of Technology** Enhanced Foreign Language Learning 3 Research and methods of the use of technology and computers to enhance foreign language instructions and second language acquisition. Credit not granted for both For L 441 and 541.
- 542 Research and Methods of Teaching Foreign Culture 3** Current research and theory-based methods for teaching culture in the foreign language classroom.
- 560 (597) Seminar in Scholarly Methodology 2** Bibliography and formal aspects of scholarly writing; general introduction to literary criticism.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.

Spanish

Span

- 550 (520) Medieval Literature 3** Prereq graduate standing or permission of instructor. Selected works. Taught in Spanish.
- 551 (522) Seminar in Golden Age Literature 3** Prereq graduate standing or permission of instructor. Reading and discussion of representative works of the Spanish Golden Age. Taught in Spanish.
- 552 (524) Topics in Nineteenth-Century Spanish Literature 3** May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing or permission of instructor. Selected works and topics. Taught in Spanish.
- 553 (525) Topics in Twentieth-Century Spanish Literature 3** May be repeated for credit; cumulative maximum 6 hours Prereq graduate standing or permission of instructor. Selected works and topics. Taught in Spanish.
- 554 (527) Seminar in Spanish Literature and/or Culture V 1-3** May be repeated for credit.
- 555 (533) Seminar in Colonial Spanish American Literature 3** May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Seminar on conquest and colonial literature in Hispanic America.
- 556 (534) Seminar in Nineteenth-Century Spanish American Literature 3** May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Study of nineteenth-century Spanish American Literature.
- 557 (535) Seminar in Twentieth-Century Spanish American Literature 3** May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Study of twentieth-century Spanish American literature and culture.
- 559 (547) Special Topics in Hispanic Studies/ or Linguistics V 1-3** May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Special interdisciplinary topics in Hispanic studies and/or Linguistics.
- 560 (540) Beginning Instructional Practicum 2** Prereq graduate standing. An introduction to foreign language instruction for beginning teaching assistants
- 561 (542) Advanced Instructional Practicum 1** May be repeated for credit; cumulative maximum 4 hours. Supervised practical experience in foreign language teaching. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study and/or Examination** Variable credit. S, F grading.

Forestry and Range Management

(See Natural Resource Sciences)

Genetics and Cell Biology

(See Molecular Biosciences)

Geology

Degrees Granted: Master of Science in Geology; Doctor of Philosophy

GRADUATE FACULTY

P. B. Larson, Chair; R. Allen-King, E. J. Brook, F. F. Foit, D. R. Gaylord, C. K. Keller, L. D. Meinert, M. C. Pope, P. E. Rosenberg, J. D. Vervoort, A. J. Watkinson, J. A. Wolff

The Department of Geology offers programs of graduate study and research leading to the degrees Master of Science in Geology and Doctor of Philosophy. Graduate students select one of five major areas in which to specialize: 1) ground water geology-hydrology, 2) mineral deposits, 3) mineralogy-petrology-geochemistry, 4) sedimentology-stratigraphy, 5) structural geology-tectonics. Each program has a core of required courses and a large selection of elective courses. Choice of elective courses within a program is based on the research interests of the student. Informal program seminars and field trips foster student-faculty interaction and an awareness of current trends in geological research.

The Department is housed in a 12-story teaching and research complex. Research facilities include a state of the art analytical geochemistry laboratory with an X-ray fluorescence spectrometer, electron microprobe, and 3 inductively coupled plasma mass spectrometers (ICP-MS); quadrupole, high resolution magnetic sector and multicollector; for analysis of isotope ratios, major and trace elements in a wide variety of geologic materials. Additionally there is a clean room for performing low-level chemical separations. Our stable isotope ratio laboratory comprises a gas-source mass spectrometer with water auto-equilibrator and microsampling apparatus including a laser fluorination line. A Fourier transform infra-red spectrometer, an X-ray powder diffractometer and facilities for gas chromatography, fluid inclusion research and preparation of thin and polished rock sections are also available. These laboratories are maintained by a staff of highly trained technicians. Other research equipment includes modern petrographic and ore microscopes, microscopes equipped for reflected light photometry and cathodoluminescence, and mineral separation apparatus. Facilities for analysis of natural and contaminated waters include an ion chromatograph, atomic absorption/flame emission and inductively coupled plasma/atomic emission spectrometers, a gas chromatograph with thermal conductivity, flame ionization, and electron capture detectors and a carbon analyzer. A drilling rig and various field and lab facilities are used for hydrogeologic and vadose-zone monitoring and experimentation. A handheld gamma ray scintillometer, a microdrill for stable isotopes and a laser diffractometer particle size analyzer are available for stratigraphic and sedimentologic studies. University facilities are also available for neutron activation analysis, electron microscopy and mass spectrometry. Information Technology is available for departmental use in addition to the Department's micro-computer laboratory with digitizing boards, scanners and slide duplicators.

The university, situated on the Columbia River basalt plateau adjacent to the Idaho batholith, and close to the highly deformed and mineralized rocks of northeast Washington, Idaho, and British Columbia and the sedimentary rocks of the Northwest.

A student wishing to pursue graduate study in geology at Washington State University should have completed or should plan to take without graduate credit, the following: 34 semester hours of undergraduate courses in geology including physical and historical geology, mineralogy, optical mineralogy, petrology, structural geology, a six-week course in geological field methods; one year of general physics, one year of general chemistry and mathematics through the first semester of calculus. A solid background in mathematics and physical chemistry is of increasing importance to graduate study in geology.

The requirements for the degree of Master of Science in Geology include 21 semester hours of approved graded coursework and a thesis. A non-thesis Master of Science degree option requiring 30 hours of approved graded coursework plus an additional 4 credit special project (Geology 702) is also available. The requirements for the degree of Doctor of Philosophy conform to the general requirements of the Graduate School. Assuming one-half time employment, normal completion times for graduate degrees are: Master of Science, 2 calendar years; PhD 3 calendar years with previous MS and 4 calendar years without previous M.S.

Students applying for admission should submit official transcripts, Graduate Record Examination scores and three letters of recommendation. If English is not your native language TOEFL scores must also be submitted. Successful applicants for the graduate program typically have GPAs above 3.0 and GRE scores above the 50th percentile.

Geology

Geol

- 505 Geophysics 4** (3-3) Prereq Geol 340. Theory and application of geophysical methods for hydrology, environmental, engineering, exploration, and structural geology; review of techniques. Credit not granted for both Geol 405 and 505.
- 511 Advanced Topics in Paleontology 3** Prereq Geol 310,320. Advanced problems and new techniques in paleontology from current literature. Cooperative course taught by WSU, open to UI students (Geol 511).
- 515 Paleocology 3** Ecological dynamics as applied to the paleontological record; preservation constraints; animal-sediment interactions; organisms' role in the relative time scale. Field trip required. Cooperative course taught by UI (Geol 515), open to WSU students.
- 520 Advanced Topics in Sedimentary Rocks 3** (2-3) May be repeated for credit; cumulative maximum 6 hours. Prereq Geol 320. Modern aspects of sedimentary rocks. Cooperative course taught by WSU, open to UI students (Geol 520). Field trip required.
- 521 Clastic Depositional Systems 3** (2-3) Prereq Geol 320. Clastic sedimentary environments, architectural element and facies analysis. Cooperative course taught by WSU, open to UI students (Geol 528). Field trip required.
- 523 Advanced Topics in Stratigraphy 3** May be repeated for credit. Prereq Geol 421. Cooperative course taught by WSU, open to UI students (Geol 523).
- 525 Carbonate Depositional Systems 3** (2-3) Prereq Geol 320. Modern carbonate environments and processes; ancient carbonate rock sequences; carbonate platform-to-basin transition; diagenesis of carbonate rocks. Field trip required. Cooperative course taught by WSU, open to UI students (Geol 529).
- 526 Geological Engineering Principles 3** Prereq graduate standing. Application of geology to solution of engineering problems; emphasis on selection of rock and soil parameters for use in design analysis. Credit not granted for both Geol 426 and 526.
- 527 Sedimentary Petrography 3** (1-4) Description and classification of sedimentary rocks in thin sections and hand specimens. Field trip required. Cooperative course taught by UI (Geol 527), open to WSU students.
- 529 Geologic Development of North America 3** Prereq Geol 310, 421. Tectonic, magnetic, and sedimentary sequence studies of North American continent through time; concepts of metal and petroleum enrichment related to time and geological processes. Field trip required. Cooperative course taught by UI (Geol 532), open to WSU students.
- 540 Tectonics 3** Prereq Geol 340. Nature and origin of the earth's major tectonic features. Cooperative course taught by WSU, open to UI students, (Geol 548).
- 541 Structural Analysis 3** (2-3) Prereq Geol 340. Structural analysis of complexly deformed rocks in orogenic belts. Field trip required. Cooperative course taught by WSU, open to UI students (Geol 541).
- 542 Geomechanics 3** Concepts of fracture mechanics as applied to the origin and evolution of faults, joints, dikes, sills, veins, and solution surfaces. Field trip required. Cooperative course taught by UI (Geol 542), open to WSU students.
- 546 Fault Mechanics 3** Prereq Geol 340 or equivalent. Examination of fault mechanics; internal fault architectures; fault slip distributions; relationship to rock properties; echelon fault systems; as well as earthquake behavior and seismic hazard recognition. Field trip required. Cooperative course taught by UI (Geol 546), open to WSU students.
- 550 Advanced Mineralogy 3** Prereq Geol 355; Chem 106. Elements of crystal chemistry and crystal physics. Cooperative course taught by WSU, open to UI students (Geol 550).
- 551 Ore Microscopy and Fluid Inclusion Analysis 3** (0-9) Prereq Geol 355, 470. Ore and alteration mineralogy of major ore deposits; mineral identification textural interpretation, sample preparation, photomicrography, fluid inclusion analysis. Field trip required. Cooperative course taught by WSU, open to UI students (Geol 551).
- 552 X-Ray Analysis in Geology 3** (2-3) Generation and use of X-rays for geological research; electron microprobe/SEM, X-ray fluorescence and X-ray powder diffraction. Cooperative course taught by WSU, open to UI students (Geol 552).
- 554 Physical Petrology 3** Prereq Geol 356. The applications of continuum mechanics and fluid dynamics to the generation, rise, storage, and eruption of magmas. Cooperative course taught by UI (Geol 554), open to WSU students.
- 557 High-Temperature Aqueous Geochemistry 1 3** (2-3) Prereq Chem 331, Geol 582; or by interview only. Application of solution chemistry to hydrothermal solutions; Eh-PH, log f(O₂)-pH, activity-activity diagrams; estimation techniques; water structure; metal complexation; solubility, transport and deposition; equilibrium speciation; geothermal fields; experimental methods, activity coefficients. Cooperative course taught by UI (Geol 557), open to WSU students.
- 558 High-Temperature Aqueous Geochemistry II 3** Prereq Chem 331, Geol 557, 582; or by interview only. Expands on topics covered in Geology 557 through seminar format; selected readings from primary literature followed by presentations and discussions in class. Cooperative course taught by UI (Geol 558), open to WSU students.
- 559 Geodynamics 3** Graduate-level counterpart of Geol 459; additional requirements. Credit not granted for both Geol 459 and 559. Cooperative course taught jointly by WSU and UI (Geol 459/559).
- 560 Advanced Igneous Petrology 3**(2-3) Origin, evolution, and tectonic significance of igneous rocks. Field trip required. Cooperative course taught by WSU, open to UI students (Geol 560).
- 561 Advanced Topics in the Geochemistry of Hydrothermal Ore Deposits 3** Advanced study of geochemical aspects of the formation of an environmental impact of metallic ores of hydrothermal origin; selected readings and presentations. Field trip required. Cooperative course taught by UI (Geol 577) open to WSU students.
- 563 Igneous Petrogenesis 3**(2-3) Prereq Geol 356. Chemical and petrologic techniques used to interpret the origin and evolution of igneous rocks. Cooperative course taught by WSU, open to UI students (Geol 563).
- 565 Biogeochemistry and Global Change 4** (3-1) Same as ES/RP 565.
- 567 Volcanology 3** (2-3) Prereq Geol 356. Eruption mechanisms, volcanic processes and landforms, and volcanic deposits. Field trips required. Cooperative course taught by UI (Geol 567), open to WSU students.
- 569 Field Methods in Hydrogeology 2** (1-3) Prereq Geol 475; Geol 577 or 579. Theory and practice of acquisition of hydrogeologic data, emphasizing design and execution of field experiments.
- 570 Advanced Topics in Hydrogeology V 1-4** May be repeated for credit; cumulative maximum 9 hours. Prereq Geol 475. Topics may include organic, inorganic contaminant fate, recharge, carbon cycling, isotope applications. Cooperative course taught by WSU, open to UI students (Geol 571).
- 571 Geochemistry of Hydrothermal Ore Deposits 3** (2-3) Prereq Geol 470. Ore formation in hydrothermal environments; sulfide mineral stability, water/rock interactions, and stable isotope relationships to altered rocks. Field trip required. Cooperative course taught by WSU, open to UI students (Geol 571).
- 573 Advanced Topics in Economic Geology 2** May be repeated for credit. Prereq Geol 470. Ore-forming process or deposit type combining literature synthesis, theoretical evaluation and field trip inspection. Cooperative course taught by WSU, open to UI students (Geol 573). Field trip required.
- 574 Advanced Remote Sensing 3** (1-4) Same as Soils 574.
- 575 Seminar in Remote Sensing 1** Same as Soils 575.
- 576 Fundamentals of Modeling Hydrogeologic Systems 3** prereq Hydr 583, Math 275, or permission of instructor. Development and application of models representing physical systems, with emphasis on groundwater flow; basic equations of potential flow; properties assignment; parameter sensitivity; dimensional analysis. Cooperative course taught by UI (Hydr 576), open to WSU students.
- 577 Advanced Groundwater Hydraulics 3** Same as C E 577.

- 579 Groundwater Geochemistry** V 2-4 May be repeated for credit; cumulative maximum 4 hours. Prereq Chem 331; Geol 475. Organic and inorganic aqueous geochemistry; controls on groundwater contaminant fate. Cooperative course taught by WSU, open to UI students (Hydro 566).
- 582 Petrologic Phase Equilibria** 3 Prereq graduate standing. Thermodynamics and graphical analysis of phase equilibria in igneous and metamorphic rock systems.
- 583 Radiogenic Isotopes and Geochronology** Radiogenic isotopes and their uses as chronometers and as tracers of earth evolution and differentiation. Graduate level counterpart of Geol 483; additional requirements. Credit not granted for both Geol 483 and 583. Cooperative course taught jointly, open to UI students (Geol 483).
- 584 Principles of Stable Isotope Geochemistry** 3 Principles and applications of isotope geochemistry in the geologic sciences. Cooperative course taught by WSU, open to UI students (Geol 584).
- 588 Isotope Geology** 4 Prereq Geol 480. Geologically useful radioactive isotopes; geochronology and isotopes as tracers. Cooperative course taught by UI (Geol 588), open to WSU students.
- 591 Remote Sensing and Geologic Applications** 3 (2-3) Prereq Geol 340; Phys 102 or 202. Remote sensing techniques and their utilization in geologic studies, air photos, radar IR and landsat imagery used. Field trip required. Credit not granted for both Geol 491 and 591.
- 592 Advanced Topics in Structural Geology** V 1-4 May be repeated for credit; cumulative maximum 6 hours. Advanced topics across normal subject boundaries. Cooperative course taught by WSU, open to UI students (Geol 592).
- 593 Advanced topics in Geomechanics** V 1-4 Advanced treatment of current topics in geomechanics and related disciplines such as structural geology, hydrogeology, engineering geology. Cooperative course taught by UI (Geol 593), open to WSU students.
- 597 Advanced Topics in Geology** V 1-4 May be repeated for credit; cumulative maximum 6 hours. Topics of current interest in geology.
- 598 Graduate Seminar** 1 May be repeated for credit; cumulative maximum 4 hours. Prereq graduate student in Geol or related field. Papers presented by students, faculty, and visiting scientists on geological research. Credit not granted for both Geol 498 and 598. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable Credit. S, F grading.

Health Policy and Administration

Degrees Granted: Master of Health Policy and Administration

GRADUATE FACULTY

W. C. Schmidt, Chair; M. M. Ahern, J. S. Coyne, M. S. Hendryx, J. J. Kennedy, D. A. Sclar, T. L. Skaer

The Department of Health Policy and Administration in the College of Pharmacy offers the Master of Health Policy and Administration (HPA) degree at WSU Spokane. The Health Policy and Administration Program's mission is: (1) to prepare working students in metropolitan Spokane, eastern Washington, and the Inland Northwest region, and excellent students nationally interested in healthier communities, for a variety of professional health services management positions, and (2) to contribute to community health services enhancement and community health policy development through education, applied research, and service. A core value of the HPA Program and its faculty is to prepare health services managers with the knowledge, skills and values to exercise professional leadership and promote healthier communities.

The 50 credit hour curriculum includes: introductory courses (Introduction to the Health Care System; Health Care Policy and Politics; Law and Ethics of Health Management; Government Regulation of Health Services; Health Care Cost Accounting); core courses (Health Care

Economics; Health Care Finance; Health Management Decision Science; Health Care Management; Health Quality Management; Research and Evaluation Methods; Health Care Information Systems); electives; 3 credit internship; 3 credit capstone course, Strategic Management and Marketing; and 3 credit graduate project or optional 5 credit thesis.

Basic knowledge of statistics, microeconomics, financial accounting, and computer skills (word processing, spreadsheet) are prerequisites for the required courses. Computer assisted programs and a listing of area classes satisfying the prerequisites are available from the Program.

Admission standards conform to the requirements of the WSU Graduate School. An undergraduate grade point average of 3.0 or better is expected. In addition, GRE or GMAT scores are required for admission to the HPA Program, except for applicants holding a professional doctoral degree (e.g., M.D., J.D., D.D.S.) or Ph.D. from a U.S. accredited school. Significant weight is given to the GRE aptitude (verbal and quantitative combined) total scores of at least 1000, or a GMAT aptitude score of at least 500. However, indications of academic ability as expressed by undergraduate grade point average and professional experience are of greater importance than specific undergraduate background and GRE or GMAT scores.

The Graduate Degree Program in Health Policy and Administration is accredited by the Accrediting Commission on Education for Health Services Administration (ACEHSA). According to the Association of University Programs in Health Administration (AUPHA) Directory of Programs, "ACEHSA is recognized by the Council for Higher Education Accreditation (CHEA) which oversees accreditation of the nation's colleges and universities, and by the Department of Accreditation by ACEHSA is the most important assurance that a graduate program meets the quality standards developed by the profession and the health services industry."

The Master of Health Policy and Administration program is also admitted to the Western Interstate Commission for Higher Education (WICHE) Western Regional Graduate Program (WRGP). According to WICHE, the Western Regional Graduate Program "consists of very high quality master's and doctoral degree programs which tend not to be widely available throughout the West." Admission of the HPA Program means that residents of Alaska, Arizona, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming are eligible to enroll at Washington resident rates of tuition.

To be admitted to WRGP, the HPA Program had to meet criteria of distinctiveness and demonstrated quality. According to WICHE, "WRGP is particularly strong in two areas: programs targeted to the emerging social, environmental, and resource development needs of the West, and innovative interdisciplinary programs. Programs are nominated by their institutions and subjected to an extensive peer review process by other graduate institutions in the western states."

Criteria for WRGP selection include:

- Be a program of high quality and demonstrate strength in terms of faculty, curriculum, library or other resources, student enrollments and placements, or other factors.
- Be distinctive with respect to total program, specialization, or resources, and fill a need not met by more than three other (four total) programs in the participating states.
- Enjoy strong institutional support and the expectation of continued support.

The WSU Health Policy and Administration program is the only health administration program admitted to WRGP of the four ACEHSA-accredited programs in the WRGP region.

Students should apply for admission to WRGP through the regular admissions process and identify themselves as "WICHE WRGP" applicants. Students should be a resident of one of the 14 participating states for one year before applying as a WRGP student. "Part-time students are eligible to participate in WRGP if they have been admitted to a WRGP program."

The department web address is <http://www.hpa.spokane.wsu.edu/>.

Health Policy and Administration

HPA

500 Introduction to the Health Care System 3 Orientation to history and organization of the health care system.

501 Health Care Policy and Politics 3 History, methods, results and evaluation of health-care-related policy and politics.

- 502 Law and Ethics of Health Management** 3 Private health law and ethics, including professional liability, relationship of physician and patient, malpractice reform, health institutions, and health access.
- 503 Government Regulation of Health Services** 3 Prereq graduate standing. Public law regulation: health care quality, personhood and individual autonomy, life/death decisions, antitrust, health care financing and cost control.
- 509 Health Care Economics** 3 Prereq microeconomics. The economics of allocating, financing and delivering medical care services.
- 510 Health Care Cost Accounting** 3 Prereq basic financial accounting; graduate standing. Basic cost-accounting concepts, principles, and applications in the health care setting.
- 511 Health Care Finance** 3 Prereq HPA 512. Aspects of health care financial management fundamentals and managerial accounting for strategic financial management.
- 512 Health Management Decision Science** 3 Prereq HPA 510. Application of decision science technology to risk-analysis problems in healthcare for both investor-owned and non-profit entities.
- 515 Health Care Management** 3 Introduction to the knowledge, skills, health and values associated with the practice of health management.
- 516 Health Quality Management** 3 Overview of the total field of health quality, including strategic quality management programs, quality assurance, quality control, and design.
- 520 Research and Evaluation Methods** 3 Prereq statistics. Basic research and evaluation methods for health care professionals
- 530 Health Care Information Systems** 3 Key attributes of health care information systems and their evolution in health care environment.
- 570 Marketing for Health Care Organizations** 3 Prereq graduate standing. Basic marketing concepts, principles, and issues related to marketing public and private health care.
- 571 Managed Care/Integrated Delivery Systems** 3 Prereq HPA 500, 511. Business, regulatory and liability issues in field of managed care.
- 572 Health Care Ethics** 3 Ethical issues affecting health care institutions, professionals and consumers.
- 573 Comparative International Health Care** 3 Analysis of key attributes of health care in selected countries and comparisons with the US health care system.
- 574 Rural Health Care in America** 3 The unique characteristics, professional opportunities, problems and reform alternatives in rural health care.
- 575 Aging and Long-term Care Administration** 3 Introduction to issues in population aging and requirements for administration of aging and long-term care programs.
- 576 Managing Change for Healthier Communities** 3 Prereq graduate standing. Prepares health leaders for managing change to create healthier communities through understanding determinants of health and implications of collaborative approaches.
- 577 Women's Health: Social, Psychological, and Physiological Issues** 2 Contemporary issues in women's health focusing on physiological, social and psychological aspects.
- 578 Innovative Leadership and Management** 3, 4 (3-3), or 5 (3-6). Same as Nurs 513.
- 579 Mental Health Policy and Law** 3 Professions regulation, negligence, consent, privacy; civil commitment, treatment rights, guardianship, trial competency, insanity defense, sex offenders, execution capacity, entitlements, discrimination.
- 590 Strategic Management and Marketing** 3 Prereq HPA 511, 515. Key components and processes in strategic planning.
- 596 Seminar in Health Policy** V 1-3 May be repeated for credit; cumulative maximum 9 hours. Major problems and research issues in health policy through dialogue among students and experts.
- 597 Internship** V 1-5 May be repeated for credit; cumulative maximum 5 hours. Prereq HPA 500. Student experience in professional work settings. S, F grading.
- 599 Special Topics in Health Policy and Administration** V 1-3 May be repeated for credit; cumulative max. 9 hrs.
- 600 Special Projects or Independent Study** Variable credit. S, F grading
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.

- 702 Master's Special Problems, Directed Study and/or Examination**
Variable credit. S, F grading.

History

Degrees Granted: Master of Arts in History; Doctor of Philosophy

GRADUATE FACULTY

R. Schlesinger, Chair; S. M. H. Armitage, D. L. Ashby, D. L. Coon, B. Farley, C. Goucher, J. B. Gough, P. W. Hirt, R. L. Hume, S. D. Kale, N. Kawamura, J. E. Kicza, L. Mercier, S. Peabody, J. Peterson, H. Streets, R. Sun, O. J. Svingen, M. A. Tolmacheva, R. S. Williams

The Department of History offers graduate study leading to the degrees of Master of Arts in History and Doctor of Philosophy. It also cooperates with other departments sponsoring the Program in American Studies leading to the degrees of Master of Arts and Doctor of Philosophy (American Studies) and by providing appropriate course, seminar, and dissertation work. The fields of study from which individual programs for all degrees may be developed include: American, East Asian, Environmental, European (including early and modern), Latin American, Middle Eastern, World, Women's, and Public History.

Studies leading to the degree of Doctor of Philosophy offer three emphases—the traditional program, the Public history track, and the World history track. The traditional program and the World history track are designed to prepare competent research-oriented scholars who also will be effective and skilled teachers. It consists of 72 credit hours beyond the bachelor's degree, including the preparation of three fields of history (one primary and two minor fields). The Public history track prepares historians for research-oriented work and service in government, business, and academe. It consists of 72 hours beyond the bachelor's degree, including a major field in American history, a co-equal primary field in public history (including interdisciplinary work in such areas as historic preservation, museology, archival and records management, and cultural resource management), and one minor field of history. Doctoral candidates with a concentration in Public history will serve an internship of at least one semester or two summers. Students in all three programs must demonstrate a reading knowledge of one foreign language. Applicants should hold an MA in History with at least a 3.50 GPA. Applicants must submit Graduate Record Examination aptitude scores and must demonstrate that a substantial beginning has been made in preparing foreign language competency. Three letters of recommendation from professors, supervisors, and others familiar with the applicant's academic training and/or occupational experience, statement of purpose, writing sample, language form, and field of study form are required.

The degree of Master of Arts in History may be sought by those who are interested ultimately in study for the Doctor of Philosophy degree as well as by teachers, public historians, and others who intend it as their final training in history. A baccalaureate degree with a 3.3 undergraduate GPA over the last half of undergraduate studies, submission of Graduate Record Examination aptitude test scores, and three letters of recommendation from professors, statement of purpose, writing sample, language form, and field of study form are required for admission. It is recommended that applicants have a minimum of 12 upper-division credits of history distributed in at least two world areas and have training in a foreign language. The language requirement, if any, will be established by the major professor in consultation with the student. Candidates may elect either the thesis or non-thesis option. The program consists of 32 credit hours beyond the bachelor's degree, including courses from two fields of history, at least one seminar, and two field courses, a general historiography course, and a final oral examination. Public history candidates will serve an internship of at least one summer in duration.

The University Library provides the basic monographic studies, general histories, and journal literature required in each of the general fields of history emphasized at Washington State University. The resources for research, in addition, are extensive and include foreign and domestic newspapers, United States government and United Nations published documents, and the parliamentary papers of the French, German, English, and Italian governments. The most important serial publications of the major powers dealing with the diplomacy connected with World Wars

I and II are available also. Latin American documentation includes a large collection of eighteenth-century Mexican papers and letters. Materials pertaining to modern China include the most important published documentary and letter collection dealing with late nineteenth and early twentieth-century political and economic modernization. Among the materials on the United States are the microfilmed American Culture Series dealing with the colonial period, and the American Periodical Series, which contains all extant magazines and journals published between 1800 and 1850. The collected papers of all major American public figures are added as they are published. Extensive microfilm holdings from the Department of State Archives to 1929 and publications of the Department of State and other administrative agencies of the Federal Government are also available. The Manuscripts, Archives and Special Collections section holds a large number of manuscripts and documents dealing with Pacific Northwest history, including a highly significant collection of Peter John DeSmet papers.

Undergraduates interested in study for graduate degrees should prepare by obtaining a broad liberal education emphasizing the humanities, social sciences, and languages. Strong undergraduate minors in such subjects as literature, philosophy, and foreign languages will be of great assistance, in addition to minors in the social sciences. At least two years of college study of one modern foreign language are strongly recommended for expeditious completion of the foreign language requirement. Adequate opportunities are provided for removing deficiencies by auditing or taking appropriate courses, whether the problem is in history, supporting studies, or languages.

History

Hist

- 510 Field Course in American History 3** May be repeated for credit. Readings and interpretive problems of American history.
- 511 American Diplomatic History 1776-1914 3** Policies and principles characteristic of American diplomacy from 1776 to 1914. Graduate level counterpart of Hist 411; additional requirements. Credit not granted for both Hist 411 and 511.
- 512 American Diplomatic History in the 20th Century 3** Graduate level counterpart of Hist 412; additional requirements. Credit not granted for both Hist 412 and 512.
- 513 Theory and Method in American Studies 3** May be repeated for credit. Same as Engl 513.
- 515 Jeffersonian-Jacksonian America 3** Social and political history of the United States from 1789 to 1845; Jeffersonian, and Jacksonian eras. Graduate level counterpart of Hist 415; additional requirements. Credit not granted for both Hist 415 and 515.
- 516 Civil War and Reconstruction 3** The Civil War as a problem in historical causation and the social, political, and economic impact of the war. Graduate level counterpart of Hist 416; additional requirements. Credit not granted for both Hist 416 and 516.
- 517 Rise of Modern America 3** Response to industrialism in the Gilded Age and the reform movements of Populism and Progressivism. Graduate level counterpart of Hist 417; additional requirements. Credit not granted for both Hist 417 and 517.
- 518 United States 1914-1945 3** America through World War I, cultural tensions of the Twenties, and the crises of Depression and World War II. Graduate level counterpart of Hist 418; additional requirements. Credit not granted for both Hist 418 and 518.
- 519 United States 1945-Present 3** International and domestic impact of Cold War, era of McCarthyism, American aspirations, tensions, and conflicts in the post-industrial era. Graduate level counterpart of Hist 419; additional requirements. Credit not granted for both Hist 419 and 519.
- 520 American Constitutional History 3** Prereq Hist 110 or Pol S 101. Graduate level counterpart of Hist 420; additional requirements. Credit not granted for both Hist 420 and 520.
- 521 The American West 3** Multicultural exploration of the frontier experience and western America; environment, economic development, gender, class and race emphasized. Graduate level counterpart of Hist 421; additional requirements. Credit not granted for both Hist 421 and 521.
- 522 History of the Pacific Northwest 3** Political, social economic and environmental history of the Pacific Northwest. Fulfills the teaching certification requirement in state history and government in Washington and other Pacific Northwest states. Graduate level counterpart of Hist 422; additional requirements. Credit not granted for both Hist 422 and 522.
- 523 Radicals, Reformers, and Romantics: Graduate level counterpart of Hist 423; additional requirements. Credit not granted for both Hist 423 and 523.**
- 525 Seminar in American History 3** May be repeated for credit.
- 527 Public History: Theory and Methodology 3** An introduction to the broad range of non-traditional careers in history. Graduate level counterpart of Hist 427; additional requirements. Credit not granted for both Hist 427 and 527.
- 528 Seminar in Public History 3** May be repeated for credit; cumulative maximum 6 hours. The development of skills at the graduate level to be used in non-traditional careers for historians.
- 529 Interpreting History through Material Culture 3** Historical interpretation to work on major historic preservation and museum projects.
- 530 History of Mexico 3** War of independence, 19th century Mexico and the liberal conservative struggle; modern Mexico since the Revolution of 1910. Graduate level counterpart of Hist 430; additional requirements. Credit not granted for both Hist 430 and 530.
- 532 20th Century Latin America 3** Contemporary developments, policies and trends in the Latin American states. Graduate level counterpart of Hist 432; additional requirements. Credit not granted for both Hist 432 and 532.
- 533 History of Cuba and the Caribbean 3** Historical development of the Caribbean, with emphasis on Cuba, from the Spanish arrival to Castro's revolution. Graduate level counterpart of Hist 433; additional requirements. Credit not granted for both Hist 433 and 533.
- 534 History of Central America 3** Social and political development in Central America; reasons for dictatorships and radical social changes. Graduate level counterpart of History 434; additional requirements. Credit not granted for both Hist 434 and 534.
- 535 Field Course in Latin American History 3** May be repeated for credit; cumulative maximum 9 hours. Readings and interpretive problems in Latin American history.
- 540 Seminar in European History 3** May be repeated for credit.
- 547 Europe in the French Revolutionary and Napoleonic Era, 1789-1815 3** Graduate level counterpart of Hist 447; additional requirements. Credit not granted for both Hist 447 and 547.
- 549 Europe and Two World Wars, 1914-1945 3** Political, intellectual, economic, and international aspects of European life during and between two world wars. Graduate level counterpart of Hist 449; additional requirements. Credit not granted for both Hist 449 and 549.
- 550 Europe Since 1945 3** Europe from the end of World War II to the present; the Cold War, European integration, social and intellectual life. Graduate level counterpart of Hist 450; additional requirements. Credit not granted for both Hist 450 and 550.
- 553 Conservatism, Liberalism, and Socialism: Europe, 1815-1870 3** The consolidation of industrial society and the nation-state in 19th century Europe. Graduate level counterpart of Hist 453; additional requirements. Credit not granted for both Hist 453 and 553.
- 554 Nationalism and National Conflict: Europe 1870-1914 3** The rise of Europe to world predominance and the crises of the European order. Graduate level counterpart of Hist 454; additional requirements. Credit not granted for both Hist 454 and 554.
- 555 From the Tudor Revolution to the Glorious Revolution 3** England in the age of the Protestant Reformation. Graduate level counterpart of Hist 455; additional requirements. Credit not granted for both Hist 455 and 555.
- 559 Modern Britain 3** Britain and the Empire from the Napoleonic wars to the present. Graduate level counterpart of Hist 459; additional requirements. Credit not granted for both Hist 459 and 559.
- 560 Field Course in Early European History 3** May be repeated for credit; cumulative maximum 9 hours. Readings and issues in early European history.
- 562 History of Imperial Russia 3** History and culture of Imperial Russia from Peter the Great to the 1905 revolution. Graduate level counterpart of Hist 462; additional requirements. Credit not granted for both Hist 462 and 562.
- 563 History of the Soviet Union 3** The Russian revolutions and the Soviet regime; 1905 to the present. Graduate level counterpart of Hist 463; additional requirements. Credit not granted for both Hist 463 and 563.

- 565 East-Central Europe 3** History, government, and culture of the countries between Germany and the Soviet Union; emphasis on the 20th century. Graduate level counterpart of Hist 465; additional requirements. Credit not granted for both Hist 465 and 565.
- 567 Modern France 3** The history of France from the revolution of 1789 to the present. Graduate level counterpart of Hist 467; additional requirements. Credit not granted for both Hist 467 and 567.
- 568 Hitler and Nazi Germany 3** Origins and rise of Nazism; state, society and culture in the Third Reich; Nazi racial ideology; world war; the Holocaust. Graduate level counterpart of Hist; additional requirements. Graduate level counterpart of Hist 468; additional requirements. Credit not granted for both Hist 468 and 568.
- 569 Field Course in Modern European History 3** May be repeated for credit; cumulative maximum 9 hours. Readings and interpretive problems in modern European history.
- 570 Field Course in Comparative History 3** May be repeated for credit; cumulative maximum 9 hours. Readings and issues in the comparative history of major world regions.
- 571 Topics in World History 3** May be repeated for credit; cumulative maximum 6 hours. Readings in themes, theories, methods and literature of a global approach to history.
- 572 20th Century Middle East 3** Developments in the Middle East since World War I; including nationalism, fundamentalism, and revolution. Graduate level counterpart of Hist 472; additional requirements. Credit not granted for both Hist 472 and 572.
- 575 Field Course in Women's History 3** May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Readings and interpretive problems in women's history.
- 576 Revolutionary China, 1800 to Present 3** Nature and effects of revolution on China from 1800 to present. Graduate level counterpart of Hist 476; additional requirements. Credit not granted for both Hist 476 and 576.
- 577 Modern Japanese History 3** The development of state and society in Japan from 1800 to present. Graduate level counterpart of Hist 477; additional requirements. Credit not granted for both Hist 477 and 577.
- 578 Field Course in Asian History 3** May be repeated for credit; cumulative maximum 9 hours. Readings and interpretive problems in Asian history.
- 580 Historiography 3**
- 581 American Historiography 3**
- 590 Politics of Developing Nations 3** Same as Pol S 435. Graduate level counterpart of Hist 490; additional requirements. Credit not granted for both Hist 490 and 590.
- 595 The Teaching of History in College V 1 or 2** May be repeated for credit; cumulative maximum 5 hours. Theory, problems, and methods of teaching history at the college level.
- 596 Topics in American Studies 3** May be repeated for credit; cumulative maximum 9 hours. Same as Engl 596. Graduate level counterpart of Hist 496; additional requirements. Credit not granted for both Hist 496 and 596.
- 597 Seminar in History 2 or 3** May be repeated for credit.
- 598 History Internship V 1-12** May be repeated for credit; cumulative maximum 12 hours. Graduate level counterpart of Hist 498; additional requirements. Credit not granted for both Hist 498 and 598.
- 599 History Colloquium 1** Weekly discussions and presentations on historical topics or current faculty and graduate student research. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Horticulture and Landscape Architecture

Degrees Granted: Master of Science in Horticulture; Master of Science in Landscape Architecture; Doctor of Philosophy (Horticulture)

GRADUATE FACULTY

W. G. Hendrix, Chair; P. K. Andrews, J. H. Bassman, K. R. Brooks, C. J. Coyne, J. K. Fellman, R. Hannan, W. G. Hendrix, L. K. Hiller, R. L. Hummel, N. R. Knowles, V. I. Lohr, J. P. Mattheis, S. E. Michael, P. P. Moore, F. O. Ndubisi, K. D. Patten, F. J. Peryea, B. W. Pooviah, R. A. Scarfo, K. A. Schekel, J. M. Tarara, L. P. Taylor, R. E. Thornton

The Department of Horticulture and Landscape Architecture offers programs of graduate study for the degrees of Master of Science in Horticulture, Master of Science in Landscape Architecture, (thesis and non-thesis options) and Doctor of Philosophy. Minor work in horticulture may be taken by students in related graduate programs. The Department also participates in the interdepartmental graduate programs in Environmental Science and Regional Planning, Genetics and Cell Biology, and Plant Physiology.

Horticulture

Graduate study and research in horticulture may be oriented to either basic or applied problems. Candidates who desire careers in research are encouraged to select courses in the basic sciences, such as plant physiology, biochemistry, botany and molecular genetics, as well as horticulture. Investigations may be oriented toward groups of plants, a single plant, a portion of a plant, a tissue, or a particular type of cell. Study may be directed toward any stage in the development of a plant, a plant part or toward stages in its post-harvest life.

Candidates who desire careers in production, management, teaching or extension are encouraged to develop a broad subject-matter knowledge. Courses may be elected in horticulture and applied sciences, such as entomology, plant pathology, soils, biological systems engineering, agricultural economics, genetics, environmental science, and the social sciences. Investigations for such a course of study may be oriented to problem diagnosis and situation appraisal related to the growth, production, or utilization of any horticultural commodity.

For complete information on departmental requirements, see Procedures and Guidelines, Graduate Program in Horticulture, available in the Horticulture and Landscape Architecture office. Course requirements for each horticultural graduate student are individualized and specifically determined by the student's major professor and graduate committee. All students must participate in a tour of horticultural industries and university research facilities throughout the state. The department also requires all students to obtain university teaching experience while pursuing their degrees. Activities such as these contribute to the broad background essential for successful careers.

Students receiving master's degrees are employed in various positions as practitioners, instructors, and researchers with universities, governments and private corporations. Former students have become extension agents, community college instructors and production managers. Students receiving Doctor of Philosophy degrees are employed as university faculty involved in teaching, research, extension, or with private research and development firms and government agencies.

The Department of Horticulture and Landscape Architecture has excellent facilities for graduate study and research on campus as well as at research centers and units located throughout the state. Laboratories include facilities for plant tissue analysis and for histological, physiological, chemical, and genetic studies. These are complemented by greenhouses, plant growth rooms and chambers, low-temperature storages, controlled atmosphere rooms, low-temperature, enzymatic preparation rooms and freezers. The extensive land resources in Pullman and at the research centers and units across the state provide varied climates and soil types which facilitate horticultural research.

Individuals with undergraduate degrees in the plant sciences, including horticulture, agronomy, plant pathology, environmental science, molecular genetics, botany, plant physiology and biochemistry, may be well prepared for graduate study in Horticulture. Individuals with an interest in horticulture, but with undergraduate degrees outside the plant sciences, may also be eligible for the program. They may expand their backgrounds by taking additional courses before applying or while pursuing their graduate degrees. Undergraduate students who are currently pursuing their studies and who contemplate graduate work in horticulture, should elect as many courses in the basic physical and biological sciences as possible.

Interested students may apply to the Department of Horticulture and Landscape Architecture by submitting an application form, copies of

academic transcripts, three letters of recommendation, Graduate Record Examination scores, and a departmental information form (obtained from the Horticulture and Landscape Architecture office). Competitive teaching assistantships, research assistantships, and scholarships are available.

Landscape Architecture

The Master of Science in Landscape Architecture is offered by the Department of Horticulture and Landscape Architecture at Pullman, and the Interdisciplinary Design Institute at Washington State University, Spokane. Faculty from the two campus locations provide advanced study in landscape architecture and landscape planning. Students can enroll at either Pullman or Spokane and take advantage of the faculty, facilities, and other resources offered at both locations. The landscape architecture program at each location has its own area of concentration.

The WSU Pullman program emphasizes the relationship between landscape architecture and environmental sciences and natural resources. Within a 300 mile radius are millions of acres of public land that are managed by the National Park service, the U.S. Forest Service, the Bureau of Land Management, the U.S. Fish and Wildlife Service, and numerous other federal, state, and local agencies. These lands, which occupy coastal, desert, and alpine ecosystems, provide excellent opportunities for advanced studies in landscape planning, landscape ecology, public land management, visual resource assessment, and recreational landscape architecture design. The Department of Horticulture and Landscape Architecture which is located in the College of Agriculture and Home Economics offers opportunities for close interaction with faculty and graduate students in horticulture, natural resource science, environmental science, regional planning, crop and soil science, engineering, and several other disciplines.

The program at WSU Spokane is part of the Interdisciplinary Design Institute. The mission of the Institute is to advance knowledge to enhance the quality of people's lives in the built and natural environment. The Institute attains this mission through interdisciplinary instruction, research, and community service. Study at the Institute offers opportunities for students in the participating programs - Landscape Architecture, Interior Design, Architecture, and Construction Management - to reinforce individual disciplinary knowledge and skills, while developing additional interdisciplinary depth of understanding. The program emphasizes urban/suburban design, interdisciplinary design, and ecological design and planning. A GIS and Simulation Lab supports teaching, research, and service learning activities.

The MSLA serves the advanced study needs of those possessing a professional degree in landscape architecture with opportunities to enhance knowledge and skills in a particular area, acquire strong research and critical thinking skills, and contribute to and advance the body of knowledge in the discipline. For applicants with degrees in other disciplines the MSLA offers the opportunity to pursue research and advanced specialization in landscape architecture that complements their current knowledge and skills. Applicants without a degree in landscape architecture may be admitted to the program but will be required to gain basic skills and knowledge in one of two ways; 1) Spending one year taking undergraduate courses in landscape architecture, emphasizing graphics, design, and landscape technology. 2) Enrolling in an eight-week intensive omnibus studio course in the summer prior to admission to the graduate program.

To be considered for admission prospective students must submit completed Graduate School application forms, two complete sets of transcripts of all previously earned post-secondary credits, a letter of intent explaining educational and professional goals and objectives, three letters of recommendation, and evidence of creative or scholarly ability.

Horticulture

Hort

503 Advanced Topics in Horticulture V 1-4 May be repeated for credit; cumulative maximum 8 hours. Prereq Bot 320. Current topics and research techniques in horticulture.

505 Genetic and Molecular Aspects of Plant Reproduction 2 or 3 Prereq BC/BP 364, Bot 320, GenCB 301. Genetic, molecular, cellular and evolutionary aspects of plant reproductive strategies and their manipulations. Credit not granted for both 405 and 505.

509 Seminar 1 May be repeated for credit; cumulative maximum 4 hours. Continuous enrollment required for regularly enrolled graduate students in Hort. Recent developments in horticulture. S, F grading.

510 Graduate Seminar 1 May be repeated for credit; cumulative maximum 4 hours. Literature reviews and research progress reports.

512 Advanced Pomology 3 Modern concepts, research, and problems of the fruit industry reflected in current literature; practice in critical review of scientific literature.

513 Advanced Viticulture 3 Graduate-level counterpart of Hort 413; additional requirements. Credit not granted for both Hort 413 and 513.

515 Seminar in Plant Physiology 1 May be repeated for credit; cumulative maximum 4. Same as PI Ph 515.

516 Advanced Horticultural Crop Physiology 3 Physiological processes related to growth, development, and productivity of horticultural crops; advances in recombinant DNA technologies; the impact on horticultural practices. Graduate level counterpart of Hort 416; additional requirements. Credit not granted for both Hort 416 and 516.

518 Post-Harvest Biology and Technology 3 (2-3) Prereq graduate standing. Physical and physiological basis for handling and storage practices; perishable organ ontogeny and physiological disorders; post-harvest environment requirements. Graduate level counterpart of Hort 418; additional requirements. Credit not granted for both Hort 418 and 518. Cooperative course taught by WSU. Open to UI students (PISci 518).

520 Potato Physiology and Production Technology 2 (1-3) Prereq Bot 320. Plant and tuber physiology; physical, chemical, physiological and technical concepts of production, storage, and processing of potatoes. Field trip required. Graduate level counterpart of Hort 420; additional requirements. Credit not granted for both Hort 420 and 520. Cooperative course taught by WSU, open to UI students (PISc 570).

521 Fruit Crops Management 3 Graduate level counterpart of Hort 421; additional requirements. Woody horticultural crop production, a plant physiology course. Management strategies for optimizing the productivity and resource utilization efficiency of horticultural fruit crops. Credit not granted for both 421 and 521.

533 Plant Tissue, Cell, and Organ Culture 3 (1-6) Prereq senior standing. By interview only. Current plant tissue techniques used in research and industry to solve problems. Cooperative course taught jointly by WSU and UI (PISc 533).

535 Chemistry and Biochemistry of Fruit and Wine 3 Graduate-level counterpart of Hort 435; additional requirements. Credit not granted for both Hort 435 and 535.

538 Ornamental Plant Production I 3 (2-3) Fall and winter production practices of greenhouse and nursery crops. Field trip required. Graduate level counterpart of Hort 438; additional requirements. Credit not granted for both Hort 438 and 538. Cooperative course taught by WSU, open to UI students (PISc 530).

539 Ornamental Plant Production II 3 (2-3) Production requirements for spring greenhouse and nursery crops; garden center management considerations. Field trip required. Graduate level counterpart of Hort 439; additional requirements. Credit not granted for both Hort 439 and 539. Cooperative course taught by WSU, open to UI students (PISc 531).

570 Plant Molecular Genetics 3 Same as GenCB 570.

590 Potato Science 3 History, botanical characteristics, seed physiology and production, plant population, physiology of growth, and pest management; factors influencing maturation, harvest, yield, grade, bruise control, storage, and quality maintenance; economics of production and research on a global basis. Graduate level counterpart of Hort 490; additional requirements. Credit not granted for both Hort 490 and 590. Cooperative course taught by UI (PISc 590), open to WSU students.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis, and/or Examination Variable credit. S, F grading.

702 Master's Special Problems, Directed Study, and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Landscape Architecture

LA

- 510 Philosophy and Theory in Landscape Architecture** 3 Prereq graduate standing. Natural and cultural processes that characterize the interaction between humans and the landscape.
- 511 Methodology and Communication in Landscape Architecture** 3 Prereq graduate standing. Methods of investigation and analysis of tools used for communication in landscape architecture research.
- 520 The Northern Rocky Mountain Regional Landscape** 4 (2-4) Prereq graduate standing. Biophysical characteristics of the Northern Rocky Mountain regional landscape.
- 521 Cultural Interpretation of the Regional Landscape** 4 (2-4) Prereq graduate standing. Cultural characteristics of the Northern Rocky Mountain regional landscape.
- 525 Landscape Modeling** 3 (1-6) Prereq L A 477 or equivalent. Visual and cartographic landscape modeling through application of GIS and visualization technologies to landscape changes.
- 530 Philosophies and Theories of the Built Environment** 3 Same as Arch 530.
- 540 Research Methods** 3 Same as Arch 540.
- 550 Design Applications** 2 Same as Arch 550.
- 560 Interdisciplinary Seminar** 3 Same as Arch 560.
- 561 Interdisciplinary Seminar II** 3 Same as Arch 561.
- 600 Special projects of Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.

Hotel and Restaurant Administration

(See Business Administration)

Human Development

Degrees Granted: Master of Arts in Human Development

GRADUATE FACULTY

T. G. Power, Chair; G. Bingham, C. Blodgett, B. J. Boyd, L. Griner Hill, J. H. Hiller, P. E. Mills, K. Peterson, T. Rane, K. B. Rodgers, S. R. Smith, N. Werner, M. H. Young

The M.A. in Human Development at Washington State University provides an integrated program of study in life-span human development. The program addresses the multi-faceted development of individuals from infancy through old age and includes study of the interactions between the individual, family, work, school and community. Through their course-work, research, and practical experiences, students receive integrated training in developmental and family theories, research, and application. Using an applied developmental science approach, the M.A. program provides students with valuable skills (e.g., needs assessment, program development, program evaluation) that prepare them for a wide range of careers in educational and social service settings; the strong research emphasis and thesis experience prepares interested students for Ph.D. programs and careers in research and teaching.

The program (39 hours) consists of the following: a) Core courses, totaling 27 hours, which all students are required to take: HD 511, HD 512, HD 513, HD 535, HD 540, HD 550, HD 560, HD 580, EdPsy 508; b) a research thesis (6 credits); and c) two elective courses (6 credits).

Greater detail about program requirements can be obtained from the Department.

Minimum requirements for admission include a 3.0 undergraduate GPA, and a score greater than 1,000 on the verbal plus quantitative portions of the GRE. If a student falls below 1000 on the GRE, or a 3.0 GPA, he/she must seek special probationary admission from the department graduate committee. Students with lower GPAs and GRE

scores will have to submit written evidence demonstrating that they can complete graduate work.

Human Development

H D

- 510 Proseminar in Human Development** 1 Introduction to human development profession, departmental faculty and their research, WSU resources, conducting research, writing thesis; preparation for field placement.
- 511 Theory and Substance of Human Development I** 3 Prereq graduate standing. Human development theories; application to life span development, cultural variations, resources, problem solving, interaction of families and individuals with other systems.
- 512 Theory and Substance of Human Development II** 3 Prereq H D 511. Continuation of 511; theory and application to concepts and issues in human development.
- 513 Research Methods in Human Development I** 3 Prereq graduate standing. Introduction to process of research and methods in human development; techniques of research, data collection, and data analysis procedures. Cooperative course taught by WSU, open to UI students (FCS 521).
- 514 Research Methods in Human Development II** 3 Prereq H D 513. Integration of formal decision making into the social science research process; procedures appropriate for experimental, quasi-experimental and field research. Cooperative course taught by WSU, open to UI students (FCS 522).
- 515 Seminar** 2 Prereq H D 510, 512, 514, 598 or c//. Application of knowledge in professional settings, analysis and integration of internship experience with theoretical and substantive expertise.
- 520 Adolescence** 3 Prereq graduate standing. In-depth examination of theories and research, developmental issues and prevention and intervention programs for school-aged child and adolescents.
- 523 Fundamentals of Participatory Research** 3 Principles/methods of involving community/interest group members in knowledge generation to understand local issues while building local capacity.
- 535 Program Development in Child, Family, and Consumer Studies** 3 Prereq graduate standing. Analysis and development of program delivery systems, curricula and evaluation models. Cooperative course taught by UI (FCS 554), open to WSU students.
- 540 Effective Intervention Programs** 3 Prereq H D 530. Innovative effective prevention and intervention programs from theoretical, applied, and outcome evaluation perspectives.
- 550 Seminar on Family Relationships** 3 Prereq graduate standing. Survey of family studies topics and issues examined from a research point of view.
- 558 Parent-Child Relationships** 3 The reciprocal interactions among family members will be examined; theoretical perspectives and empirical findings will be explored in terms of implications for education and practice.
- 560 Seminar in Child Development** 3 Prereq graduate standing. Survey of literature on selected areas in child development; discussion of research and application related to current issues and trends.
- 561 Advanced Curriculum for Early Childhood Programs** 3 Opportunity to explore curriculum practices in early childhood education; discussion, evaluation and adaptation of curricula based on current research.
- 562 Administration and Leadership in Programs** 3 Examining early childhood administrator role; analysis and application of research to administration, developing concrete skills necessary for successful administration.
- 570 Families and the Economy** 3 Prereq graduate standing. Family/household as an earning and consuming unit; theoretical and policy approaches to income and household production and consumer behavior.
- 575 Family Resource Management** 3 Prereq graduate standing. Management of economic and human resources with focus on family structures in all socioeconomic and age groups. Cooperative course taught by UI (FCS 560), open to WSU students.
- 580 Families, Community and Public Policy** 3 Prereq H D 513, 514 or approved graduate research methods course. Analysis of family policy research; role of family policy research in public policy and knowledge building processes. Cooperative course taught by WSU, open to UI students (FCS 580).

- 586 Special Topics in Human Development V** 1-3 May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Assessment and evaluation of families and children.
- 595 Instructional Practicum V** 1-4 May be repeated for credit; cumulative maximum 8 hours. Prereq senior standing. Supervised instructional practicum for departmental majors. S, F grading.
- 598 Professional Internship 3** Prereq H D 510. Supervised individual experiences with related organizations, businesses, or government agencies; opportunities for interaction with professionals in related fields. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.

Individual Interdisciplinary Doctoral Program

The Graduate School provides the opportunity for graduate students to prepare a program of study leading to the degree Doctor of Philosophy outside the area of any department or program presently authorized to offer the doctoral degree.

Graduate students who have earned a master's degree are eligible to apply for the Individual Interdisciplinary Doctoral Program. Prerequisites for admission into the program include: a cumulative grade point average of at least 3.25 in all graduate coursework; a master's degree from an accredited institution; evidence that no existing program at Washington State University would be suitable for the student's research interests; evidence that faculty members and resources at Washington State University are available to support the student's proposed program. Students interested in this program should contact the Associate Dean of the Graduate School for details.

University

Univ

- 590 Preparation for College Teaching 2** Prereq graduate student/TA appointment. Cross-discipline instructional development for graduate teaching assistants; course development teaching techniques, university policies and procedures. S, F grading.
- 591 Interdisciplinary Studies 1** May be repeated for credit. Contemporary issues in interdisciplinary education and research. Open to all interested students.
- 592 Interdisciplinary Ethical Issues in Graduate Study 3** Prereq graduate standing. Research and discussion of ethical issues arising in graduate study across disciplinary lines.
- 597 Preparing the Future Professorate 2** Prereq doctoral student status. Course provides students with understanding and contextual knowledge of the professorate and issues facing higher education.
- 598 Seminar in Interdisciplinary Studies 1** May be repeated for credit; cumulative maximum 3 hours. Prereq Univ 591. Seminar on theory and practice of advanced interdisciplinary doctoral study.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. (For Interdisciplinary PhD only) S, F grading.

Integrated Pest Management

(See Entomology)

Interior Design

Degrees Granted: Master of Arts in Interior Design

GRADUATE FACULTY

N. Blossom, Chair; C. Bicknell, N. C. Brown, B. Krikac, J. A. Thompson, J. Turpin

Faculty of the Department of Interior Design offer a degree program that provides students with additional depth in the discipline and an opportunity to focus on individualized scholarship areas. Graduates have been

highly successful securing positions in business and industry, and higher education.

The Master of Arts in Interior Design program combines studio design experiences with qualitative and quantitative research methodologies to explore the interface between human behavior and interior environments, examine design theories, and to experiment in design technology.

The goals of the MA degree are

- To build on the undergraduate experience by providing students with opportunities to explore advanced design theories, problem-solving techniques, methodologies, and individual research and design applications;
- To engage students intellectually and creatively in the design and research process;
- To encourage interdisciplinary learning and collaboration through the core curriculum at the Interdisciplinary Design Institute;
- To contribute to and advance the body of knowledge pertaining to interior design and the built and natural environments;
- To prepare students to study for the Ph.D. or Doctor of Design degrees.

The MA degree requires a minimum of 33 credits, including the completion of a research thesis, and is offered in a two-year and a three-year option. The two-year option is for students who have an undergraduate degree in interior design and are prepared to pursue graduate level studies in interior design. The degree requires students without a background in Interior Design take a series of foundation courses that "immerse" them in the major. At the same time, students are introduced to graduate level core courses such as Design Theory, Interior Design Readings, Research Methods, Design Applications, and Interdisciplinary Seminars. Normally, a program of study for someone without a background in Interior Design takes three years.

Admission

Minimum qualifications for admission to the WSU Graduate School and the Master of Arts in Interior Design degree program include a bachelor's degree from an accredited program in Interior Design or related design degree; applicants without a design degree will be evaluated for the three year program and will be required to take additional course work to obtain the graduate degree; a 3.0 minimum GPA; minimum TOEFL score of 550 paper based or 213 computer based test (international applicants); a one to two-page personal statement addressing the applicants interest in the program, the anticipated career path, and specific areas or research interest; three letters of recommendation written by college level professors or advisors, and professional references that address the applicant's ability for intellectual engagement, creative thinking, professional attitude, and motivation; an essay or other visual evidence that demonstrates creativity; and all other requirements of the WSU Graduate School. The MA program only accepts applications for fall semester. Published deadlines are March 1st for International Applicants and assistantships, April 1st for all others.

Interior Design

ID

- 525 Interior Design Graduate Studio I 5** (0-10) Prereq I D 426. Graduate studio; application of advanced design theories, philosophies and research methodologies to enhance undergraduate design foundations through interdisciplinary studio experiences.
- 526 Interior Design Graduate Studio II 5**(0-10) Prereq I D 525. Graduate studio; individual thesis topics and the application of advanced design theories, philosophies, and research methodologies to student's focus topic.
- 528 International Design and Industry Experience 3** Study abroad working with design and industry representatives in Europe. Graduate level counterpart of ID 428. Credit not granted for both I D 428 and 528.

- 530 Philosophies and Theories of the Built Environment** 3 Same as Arch 530.
- 540 Research Methods** 3 Same as Arch 540.
- 550 Design Applications** 2 Same as Arch 550.
- 560 Interdisciplinary Seminar** 3 Same as Arch 560.
- 561 Interdisciplinary Seminar II** 3 Same as Arch 561.
- 594 Readings in Interior Design** 3 Prereq graduate standing. Exploration of current topics through readings in interior design.
- 597 Advanced Design Theory** 3 Prereq I D 425. Environmental and product design theory and development.
- 598 Topics in Interior Design** V 1-3 May be repeated for credit; cumulative maximum 6 hours.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.

Materials Science

Degrees Granted: Doctor of Philosophy (Materials Science)

GRADUATE FACULTY

M. G. Norton, Chair; S. D. Antolovich, D. F. Bahr, A. Bandyopadhyay, S. Bose, D. Blume, G. S. Collins, G. A. Crosby, S. L. Dexheimer, J. T. Dickinson, D. P. Field, K. W. Hipps, W. E. Johns, C. H. Kang, A. D. Li, K. C. Lidell, M. G. Kuzyk, K. G. Lynn, U. M. Mazur, M. D. McCluskey, S. Mesarovic, M. A. Osman, B. B. Pate, L. V. Smith, L. Wang, L. S. Wang, R. D. Willett, M. P. Wolcott

Materials science includes the principles and practice of designing, synthesizing, characterizing, preparing, and fabricating useful materials. The Materials Science Program accepts qualified bachelor's and master's graduates in the sciences and engineering who now wish to pursue graduate research for a PhD in the area where the disciplines overlap. Materials science is an interdisciplinary program and this feature is emphasized in the research activities.

Requirements for the Materials Science PhD include a minimum of 72 credit hours of which at least 34 hours are graded course work. The common ground for all participants in materials science is covered by the core of courses (16 credits) required of all students. The core provides a general overview to the field as well as advanced courses in thermodynamics, solid state physics, applied mathematics, and materials characterization. All students must attend the materials science seminar series, which provides an opportunity to find out the current research activities in the program and associated departments. After completion of the core of courses, students then select additional courses (a minimum of 18 credit hours) in areas that are applicable to their research program. These courses can come from any area of physical science, engineering, and mathematics.

All students complete an original research dissertation (MatS 800). After admission to candidacy for the degree, students select a research supervisor from the materials science faculty. A broad spectrum of contemporary research areas is available.

Materials Science

Mat S

- 503 Current Topics in Materials Science** V 1-3 May be repeated for credit. Recent advances and current research at the forefront of material science.
- 505 Advanced Materials Science** 4 Provides abroad baseline in materials science and will include relationships between structure and properties at graduate level. Same as MAT S505.
- 513 Crystal Plasticity** 3 Same as MSE 513
- 516 Phase Transformations** 3 Same as MSE 516
- 538 Special Topics** V 1-3 May be repeated for credit. Selected topics of current interest in advanced materials science.
- 571 Microscopic Analysis of Solids and Surfaces** 3 Modern spectroscopic methods for microscopic analysis of solids and surfaces.
- 593 Seminar in Physical Chemistry and Materials Science** 1 Same as Chem 593.

- 600 Special Projects or Independent Study** Variable Credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading

Materials Science and Engineering

(See Mechanical and Materials Engineering)

Mathematics

Degrees Granted: Master of Science in Mathematics,; Doctor of Philosophy

GRADUATE FACULTY

A. C. Genz, Chair; K. A. Ariyawansa, D. Boyd, S. C. Cooper, D. W. De-Temple, R. H. Dillon, R. S. Gomulkiewicz, M. G. Hudelson, M. A. Jacroux, V. K. Jandhyala, M. J. Kallahaer, D. C. Kent, A. Y. Khapalov, J. E. Kucera, H. Li, V. S. Manoranjan, J. J. McDonald, R. B. Mifflin, F. Pascual, E. F. Pate, M. F. Schumaker, D. Slavit, M. J. Tsatsomeros, D. S. Watkins, W. A. Webb, D. J. Wollkind, H. Yin

Graduate programs leading to the degrees Master of Science in Mathematics (which also has an Applied Mathematics Option) and Doctor of Philosophy are offered by the Department of Mathematics. Information on all degree programs in Mathematics can be found in the Department's web site: www.math.wsu.edu.

Requirements for the Master of Science in Mathematics include at least 31 credit hours of graduate work. Degree candidates take 6 hours of material from real analysis and introduction to functional analysis, and pass an oral examination over their course work plus the content of Mathematics 401-02 and 420-21. Each candidate for this degree must participate in a one-credit proseminar devoted to the problems of instruction in mathematics, carry out a four-credit special project, and be responsible for teaching at least one undergraduate class for a semester.

Requirements for the Applied Mathematics Option of the Master of Science in Mathematics include 35 credit hours of approved course work. This course work should include 2 graduate courses chosen from one of the three following areas: Numerical Analysis/Optimization; Modeling/Simulation; and Statistical Analysis. Each candidate for this degree must complete a two-credit group project supervised by at least two faculty members in different areas of applied mathematics or other application areas, and a two-credit individual project supervised by the candidate's degree committee members.

Requirements for the degree Doctor of Philosophy include 72 credit hours of approved course work; passing written examinations over material from real analysis in a single variable, functions of several variables, linear algebra, and functional analysis; demonstrating at least a minimal ability to read mathematical literature in two of the following foreign languages: French, German, and Russian; passing a preliminary examination over the student's specialty; completing a doctoral thesis which in originality and importance is at least good enough to appear in a research journal; and passing a final oral examination. Requirements for the proseminar and teaching experience are the same as those described above for the Master of Science degree.

The Department has masters and doctoral programs for those who are interested in nonteaching careers in mathematics. These programs have been designed with extensive encouragement and advice from many experts on applied mathematics education and from representatives of many industrial and governmental organizations. Special features of these programs include:

- courses and seminars devoted to mathematical modeling, data analysis, optimization, discrete mathematics and other applications-related subjects;
- a curriculum with recommended concentrations in operations research, computational mathematics, applied statistics, discrete mathematics and mathematical modeling;

- a sequence of practical experiences, including internships;
- a PhD dissertation in which the emphasis is on using powerful mathematical methods to solve problems outside mathematics rather than on presenting new mathematical discoveries as such.

At the same time, the Department continues to offer the traditional PhD with specialization in such areas as topology, number theory, finite geometry, algebra and analysis. The Department has a teaching emphasis option to its PhD program.

The degree Doctor of Philosophy with teaching emphasis certifies completion of a graduate program designed to provide exceptionally strong preparation for teaching mathematics to undergraduates. It differs from the traditional PhD in its objectives but not in the expected degree of competence in the “core” areas of mathematics and in foreign languages. This program also requires or strongly recommends study in: the history and philosophy of mathematics; disciplines where applications of mathematics frequently occur; computing; and the craft of teaching generally, and in mathematics particularly. In connection with this last, each candidate serves a term as a full-time teaching intern at an undergraduate college. To offset these additional requirements, the traditional PhD research thesis requirement is replaced by requiring a thesis that does not necessarily make an original contribution to mathematics itself but is a piece of mathematical scholarship that may serve a prospective college teacher even better.

In general the requirements have been so chosen that transfer from the Doctor of Philosophy with teaching emphasis to the Doctor of Philosophy or vice versa, when approved, should be feasible with as little difficulty as possible. The record for placement of graduates from this program in suitable academic and nonacademic positions has been excellent.

Interested persons are urged to request detailed information about these programs and the supporting staff and facilities from the Chair of the Department.

Students anticipating graduate study in mathematics should ideally have an extensive knowledge of undergraduate mathematics including, beyond the calculus, at least two years of analysis and one year of algebra. They should have studied also computer programming. Moreover, some acquaintance with applied mathematics (e.g., or some other area which makes extensive use of mathematics) is highly desirable, as is at least a moderate reading knowledge of French, German, or Russian.

Mathematics

Math

- 500 Proseminar** 1 May be repeated for credit; cumulative maximum 2 hours. S, F grading.
- 501 Real Analysis** 3 Prereq Math 402. Metric spaces, convergence, continuous functions, infinite series, differentiation and integration of functions of one and several variables.
- 502 Introduction to Functional Analysis** 3 Prereq Math 420, 501. Normed linear spaces Banach spaces, introduction to Hilbert space, linear operations.
- 503 Complex Analysis** 3 Prereq Math 501. Analytic functions, complex integration, Taylor and Laurent series, conformal mapping, Riemann surfaces and analytic continuation. Cooperative course taught jointly by WSU and UI (Math 531).
- 504 Measure and Integration** 3 Prereq Math 501. Lebesgue measure, Lebesgue integration, differentiation, L spaces general measure and integration, Radon-Nikodym Theorem, outer measure and product measures. Cooperative course taught jointly by WSU and UI (Math 571).
- 505 Abstract Algebra** 3 Prereq Math 421, 501. Groups, rings, fields and homological algebra.
- 506 Abstract Analysis** 3 Prereq Math 502. Generalized measure and integration, topological vector spaces, duality, advanced topics in functional analysis. Cooperative course taught jointly by WSU and UI (Math 572).
- 507 Advanced Theory of Numbers** 3 May be repeated for credit, cumulative maximum 6 hours. Analytic and algebraic number theory. Cooperative course taught by WSU, open to UI students (Math 507).
- 508 Topics in Applied Analysis** 3 Prereq Math 502. Advanced treatment of applications using techniques from fundamental analysis, convexity, analytic function theory, asymptotics, differential equa-

tions. Cooperative course taught by WSU, open to UI students (Math 508).

- 509 Foundations of Mathematics** 3 The basis of mathematics in logic and set theory; continuum hypothesis; Godel's theorems, recent developments. Cooperative course taught by WSU, open to UI students (Math 509).
- 510 Topics in Probability and Statistics** 3 Prereq stat course. Same as Stat 510. Credit not granted for both Math 410 and 510.
- 512 Ordinary Differential Equations** 3 Prereq Math 402. Existence of solutions; linear systems; qualitative behavior, especially stability; periodic solutions. Cooperative course taught jointly by WSU and UI (Math 539).
- 515 Statistical Packages** 3 (2-3) Same as Stat 515.
- 516 Simulation Methods** 3 Model formulation and simulation in business, industry, and government; simulation languages; analysis of simulation output; applications. Graduate level counterpart of Math 416; additional requirements. Credit not granted for both Math 416 and 516.
- 518 Mathematical and Scientific Visualization** 3 Prereq graduate standing. Three-dimensional computer imaging of scientific, engineering, and mathematical phenomena using modern techniques for curve and surface display in computer-aided design. Graduate level counterpart of Math 418; additional requirements. Credit not granted for both Math 418 and 518.
- 523 Statistical Methods for Engineers and Scientists** 3 Same as Stat 523. Credit not granted for both Math 423 and 523.
- 525 General Topology** 3 Prereq Math 402. Sets, metric spaces, topological spaces; continuous mappings, compactness, connectedness, local properties, function spaces, and fundamental groups. Cooperative course taught jointly by WSU and UI (Math 511).
- 526 Advanced Topology** 3 Prereq Math 421, 525. General topology; basic ideas of algebraic topology. Cooperative course taught jointly by WSU and UI (Math 512).
- 527 Algebraic Topology I** 3 Prereq Math 526. Basic homotopy theory and application. Cooperative course taught by UI (Math 523) open to WSU students.
- 528 Algebraic Topology II** 3 Prereq Math 527. Continuation of Math 527. Cooperative course taught by UI (Math 524), open to WSU students.
- 531 Topics in Science and Mathematics Teaching** 1 or 2 New curricula and pedagogical techniques for middle school/high school instruction in science and mathematics. May be repeated for credit. Graduate level counterpart of Math 431; additional requirements. Credit not granted for both Math 431 and 531.
- 532 Foundations of Secondary School Mathematics** 2 Prereq graduate standing. Pre-algebra and algebra from a mature point of view; properties of systems; open sentences; equations; functions and graphs. Graduate level counterpart of Math 432; additional requirements. Credit not granted for both Math 432 and 532.
- 534 Approaches to Mathematics Teaching** 2 Prereq graduate standing. Problem solving and the use of manipulative devices in the teaching of K-8 mathematics. Graduate level counterpart of Math 434; additional requirements. Credit not granted for both Math 434 and 534.
- 536 Statistical Computing** 3 (2-3) Same as Stat 536.
- 538 Topics in Modern Astrophysics** 3 May be repeated for credit; cumulative maximum 9 hours. Same as Astr 538.
- 539 Applications of School Mathematics** 3 Prereq graduate standing. Role of application in the classroom; examples using arithmetic, algebra, geometry, counting principles and probability; teaching concepts in applications. Graduate level counterpart of Math 439; additional requirements. Credit not granted for both Math 439 and 539.
- 540 Applied Mathematics I** 3 Prereq graduate standing. Partial differential equations; Fourier series and integrals; Bessel functions; calculus of variations; vector calculus; application. Graduate level counterpart of Math 440; additional requirements. Credit not granted for both Math 440 and 540.
- 541 Applied Mathematics II** 3 Prereq graduate standing complex variable theory including analytical functions, infinite series, residues, and conformal mapping; Laplace transforms; applications. Graduate level counterpart of Math 441; additional requirements. Credit not granted for both 441 and 541.

- 543 Approximation Theory 3** Univariate polynomial and rational approximation techniques; approximation using splines and wavelets; selected topics in multivariate approximation; algorithms for approximation. Cooperative course taught by WSU, open to UI students (Math 543).
- 544 Advanced Matrix Computations 3** Prereq Math 548. Advanced topics in the solution of linear systems and eigenvalue problems, including parallel matrix computations. Cooperative course taught by WSU, open to UI students (Math 548).
- 545 Numerical Analysis of Evolution Equations 3** Prereq Math 448. Discretization and numerical solution of partial differential equations of evolution; stability, consistency, and convergence; shocks; conservation of forms. Cooperative course taught by WSU, open to UI students (Math 545).
- 546 Numerical Analysis of Elliptic PDEs 3** Prereq Math 448. Methods of discretizing elliptic partial differential equations and solving the resulting systems of equations; error analysis. Cooperative course taught by WSU, open to UI students (Math 547).
- 548 Numerical Analysis 3** Prereq graduate standing. Fundamentals of numerical computation; finding zeroes of functions, approximation and interpolation; numerical integration (quadrature); numerical solution of ordinary differential equations. Graduate level counterpart of Math 448; additional requirements. Credit not granted for both Math 448 and 548.
- 550 Advanced Topics in Geometry 3** Projective, affine, and non-Euclidean geometries and their relation to abstract algebra and differential geometry. (a/y) Cooperative course taught by WSU, open to UI students (Math 554).
- 551 Ring Theory 3** Ideals quotient rings, modules, radicals, semi-simple Artinian rings, Noetherian rings. (a/y) Cooperative course taught by UI (Math 551), open to WSU students
- 552 Galois Theory 3** Field extension, automorphisms, normality, splitting fields, radical extension, finite fields, separability. Cooperative course taught by UI (Math 552), open to WSU students.
- 553 Graph Theory 3** Prereq graduate standing. Graphs and their applications, directed graphs, trees, networks, Eulerian and Hamiltonian paths, matrix representations, construction of algorithms. Graduate level counterpart of Math 453, additional requirements. Credit not granted for both Math 453 and 553.
- 554 Linear Algebra 3** Prereq Math 420. Vector spaces, direct sums, quotient spaces, similarity, Jordan forms, inner products, eigenvalues, eigenvectors, spectral theory. Cooperative course taught jointly by WSU and UI (Math 550).
- 555 Topics in Combinatorics 3** May be repeated for credit; cumulative maximum 6 hours. Combinatorics, generating functions, recurrence relations, inclusion-exclusion, coding theory; experimental design, graph theory.
- 556 Introduction to Statistical Theory 3** Same as Stat 556. Credit not granted for both Math 456 and 556.
- 560 Partial Differential Equations I 3** Prereq Math 402. Partial differential equations and other functional equations: general theory, methods of solution, applications. Cooperative course taught by WSU, open to UI students (Math 540).
- 561 Partial Differential Equations II 3** Prereq Math 560. Continuation of Math 560. Cooperative course taught by WSU, open to UI students (Math 542).
- 562 Secondary School Mathematics 3** Same as T & L 562. Cooperative course taught jointly by WSU and UI (Math 504).
- 563 Mathematical Genetics 3** Prereq MbioS 301; Stat 412, 430, or 443; Math 273. Mathematical approaches to population genetics and genome analysis; theories and statistical analyses of genetic parameters.
- 564 Topics in Optimization 3** May be repeated for credit. Prereq advanced multivariable calculus and a programming language, Rec Math 464, 544. Advanced topics in the theory and computing methodology in optimization with emphasis on real-life algorithmic implementations. Cooperative course taught by WSU, open to UI students (Math 564).
- 566 Optimization in Networks 3** Prereq graduate standing. Formulation and solution of network optimization problems including shortest path, maximal flow, minimum cost flow, assignment, covering, postman and salesman. Credit not granted for both 466 and 566.
- 568 Statistical Theory I 3** Same as Stat 548.
- 569 Statistical Theory II 3** Same as Stat 549.
- 570 Mathematical Foundations of Continuum Mechanics I 3** Prereq advanced calculus and differential equations. The basic mathematical theory of continuum mechanics and its relation to perturbation techniques and stability methods. Cooperative course taught by WSU, open to UI students (Math 570).
- 571 Mathematical Foundations of Continuum Mechanics II 3** Prereq Math 570. Continuation of Math 570. Cooperative course taught by WSU, open to UI students (Math 573).
- 573 Reliability Theory 3** Same as Stat 573.
- 581 Seminar in Analysis V 1-3** May be repeated for credit. Cooperative course taught jointly by WSU and UI (Math 541).
- 582 Seminar in Algebra V 1-3** May be repeated for credit. Cooperative course taught jointly by WSU and UI (Math 561).
- 583 Seminar in Applied Mathematics V 1-3** May be repeated for credit. Cooperative course taught by WSU, open to UI students (Math 583).
- 584 Seminar in Topology and Geometry V 1-3** May be repeated for credit. Cooperative course taught by WSU, open to UI students (Math 584).
- 585 Seminar in Number Theory V 1-3** May be repeated for credit. Cooperative course taught by WSU, open to UI students (Math 587).
- 586 Mathematical Modeling in the Natural Sciences 3** Graduate level counterpart of Math 486; additional requirements. Credit not granted for both 486 and 586.
- 589 Seminar in Precollege Mathematics Education 3** Same as T & L 563.
- 590 Seminar in Undergraduate Mathematics Instruction V 1-3** May be repeated for credit; cumulative maximum 6 hours. Curricular and other problems of teaching mathematics to undergraduates.
- 591 Seminar in the History of Mathematics I 1** Topics in the history of mathematics to 1800.
- 592 Seminar in the History of Mathematics II 1** Topics in the history of mathematics from 1800 to present.
- 597 Mathematics Instruction Seminar 1** May be repeated for credit; cumulative maximum 5 hours. prereq graduate standing
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 602 Internship V 2-12** May be repeated for credit. Prereq 40 hrs graduate work. A structured internship from 3-9 months; teaching at the postsecondary level or applied work in a non-academic environment. S, F grading.
- 700 Master's Research, Thesis and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Mechanical and Materials Engineering

Degrees Granted: Master of Science in Mechanical Engineering; Master of Science in Materials Science and Engineering; Doctor of Philosophy (Mechanical Engineering)

GRADUATE FACULTY

H. M. Zbib, Interim Director; S. Antolovich, D. F. Bahr, A. Bandyopadhyay, S. Bose, G. J. Cheng, D. Chiang, C. T. Crowe, J. T. Dickinson, J. L. Ding, P. Dutta, D. P. Field, W. J. Grantham, B. H. Gurocak, D. V. Hutton, S. Jayaram, U. Jayaram, W. E. Johns, W. Kinsel, B. Q. Li, S. Mesarovic, M. G. Norton, C. Pezeshki, B. R. Ramaprian, C. D. Richards, R. F. Richards, L. V. Smith, D. E. Stock, T. R. Troutt, P. G. Vaidya, R. V. Westphal

Mechanical Engineering

The School of Mechanical and Materials Engineering has graduate degree programs in the general fields of mechanical engineering and materials science and engineering. The Master of Science in Mechanical Engineering (thesis and nonthesis) and the Doctor of Philosophy (Me-

chanical Engineering) are offered with courses and research in the following areas: dynamics, optimization and controls, solid mechanics, manufacturing and design, multi-phase flow, fluid mechanics, heat and mass transfer, thermodynamics, combustion, and micro-electrical mechanical.

Interdisciplinary programs in Engineering (MS), Engineering Management (MS), Engineering Science (PhD), and Materials Science (PhD) can be arranged for students having interest in these areas. For details on the Engineering and Engineering Science programs, see the section Engineering Science/Engineering. For details on the Engineering Management or Materials Science programs, see those sections.

The thermal and fluid sciences laboratories provide state-of-the-art facilities for research in combustion, two-phase flow, heat transfer, and turbulent fluid mechanics. Specific research areas include boiling, transport processes of droplets, heat and mass transfer in porous media, turbulent two-phase combustion, detonation processes, catalytic combustion, fire modeling, radiative heat transfer, environmental transport, and fundamentals of turbulent flows.

Sophisticated facilities are available for instruction and research in metal cutting, water-jet assisted machining, metal forming, manufacturing automation, artificial intelligence, nonlinear dynamics, controls, virtual reality, vibrations, material behavior, multiaxial testing, tribology, and microfabrication of MEMS. The laboratories are equipped with machine tools, material testing machines, wear testing facilities, high-precision specimen preparation facilities, a sophisticated metallograph, microscopes, acoustic emission sensing equipment, and surface studies equipment. Facilities are available for research in plastic deformation, properties of materials, superplastic forming and creep. In addition, all labs are served by dedicated data acquisition systems and microcomputers.

Teaching and research assistantships are available for qualified students. Information on fellowships and applications for financial assistance can be obtained from the Department. Awards are made on the basis of scholarship and research capabilities.

The master's degree, thesis option, requires 24 hours of graded coursework beyond the bachelor's plus six credits of thesis. For students choosing the nonthesis option for the Master of Science in Mechanical Engineering, 27 hours of coursework and three credits of special project are needed. The Engineering Management program in Mechanical Engineering requires an additional four credits beyond the nonthesis option. The students present their research results to the faculty at the end of their last semester. The master's degree is awarded after approval of the research by the student's advisory committee. Typically, a master's degree can be obtained in three semesters; a student who is particularly well prepared can reduce the time to a single year.

The PhD in Mechanical Engineering requires 45 hours of graded coursework beyond the bachelor's in addition to a dissertation on a significant research topic chosen to be of mutual interest to the student and an appropriate faculty member. Students are required to pass a qualifying examination within the first year of admission to the PhD program. Advancement to candidacy follows the successful completion of a comprehensive written oral examination of the student's proposal for research. One year of residency on the Pullman campus is a requirement for the PhD; proficiency in a foreign language is not.

A Bachelor of Science degree from an accredited program in mechanical engineering or materials science and engineering provides a good background for the graduate program. Students with bachelor degrees in other engineering disciplines, mathematics, and the physical sciences are routinely admitted, but may be required to make up requisite undergraduate deficiencies. An undergraduate grade point average of 3.0 is a minimum for admission to the MS programs. A 3.4 in graduate level courses is a requirement for the PhD. The Graduate Record Examination is not required for admission. Official transcripts from all institutions attended and three letters of recommendation are needed to complete the application.

Materials Science and Engineering

The School of Mechanical and Materials Engineering offers programs of study leading to the degrees Master of Science in Materials Science and Engineering and Doctor of Philosophy through the interdisciplinary Materials Science Program. The programs within materials science and engineering are available to students with an undergraduate degree in the sciences or engineering, although deficiencies at the undergraduate

level in materials science and engineering may need to be remedied during the first year of study.

Ongoing research provides opportunities for specialization in all areas of materials science and engineering. Facilities are available for materials fabrication, scanning and transmission electron microscopy and microanalysis, and advanced mechanical testing. Current research topics at the fundamental and applied levels include fatigue and fracture of metals and ceramics, electron microscopy, mechanical properties of thin layers, materials for MEMS, biomaterials, ceramic processing, microstructure of metals and alloys, and the growth and characterization of single crystals.

Materials Science and Engineering

MSE

501 Advanced Topics in Materials Science 2 or 3 May be repeated for credit; cumulative maximum 6 hours. Chemical crystallography, microstructure, ultra-structure, theories of crystalline and non-crystalline solids, rheology and fracture mechanism of materials. Cooperative course taught by WSU, open to UI students (Met 544).

503 Advanced Topics in Materials Engineering V 1-3 May be repeated for credit; cumulative maximum 6 hours.

505 Advanced Materials Science 4 Provides a broad baseline in materials science and will include relationships between structure and properties at graduate level. Same as MAT S 505.

513 Crystal Plasticity 3 Rec Math 440. Dislocation theory; slip; climb; mechanical properties of polycrystalline materials, and application to important deformation processes.

514 Thermodynamics of Solids 3 Rec MSE 312. Thermodynamic properties of solid solutions; models for substitutional and interstitial solutions; configurational and non-configurational contributions; calculation of phase diagrams.

515 Electronic Properties of Materials 3 Electron energy bands in solids, electrical conduction in metals and semi-conductors, applications to semi-conduction devices based on silicon and III-V compounds.

516 Phase Transformations 3 Rec MSE 314, 416. Thermodynamics, nucleation, interface motion, mechanisms and kinetics of chemical reactions between solid metals and their environment.

517 Thin Films 3 prereq graduate standing or senior in engineering or science. Materials science aspect of thin films, including growth, characterization, and properties for electrical, mechanical, corrosion, and optical behavior.

519 Corrosion and Oxidation of Metals 3 Prereq MSE 316. Basic corrosion and oxidation mechanisms for various metals with emphasis on those pertaining to stainless steels.

520 Seminar 1 May be repeated for credit; cumulative maximum 3 hours. Reporting problems, research and research methods in materials science and engineering. S, F grading.

523 Ceramics Processing 3 Prereq graduate standing. Fundamentals of ceramic processing science for thin films and bulk ceramics.

537 Fracture Mechanics and Mechanisms 3 Fracture mechanics and mechanisms and the microstructural origins of toughness in metals polymers, and composites.

549 Nondestructive Testing of Wood Based Materials 3 Same as C E 536.

592 Transmission Electron Microscopy 3 Development of the principles and applications of electron optics in microscopy.

593 Practical Electron Microscopy 1(0-3) Prereq MSE 592 or c//. Experimental methods in electron microscopy and microanalytical techniques, for materials science. S, F grading.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis, and/or Examination Variable credit. S, F grading.

702 Master's Special Problems, Directed Study, and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Mechanical Engineering

M E

- 501 Continuum Mechanics** 3 Prereq graduate standing. Unified presentation of principles common to all branches of solid and fluid mechanics; viscous fluids, elasticity, viscoelasticity, and plasticity.
- 509 MEMS Engineering** 3 (2-3). Prereq graduate standing or instructor's permission. Introduction to the design fabrication and application of microelectromechanical systems
- 513 Conduction Heat Transfer** 3 Rec M E 404. Analytical methods applied to multidimensional steady-state and transient conduction heat transfer, melting and ablation, numerical methods.
- 514 Thermal Radiation Processes** 2 or 3 Rec M E 404. Thermal radiation within enclosures, ideal and real surfaces; radiative processes within absorbing/emitting media; applications to furnaces, solar energy systems. Cooperative course taught jointly by WSU and UI (M E 547).
- 515 Advanced Heat Transfer** 3 Rec M E 404, 521. Derivation of the energy conservation equation; laminar and turbulent forced convection heat transfer with internal and external flow; free convection.. Cooperative course taught jointly by WSU and UI (M E 546).
- 521 Fundamentals of Fluids** 3 Prereq M E 303 or C E 315. Governing equations of fluid mechanics accompanied by applications of Navier-Stokes equation to simple flow situations, boundary layer analysis.
- 522 Fundamentals of Fluids II** 3 Rec M E 521. Viscous shear layers including heat and mass transfer, compressibility effects, vortex dynamics, stability and transition, turbulence analysis and modeling.
- 523 Engineering Acoustics** 3 Prereq graduate standing. Fundamentals of acoustics including wave theory; transmission through layers; generation and reception, low frequency models; application to sound measurement, transducers, loudspeaker cabinet design, and nondestructive testing; acoustic design project required. Cooperative course taught by UI (M E 513), open to WSU students.
- 526 Microscopic Thermodynamics** 3 Microscopic development of equilibrium; classical and quantum particle statistics; statistical description of real and ideal gases, solids, and liquids. Cooperative course taught jointly by WSU and UI (M E 526).
- 527 Macroscopic Thermodynamics** 3 Advanced thermodynamics from macroscopic viewpoint; basic postulates, equilibrium, stability, property relations; application to thermal-fluid and solid mechanics; irreversible thermodynamics. Cooperative course taught jointly by WSU and UI (M E 527).
- 530 Elasticity** 3 Prereq graduate standing. Theory of kinematics of solid deformable bodies; conservation laws applied to an elastic continuum; generalized linear stress-strain behavior with applications.
- 531 Theory of Plasticity** 3 Rec M E 501. The fundamentals of the theory of plasticity; the classical theory of plasticity; the classical theory and modern continuum theories of large elasto-plastic deformations.
- 532 Finite Elements** 3 Same as C E 532.
- 533 Experimental Methods in Materials and Manufacturing Process** 3 Rec M E 530. Theoretical and experimental techniques in engineering material behavior and manufacturing processes. Cooperative course taught by WSU, open to UI students (M E 533).
- 534 Mechanics of Composite Materials** 3 Prereq M E 414. Analysis of micromechanical and macromechanical behavior of composite materials with emphasis on fiber-reinforced composite; prediction of properties; stiffness and strength theories; laminated beams and plates; dynamic behavior; environmental effects. Cooperative course taught jointly by WSU and UI (M E 534).
- 535 Tribology** 3 Rec M E 530. Friction, wear, and lubrication of solids with emphasis on metals.
- 537 Fracture Mechanics and Mechanisms** 3 Same as MSE 537.
- 540 Advanced Dynamics of Physical Systems** 3 Newtonian dynamics, rotating coordinate systems; Lagrangian and Hamiltonian mechanics; gyroscopic mechanics, other applications. Cooperative course taught by WSU, open to UI students (M E 504).
- 541 Advanced Mechanical Vibrations** 2 or 3 Rec M E 449. Response of single and multi degree of freedom systems; finite element formulation; matrix methods, random vibrations. Cooperative course taught by WSU, open to UI students (M E 572).
- 542 Optimal Control of Dynamic Systems** 3 Introduction to optimal control theory, differential games, and multiple criteria systems. Applications in engineering, biology, economics, agriculture, and medicine. Cooperative course taught by WSU, open to UI students (M E 542).
- 544 Optimal Systems Design** 3 Parameter design optimization techniques for nonlinear systems; theory, numerical methods, and applications; multiple criteria optimal trade-off analysis and game theory.
- 545 Nonlinear Dynamics** 3 Rec M E 540 or 541. Fundamentals of nonlinear oscillations, stability theory, perturbation methods, and chaotic behavior in nonlinear dynamical systems.
- 548 Acoustics** 3 Fundamental principles of linear and non-linear acoustics and its applications.
- 551 Turbulent Flow** 3 Rec M E 521 or C E 521. Turbulent flow; dimensional analysis, statistical models and descriptions of organized structures.
- 552 Experimental Methods in Thermal-Fluid Science** 3 (2-3) Theory and practice in the use of instrumentation for measuring temperature, velocity, pressure and concentration; measurement of classical flow fields.
- 553 Two-Phase Flow** V 1-3 May be repeated for credit, cumulative maximum 3 hours. Rec M E 521. Fundamentals of the flow of fluids with two phases and applications. Cooperative course taught by WSU, open to UI students (M E 553).
- 556 Numerical Modeling in Fluid Mechanics** 3 Same as C E 556. Cooperative course taught by WSU, open to UI students (M E 556).
- 561 Combustion** 3 Rec M E 521. General combustion phenomena, chemical reactions, combustor modeling, laminar and turbulent flame theory, emissions. Cooperative course taught by WSU, open to UI students (M E 561).
- 562 Nuclear Reactor Theory** 3 Prereq M E 461. Differential equations. Basic reactor neutronic theory including the transport equation; multi-group, multi-region diffusion theory; kinetics; and perturbation theory.
- 565 Nuclear Reactor Engineering** 3 Prereq M E 461. Reactor power distribution; thermal and exposure limits; critical heat flux and pressure design; neutronic/thermal hydraulic relationships; transient/accident analysis.
- 569 Advanced Topics in Thermal and Fluid Sciences** V 1-3 May be repeated for credit. Advanced topics in thermodynamics, heat transfer or fluid mechanics; analytical and experimental methods.
- 574 Foundations of CAD** 3 Topics fundamental to the creation of CAD, engineering visualization, and virtual reality based engineering software. Cooperative course taught by WSU, open to UI student (M E 574).
- 575 Geometric Modeling** 3 Study of the mathematics behind the creation of complex shapes for CAD using curves, surfaces, and solids.
- 579 Advanced Topics in Design and Manufacturing** V 1-3 May be repeated for credit.
- 598 Seminar** 1 May be repeated for credit. Seminar on current research interests. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

(Basic) Medical Sciences

The Program in Basic Medical Sciences does not offer degrees. It is part of a five-state, five-university cooperative program in medical education, WWAMI, with the Doctor of Medicine degree being granted by the University of Washington School of Medicine. Ordinarily, only students enrolled at the University of Washington School of Medicine register to take Medical Science courses. Matriculated graduate and senior undergraduate students may register for credit in certain Medical Science courses under appropriate circumstances. In such cases prior approval must be obtained from the faculty member chairing the course and the WWAMI director. Permission to register will usually depend on the student also having approval from his/her academic advisor (senior undergraduate students must also obtain approval from the Dean of the

Graduate School) and be limited to not more than two Medical Science courses per semester. Medical Science courses 505 (preceptorship), and 513, 522, and 535 (Introduction to Clinical Medicine I, II, III respectively) are closed to all but WWAMI medical students.

Medical Science

Med S

- 510 Histology 3** (2-3) Description and microscopic examination of cell types, tissue and major organs of the human body.
- 512 Basic Mechanisms in Cellular Physiology 4** Basic physiological mechanisms, primarily at the cellular level.
- 514 Molecular and Cellular Biology I 3** Classical molecular and cellular biochemistry, cellular physiology and molecular genetics.
- 516 Systems of Human Behavior I 2** Physical and psychological development of the individual; conceptual systems and models of behavior related to medicine.
- 520 Cell and Tissue Response to Injury 3** Patterns of cell and tissue response to injury; inflammation; neoplasia.
- 521 Natural History of Infectious Disease and Chemotherapy 5** (4-3) Pathogenesis and immunity of infectious diseases, clinical manifestations and control of representative bacterial, fungal, parasitic, and viral infectious diseases.
- 524 Molecular and Cellular Biology II 2** Continuation of Med S 514.
- 526 Systems of Human Behavior II 2** Continuation of Med S 516 with an emphasis on models of behavior, normality and abnormality related to medicine. S, F grading.
- 531 Head, Neck, Ear, Nose and Throat 5** (4-3) Gross anatomy, including skull, pharynx, and larynx; audition and balance.
- 532 Nervous System 5** (4-3) Normal structure and function of the nervous system, including the eye.
- 600 Special Projects or Independent Study V** 1-6 May be repeated for credit; cumulative maximum 6 hours.

Molecular Biosciences

Degrees Granted: Master of Science in Biochemistry, Master of Science in Genetics and Cell Biology, Master of Science in Microbiology; Master of Science (non-thesis) in Biotechnology; Doctor of Philosophy (Biochemistry, Genetics and Cell Biology, Microbiology)

GRADUATE FACULTY

J. Nilson, Director; K. P. Bertrand, M. Black, R. W. Brosemer, J. A. Browse, R. B. Croteau, J. Dahl, W. Davis, A. G. Garza, L. Gloss, H. Granzier, H. D. Grimes, M. D. Griswold, J. Harding, C. Her, H. L. Hosick, J. K. Hurst, J. Jones, S. Jones, M. L. Kahn, C. Kang, K. H. Kim, A. Kleinhofs, M. E. Konkel, D. M. Kramer, M. S. Lanier, N. G. Lewis, P. F. Lurquin, N. S. Magnuson, F. J. Muehlbauer, T. W. Okita, M. L. Pall, J. L. Paznokas, K. Postle, O. R. Reeves, J. C. Rogers, J. Schenk, M. K. Skinner, M. Smerdon, L. P. Taylor, L. S. Thomashow, G. H. Thorgaard, D. von Wettstein, J. Wyrick, L. Xun, R. G. Yount, S. Zhou

Molecular biosciences can be best viewed as a dynamic continuum in which approaches derived from chemistry, physics and biology are utilized to address the fundamental mechanisms of living organisms. The School of Molecular Biosciences (SMB) offers many exciting opportunities for students who want to explore the possibilities of a wide range of future career paths in the life sciences. With 50 active research and teaching faculty members, and many research associated faculty members who have earned national and international reputations as experts in their respective areas of research, the School provides unlimited opportunities for a rich and varied experience.

The School offers programs leading to B.S., M.S., and Ph.D. degrees in Biochemistry, Genetics and Cell Biology, and Microbiology. In addition, a Masters of Science (non-thesis) in Biotechnology is available. Options within these degrees offer flexibility to add emphasis in chemistry, molecular biology, physics, and biotechnology. A hallmark of the graduate education in Molecular Biosciences is the flexibility offered, in terms of both research and course work, to individual students.

Students graduating from the School have numerous career opportunities available to them including technical positions in food, pharmaceutical and biotechnology industries, private or government laboratories

and departments, and nonprofit institutions such as clinical and hospital laboratories and institutes whose main activity is research. Graduates are also well prepared for advanced degree work in medicine, dentistry, veterinary science, and other fields. With the advent of the "biological revolution" which will continue well into the 21st century, new opportunities with links to the worlds of business, law and government are ever expanding.

The School is well equipped for state-of-the-art teaching and research in many fields. Equipment for ultracentrifugation, recombinant DNA techniques, HPLC, protein analysis and purification, DNA sequencing and synthesizing, etc. is available. In addition, many excellent support facilities are available on campus including the Electron Microscopy Center, Bioanalytical Laboratory, Nuclear Radiation Center, NMR Center, X-ray Crystallography Laboratory, Science Instruction Learning Center and the adjoining seven-story Owen Science and Engineering Library.

Washington State University's Pullman campus is situated in the rich agricultural area known as the Palouse in eastern Washington. Pullman is only eight miles from University of Idaho at Moscow, Idaho, approximately 1.5 hours south of Spokane, Washington, and 5.5 hours from Seattle, Washington. The Pullman environs offers many recreational activities including skiing, fishing, hunting, whitewater rafting, camping, hiking, and rock climbing. Pullman is near the Bitterroot Wilderness in the foothills of the Rocky Mountains, and near numerous rivers and lakes; Snake, Salmon, Clearwater, and Columbia rivers and Coeur d'Alene, Pend Oreille, and Priest lakes, to name a few.

Students who anticipate graduate study in Molecular Biosciences should strive to include in their undergraduate work basic courses in chemistry, physics, calculus, genetics, cell biology, biology, as well as courses (e.g. microbiology or biochemistry) that may be pertinent to a specific degree program. Students applying to Molecular Biosciences are required to submit a formal application (to both SMB and the Graduate School), three confidential letters of recommendation, official transcripts of all college work, scores of the general aptitude portion of the Graduate Record Examination (the Advanced Biology or the Biochemistry, Cell and Molecular Biology tests are not required but are recommended). International students from non-English speaking countries must submit a TOEFL score of 550 or better to be eligible for admission. All SMB students are supported on Research Assistant or Teaching Assistant positions throughout their graduate education.

Molecular Bioscience

MBioS

- 501 Cell Biology 3** Prereq MBioS 301, 303. Graduate-level counterpart of MBioS 401; additional requirements. Credit not granted for both MBioS 401 and 501. Cooperative course taught by WSU, open to UI students (Genet/PISc 550).
- 503 Molecular Biology I 3** Prereq MBioS 301, 303. DNA replication and recombination in prokaryotes and eukaryotes; recombinant DNA methods and host/vector systems; genome analysis; transgenic organisms.
- 504 Molecular Biology II 3** Prereq MBioS 301, 303. Gene expression and regulation in prokaryotes and eukaryotes, including transcription, RNA processing, and translation; chromatin structure; DNA repair.
- 506 Molecular Techniques in Microbiology 4** (2-6) Prereq graduate level biochemistry or molecular biology course or instructor consent. Current molecular biology techniques applied to DNA and protein isolation and characterization: southern and western blots, PCR, PAGE, computer cloning. Cooperative course taught by WSU, open to UI students (MMBB 529).
- 513 General Biochemistry 3** Graduate-level counterpart of MBioS 413; additional requirements. Credit not granted for both 413 and 513. Cooperative course taught by WSU, open to UI students (MMBB 541).
- 514 General Biochemistry 3** Graduate-level counterpart of MBioS 414; additional requirements. Credit not granted for both 414 and 514. Cooperative course taught by WSU, open to UI students (MMBB 542).
- 520 Eukaryotic Molecular Genetics 2** Prereq MBioS 301, 303. Gene control and organization; lower eukaryotic and cell culture genetics.
- 521 Cell Biotechnology V** 1-3 Prereq MBioS 303, 401. Contemporary cell biotechnology; techniques including: cell culture, immunology

- (including preparation and use of monoclonal antibodies), nucleic acid hybridization (including in situ).
- 522 Genetic and Molecular Aspects of Plant Reproduction** 2 or 3 Graduate-level counterpart of MBioS 422; additional requirements. Credit not granted for both MBioS 422 and 522.
- 523 Fundamentals of Oncology** 3 Same as P/T 572.
- 524 Cellular and Molecular Aspects of Development** 3 Same as Biol 573.
- 525 Advanced Topics in Genetics** V 1-2 May be repeated for credit. Prereq MBioS 520 or 511. Recent research in selected areas of genetics.
- 526 Advanced Topics in Cell Biology** V 1-3 May be repeated for credit; cumulative maximum 7 hours. Current research in cell structure and function. Cooperative course taught by WSU, open to UI students (Genet/PISc 592).
- 527 Perspectives in Biotechnology** 3 Graduate-level counterpart of MBioS 427; additional requirements. Credit not granted for both MBioS 427 and 527.
- 528 Molecular and Cellular Reproduction** 3 (2-2) Course will review the state of the art concepts of the molecular, cellular, and physiological aspects of mammalian reproduction.
- 530 Plant Molecular Genetics** 3 Prereq MBioS 520. Plant molecular genetics with emphasis on systems specific to plants and plant genetic engineering. Cooperative course taught by WSU, open to UI students (Genet 570/PISc 571).
- 531 Plant Cell Biology** 3 Prereq graduate standing. Function of the plant cell with emphasis on current research; topics include membrane biology, protein targeting, and molecular signaling.
- 532 Plant Transmission Genetics** 3 Same as CropS 504.
- 534 Fungal Genetics** 4 (3-3) Same as PI P 534.
- 535 Molecular Genetics of Plant and Pathogen Interactions** 2 Same as PI P 535.
- 536 Molecular Genetics** 3 Prereq MBioS 513; MBioS 301, 502, or MBioS 302. Biochemical description of genetic processes in microorganisms.
- 539 Protein Trafficking in Eucaryotic Cells** 3 Same as PI Ph 580.
- 540 Immunology** 4 The immune system at the animal, cellular, and molecular levels. Credit not granted for both MBioS 440 and 540. Cooperative course taught by WSU, open to UI students (MMBB 512).
- 541 Seminar** 1 May be repeated for credit. Literature reviews and research reports.
- 542 General Virology** 3 Graduate-level counterpart of MBioS 442; additional requirements. Credit not granted for both MBioS 442 and 542.
- 543 Advanced Pathogenic Mechanisms** 3 Prereq by interview only. Detailed analysis of microbial virulence factors and host factors involved in infection and infectious disease. Cooperative course taught jointly by WSU and UI (MMBB 562).
- 544 Microbial Transformation** 3 Prereq MBioS 303, MBioS 450. Use of microbes in the biodegradation of wastes and bioprocessing to produce valuable chemical stocks. Cooperative course taught by UI (MMBB 568), open to WSU students.
- 545 Advanced Immunology** 3 Prereq introductory course in immunology. Cellular and molecular regulation of the immune response. Cooperative course taught by WSU, open to UI students (VS 570).
- 546 Selected Topics in Microbiology** 1 May be repeated for credit; cumulative maximum 2 hours. Prereq 9 hours 300-400-level Micro.
- 547 Advanced Topics in Microbiology** V 1-3 May be repeated for credit.
- 548 Selected Topics in Virology** 1 May be repeated for credit. Prereq MBioS 542 or c//; by interview only. Selected topics in virology using the current literature.
- 549 Selected Topics in Immunology** 1 May be repeated for credit; cumulative maximum 2 hours. Prereq course in immunology. Seminar series on advances in immunology.
- 550 Basic and Applied Microbial Physiology** 3 Graduate-level counterpart of MBioS 450; additional requirements. Credit not granted for both MBioS 450 and 550 .
- 552 Environmental Microbiology** 3 Graduate-level counterpart of MBioS 452; additional requirements. Credit not granted for both MBioS 452 and 552.
- 561 Biochemical Signaling in Plants, Animals and Microorganisms** 2 Prereq MBioS 513. New research on intra and extra cellular biochemical signaling, including communication in plants and hormone action in animals.
- 567 Proteins and Enzymes** 3 Prereq MBioS 513. Enzyme mechanisms; protein structure and function; protein evolution.
- 568 Advanced Topics in Biochemistry** V 1-3 May be repeated for credit. Prereq MBioS 513 or c//. Recent research in selected areas of biochemistry.
- 570 Biological Membranes** 2 or 3 Prereq MBioS 514. Structure and function of biological membranes; composition, transport, receptors, and sensory phenomena.
- 571 Advanced Topics in Plant Biochemistry** 2 Prereq MBioS 514; basic botany. Biochemistry unique to plants; new research advances.
- 573 Physical Biochemistry** 3 Prereq MBioS 465 or one year physical chem. Techniques for the study of biological structure and function; spectroscopy, magnetic resonance, diffusion, and sedimentation, electron microscopy, diffraction and scattering.
- 574 Protein Biotechnology** 3 Biotechnology related to the isolation, modification and large scale commercial production, patenting and marketing of useful recombinant proteins and products.
- 575 Protein Trafficking in Eucaryotic Cells** 3 Same as PI Ph 580.
- 576 Molecular Biology Techniques I** 1 (0-3) Prereq MBioS 514 or c//. Modern laboratory technique in the sequencing of nucleic acids.
- 577 Molecular Biology Techniques II** 1 (0-3) Prereq MBioS 514 or c//. Modern laboratory techniques in the use of plasmids as cloning vehicles.
- 578 Molecular Biology Computer Techniques** V 1 (0-3) to 4 (2-6) May be repeated for credit; cumulative maximum 4 hours. Prereq MBioS 301; MBioS 303 or 513. Computer analysis of nucleic acid sequences and/or protein structure. Cooperative course taught by WSU, open to UI students (MMBB 578).
- 579 Biochemistry Seminar** 1 or 2 May be repeated for credit; cumulative maximum 10 hours. Required of all graduate students in biochemistry.
- 581 Seminar in Animal Physiology** 1 Same as A S 540.
- 593 Research Proposal** 2 May be repeated for credit; cumulative maximum 4 hours. Written and oral presentation of an area of biochemistry.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

School of Music and Theatre Arts

Degree Granted: Master of Arts in Music

GRADUATE FACULTY

Music

G. B. Berthiaume, Director, School of Music and Theatre Arts; C. E. Argersinger, M. Arksey, S. Chan, L. K. Johnson, E. J. Lear, H. J. Schoepflin, D. Turnbull, C. J. von Baeyer, J. Wieck, L. Wiest, G. W. Yasiniitsky, H. A. Young

Theatre Arts

G. Berthiaume, Director, School of Music and Theatre Arts; G. R. Caldwell, T. J. Converse, L. J. Harris, E. J. Lear, W. H. Shephard

The Music Program in the School of Music and Theatre Arts offers the degree Master of Arts in Music, which may be earned through studies in the areas of music education, composition, music history and literature, conducting, and performance studies. Though selection of an emphasis is not required, four emphases are available. The emphasis in music education provides advanced studies for experienced and prospective teachers. The emphases in performance and composition are selected

by students wishing to teach at the college level or intending to enter such professions as music performance, conducting, composing and arranging. Students electing the jazz emphasis focus on one or more aspects of jazz music - performance, composition, arranging, pedagogy, or history for example - in preparation for careers in jazz. The program offers both thesis and non-thesis options, designed according to the goals of the student. Composition emphasis students must complete the thesis option.

A prospective graduate student must have earned a baccalaureate degree in music from an accredited college or university. All graduate student applicants must complete a vocal or instrumental audition prior to admission. When possible, the applicant should audition and be personally interviewed on the WSU campus. Tape recordings may be submitted in lieu of personal audition. Passing the audition confirms the applicant's preparedness to enroll in an ensemble. Auditions are heard by at least one ensemble director and at least one faculty member who teaches the applicant's instrument or voice. Music manuscripts, videotapes, written research, and/or performance of a more comprehensive audition are required for acceptance into particular emphases—composition, performance (includes conducting), music education, or jazz studies—of the MA in Music. Such materials or performance may be presented following initial enrollment but must be reviewed prior to submission of a Program of Study naming an emphasis. Reviews confirm candidate's preparedness to complete course work required by the respective emphases. Entering graduate students are required to take diagnostic placement examinations in theory (including aural skills), music history and literature, and piano proficiency prior to enrolling for classes. These examinations are used to help plan the student's course of study, including the remedying of deficiencies.

Requirements for the Master of Arts in Music degree include at least 30 credit hours of approved graduate work. Fourteen of these hours constitute a required core. The remaining sixteen hours are electives. Core curriculum requirements for all graduate students include Introduction to Graduate Studies in Music, Seminar in Analysis, one additional course in the theory area, two additional history-literature courses and 4 credits of performance (lessons or ensembles). The structure and design of the master's program normally require 2 years (4 semesters) of study. The thesis option requires completion of an approved thesis (MUS 700) for credit, while the non-thesis option requires completion of an approved project or special problem (MUS 702) for credit. Graduate students may complete portions of their degree program during summer sessions. All degree options culminate in a final oral examination during which time candidates are expected to demonstrate the ability to integrate and interpret material in the major field with emphasis on the work presented in the thesis, the project or special problem.

Music Performance Studies

The 500- level denotes credit given for graduate study in a primary performance area, and is limited to enrolled graduate students pursuing a master's degree. Credit is granted on the basis of two credits for one half-hour lesson per week and four credits for two half-hour lessons per week. Auditions are required. All courses may be repeated for credit with applied faculty approval.

Music Performance Studies

Mus

- 501 Graduate Organ 2 or 4 May be repeated for credit.
- 502 Graduate Piano 2 or 4 May be repeated for credit.
- 503 Graduate Voice 2 or 4 May be repeated for credit.
- 504 Graduate Horn 2 or 4 May be repeated for credit.
- 505 Graduate Trumpet 2 or 4 May be repeated for credit.
- 506 Graduate Trombone 2 or 4 May be repeated for credit.
- 507 Graduate Baritone 2 or 4 May be repeated for credit.
- 508 Graduate Tuba 2 or 4 May be repeated for credit.
- 509 Graduate Percussion 2 or 4 May be repeated for credit.
- 510 Graduate Violin 2 or 4 May be repeated for credit.
- 511 Graduate Viola 2 or 4 May be repeated for credit.
- 512 Graduate Violoncello 2 or 4 May be repeated for credit.
- 513 Graduate Contrabass 2 or 4 May be repeated for credit.
- 514 Graduate Flute 2 or 4 May be repeated for credit.
- 515 Graduate Oboe 2 or 4 May be repeated for credit.
- 516 Graduate Clarinet 2 or 4 May be repeated for credit.

517 Graduate Bassoon 2 or 4 May be repeated for credit.

518 Graduate Saxophone 2 or 4 May be repeated for credit.

519 Secondary Performance Study 1 or 2 May be repeated for credit, cumulative maximum 6 hours. Prereq bachelor's degree in music. Instruction on instruments or voice other than major performing medium.

Music Performing Groups

Mus

- 528 Opera Workshop 1 (0-4) May be repeated for credit; cumulative maximum 8 hours. Graduate level counterpart of Mus 428; additional requirements.
- 531 Concert Choir 1 (0-4) May be repeated for credit; cumulative maximum 8 hours. Graduate level counterpart of Mus 431; additional requirements.
- 533 Vocal Ensembles 1 (0-4) May be repeated for credit; cumulative maximum 8 hours. Graduate level counterpart of Mus 433; additional requirements.
- 534 Symphony Orchestra 1 (0-4) May be repeated for credit; cumulative maximum 8 hours. Graduate level counterpart of Mus 434; additional requirements.
- 535 Chamber Ensembles 1 (0-4) May be repeated for credit; cumulative maximum 8 hours. Graduate level counterpart of Mus 435; additional requirements.
- 537 Wind Symphony 1 (0-4) May be repeated for credit; cumulative maximum 8 hours. Graduate level counterpart of Mus 437; additional requirements.
- 538 Jazz-Lab Band 1 (0-4) May be repeated for credit; cumulative maximum 8 hours. Graduate level counterpart of Mus 438; additional requirements.
- 539 Vocal Jazz Ensemble 1 (0-4) May be repeated for credit; cumulative maximum 8 hours. By audition only. Graduate level counterpart of Mus 439; additional requirements.
- 540 Jazz Combos 1 (0-4) May be repeated for credit; cumulative maximum 8 hours. By audition only. Graduate level counterpart of Mus 440; additional requirements.
- 541 Accompanying 1 (0-4) May be repeated for credit; cumulative maximum 8 hours. Graduate level counterpart of Mus 441; additional requirements.

Theory

Mus

- 550 Seminar in Analysis 2 May be repeated for credit; cumulative maximum 4 hours. Prereq Mus 453 or c//. Required of all graduate students. Applications of analytical techniques to develop a basis for musical understanding and interpretation.
- 553 Seminar in Music Theory 2 May be repeated for credit; cumulative maximum 4 hours.
- 556 Graduate Seminar in Advanced Composition V 2 (1-2) or 3 (1-4) May be repeated for credit; cumulative maximum 10 hours. Prereq by interview only. The creation of works for either traditional acoustic ensembles or electro-acoustic media.

History and Literature

Mus

- 560 Introduction to Graduate Studies in Music 2 Required of all graduate students in Mus. Basic bibliographic and research techniques; written presentations related to area of emphasis.
- 561 Seminar in Literature of 20th Century Music 2 Prereq Mus 351. Impressionism, expressionism, neoclassicism, neoromanticism, jazz and recent electronic music.
- 562 Symphonic Literature 2 Symphony orchestra and symphonic form from its beginning to modern times studied from the score.
- 566 Seminar in Music History 2 May be repeated for credit; cumulative maximum 6 hours. Prereq Mus 361. Various historic periods and composers.

Music Education, Pedagogy, and Conducting

Mus

- 575 Advanced Conducting 2 or 3 May be repeated for credit. Prereq Mus 482. Rehearsing orchestras, bands, and choruses. Public performance may be required.

- 586 Seminar in Piano Pedagogy** 2 Graduate level counterpart of Mus 486; additional requirements. Credit not granted for both 486 and 586.
- 588 Choral Methods and Materials I** 2 (0-6) Preparation in the administration of choral programs from auditions to the selection and rehearsal of choral literature. Credit not granted for both Mus 488 and 588.
- 589 Choral Methods and Materials II** 2 Prereq Mus 588. Development of skills in choral arranging, curriculum construction, research, and job placement. Credit not granted for both Mus 489 and 589.
- 590 General Music Materials/Methods** 4 (3-2) Graduate level counterpart of Mus 490; additional requirements. Credit not granted for both Mus 490 and 590.
- 591 Vocal Pedagogy** 2 (1-3) Prereq graduate standing. Pedagogy methods course in voice; anatomy of the singing process; methodology of teaching voices in various learning and teaching styles. Graduate level counterpart of Mus 491; additional requirements. Credit not granted for both Mus 491 and 591.

Problems, Research, Recitals and Thesis

Mus

- 522 Graduate Recital** 2 May be repeated for credit; cumulative maximum 4 hours. Private screening and public performance as required within each performance emphasis.
- 596 Topics for Music** V 1-4 Varying subjects offered at graduate level.
- 597 Topics for Music** V 1-4 Varying subjects offered at graduate level.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.

The degrees in theatre are currently on moratorium. New students will not be admitted until further notice. Selected graduate courses are offered each semester.

The Theatre Program in the School of Music and Theatre Arts offers both the Master of Arts and the Master of Arts in Teaching. The Master of Arts degree requirements and program are intended to provide a general education in theatre with the opportunity to emphasize the specific areas of acting, directing, theatre history, and child drama. The Master of Arts in Teaching (a joint offering with the College of Education) provides training for both experienced and prospective teachers of drama in elementary and secondary schools. The master of arts and master of arts in teaching programs offer both thesis and non-thesis options, designed to meet the needs and goals of each student.

Course work in the Theatre Program includes a variety of studies in acting, directing, design, theatre history, theatre for youth, dramatic literature, and performance theory. Core curriculum requirements for all graduate students include 501 Research Methods, 502 Production Analysis (2 credits), 541 Theatre History, 542 Theatre History and one course from among 450 Advanced Acting, 463 Theatre Design, or 561 Play Directing. In addition, 4 credits of 700 Thesis or 702 Special Problems are required. Specific degree requirements for the Master of Arts in Teaching vary depending on whether the student is already certified to teach. Students should consult the Theatre Program's Graduate Handbook for details. Internships with professional theatre companies are available to help students bridge the gap between their educational experiences and the professional world.

Theatre facilities include an intimate, experimental theatre space, a versatile proscenium/thrust stage, a concert hall for musical productions, and a Performing Arts Coliseum seating over 1800. Graduate students are encouraged to explore all forms of theatre arts from avant-garde plays and modern performance techniques to more traditional dramas and modes of production. The School of Music and Theatre Arts sponsors an active summer theatre for which graduate credit is available.

The Theatre Program has a number of graduate assistantships available in the areas of acting, costuming, technical theatre management, and teaching.

Theatre Arts and Drama

Theatre

- 501 Research Methods and Dramaturgy** 3 Prereq graduate standing. Theory, methods and practice of graduate level research as applied to both scholarship and theatre production.
- 502 Production Analysis** 1(0-3) May be repeated for credit; cumulative maximum 6 hours. Analysis and comparison of theatre productions through discussion and written evaluation. Required of Theatre Arts majors. Credit not granted for both Drama 402 and 502.
- 504 Instructional Practicum** 1 May be repeated for credit; cumulative maximum 4 hours. Instruction and guidance in teaching theatre arts and drama. S, F grading.
- 541 History of the Theatre I** 3 Major developments of all aspects of theatre arts from preliterate times of 1650.
- 542 History of the Theatre II** 3 Major developments of all aspects of theatre arts from 1650 to 1800.
- 561 Performance III: Directing** 3 (0-6) Graduate level counterpart of Theat 461; additional requirements. Advanced work in stage direction; weekly exercises focusing on modern, non-realistic theatrical forms and culminating in directing a one-act play. Credit not granted for both Drama 461 and 561.
- 563 Scene Design: Art and Practice** 3 (0-6) Prereq graduate standing. The art of scene design, conceptualization and actualization; design analysis, research, and technical skills needed to execute renderings and models.
- 564 Creative Drama** 3 Prereq graduate standing. Philosophy and techniques of informal drama; practical experience integrated into the curriculum; emphasis on application to educational setting. Graduate level counterpart of Drama 464; additional requirements. Credit not granted for both Theat 464 and 564.
- 565 Seminar in Drama** 3 May be repeated for credit; cumulative maximum 6 hours. Seminar in various periods, movements, and phases of drama.
- 568 Theatre for Young Audiences** 3 Graduate level counterpart of Theat 468; additional requirements. Prereq graduate standing. Study in evolution of dramatic literature and production demands of Theatre for Young Audiences. Credit not granted for both Theat 468 and 568.
- 570 Theory and Practice of Puppetry Arts** 3 Prereq Theat 163. Graduate level counterpart of Theat 470; additional requirements. Credit not granted for both Theat 470 and 570.
- 571 Applied Puppetry Arts** 2 (1-3) Prereq Drama 470, 570, or c//. Application of puppetry arts theory to specific emphases: production, education and therapy. Credit not granted for both Drama 471 and 571.
- 572 Drama Therapy** 3 Prereq current knowledge in psychology/counseling theory. Balanced theoretic and experiential approach toward understanding therapeutic applications of drama and theatre. Credit not granted for both Drama 472 and 527.
- 590 Graduate Internship in Professional Theatre** V 2-15 Prereq Drama 501 and completion of one academic year of master's level course work in Theatre Arts and Drama at WSU. Internship positions at upper levels of administration or production that requires expertise in specific areas; theories/practical application. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.

Natural Resource Sciences

Degrees Granted: Master of Science in Natural Resources, Master of Science in Natural Resource Sciences; Doctor of Philosophy (Environmental and Natural Resource Sciences)

GRADUATE FACULTY

K. A. Blatner, Chair; J. H. Bassman, D. M. Baumgartner, A. A. Berryman, M. S. Carroll, R. C. Chapman, E. J. DePuit, W. J. Foreyt, L. H. Hardesty, J. D. Johnson, B. C. Moore, C. T. Robbins, J. D. Rogers, R.

D. Saylor, D. L. Scarnecchia, L. A. Shipley, R. B. Wielgus, G. W. Witmer, B. S. Zamora

The Department of Natural Resource Sciences offers programs of graduate study and research leading to a Master of Science in Natural Resource Sciences and a Master of Science in Natural Resources. The Master of Science in Natural Resource Sciences emphasizes the conduct of original research by the student while the Master of Science in Natural Resources is a non-thesis degree. The latter degree program; [1] provides natural resource professionals (including recent graduates) with the opportunity to maintain or upgrade their professional competence and [2] furnishes individuals with academic backgrounds in non-natural resource disciplines with an opportunity to obtain the advanced education in natural resource sciences needed for professional work. In this non-thesis program the research requirement is replaced by demonstrated scholarship which is reflected in the extended course work, the master's special problem report, and the performance in the oral examination.

The Department of Natural Resource Sciences and the Program in Environmental Science and Regional Planning jointly offer an interdisciplinary PhD program with options in (1) environmental and natural resource science, (2) sustainable resource production, and (3) natural resource and environmental planning, policy and administration.

The Department has laboratories, green houses and animal research facilities on campus. Field facilities are available at the 12,000 acre Colockum Multiple Use Research Unit located near Wenatchee, WA. Cooperative graduate courses with the University of Idaho which is only eight miles from the Pullman campus provides students with additional educational opportunities.

In addition to the Graduate School's admission requirements the Department of Natural Resource Science requires Graduate Record Examination scores, TOEFL scores (if appropriate), three letters of reference and completion of the department's statement of interest form which may be obtained from the Department. Acceptance of an academically qualified applicant is based on the availability of a faculty graduate advisor and the availability of research funds. Students are encouraged to correspond with individual faculty members under whose direction they are interested in studying. A limited number of state supported teaching assistantships are available. Completed applications must be on file by October 15 or February 15 to be considered for state-supported assistantships the subsequent spring or fall semester. Deadlines for faculty grant supported research assistantships are at the discretion of the granting agency and the faculty member.

Natural Resources

NATRS

- 510 Forest Finance and Valuation** 3 Prereq Math 107; Econ 101 or Ag Ec 201. Economic and finance principles applied to forest management and appraisals. Credit not granted for both NATRS 410 and 510.
- 513 Forest Nursery Management** 3 Forest nursery design; seed processing and quality; nursery equipment and cultural practices; seedling quality. Field trips required. Credit not granted for both NATRS 413 and 513. Cooperative course taught by UI (For 513), open to WSU students.
- 515 Aquatic Restoration Ecology** 3 Review of the response of impacted lake, stream, and wetland systems to rehabilitation and restoration; theory and working examples of each will be addressed. Cooperative course taught by UI (Fish 519), open to WSU students.
- 518 Forest Growth and Yield** 2 Prereq graduate standing. Factors influencing forest yields, traditional prediction methods; development and application of growth and yield simulators. Credit not granted for both NATRS 418 and 518.
- 519 Advanced Topics** V (1-3) May be repeated for credit; cumulative maximum 6 hours.
- 521 Human Dimension of Wildlife Management** 2 Prereq NATRS 435. An exploration of the elements involved in the management of wildlife for non-consumptive activities, the impacts of such activities on wildlife, the role of national parks and protected areas in providing wildlife viewing opportunities, and public attitudes toward wildlife species. Cooperative course taught by UI (WLF 520), open to WSU students.
- 522 Tropical Dendrology and Ecology** 3 (2-4) Distribution physiognomy and climate of world tropical and subtropical vegetation types.

Credit not granted for both NATRS 422 and 522. Cooperative course taught by UI (For 520), open to WSU students.

- 524 Plant Ecophysiology** 3 Prereq course in general Ecology or Botany. Adaptations of individual plant species to their environment, emphasizing ecophysiological mechanisms that influence plant establishment, below and above ground productivity. Field trips required. Cooperative course taught by UI (Rnge 560), open to WSU students.
- 525 Experimental Plant Ecology** 3 (1-6) Experimental techniques in plant ecology with orientation toward environmental and physiological measurement in field and laboratory research. Cooperative course taught by WSU, open to UI students (Rnge 525).
- 526 Population Analysis** 1 Prereq NATRS/Entom/Zool 529, biometry. Analysis, diagnosis, interpretation, and forecasting of population change.
- 527 Forest Gene Resource Management** 3 Prereq graduate standing. Genetic principles applied to forest ecosystems management; origin and function of genetic diversity; implications of silvicultural practices on gene pools. Field trips required. Cooperative course taught by UI (For/Genet 428/528), open to WSU students.
- 528 Resolving Environmental Conflicts** 4 (3-3) Same as R S 535. Graduate-level counterpart of NATRS 428; additional requirements. Credit not granted for both NATRS 428 and 528.
- 529 Principles of Population Dynamics** 1 Prereq general ecology. Development of the theory of population dynamics from Mathus to the present.
- 531 Wildlife Nutrition** 3 (2-3) Nutritional requirements and interactions of wildlife populations. Credit not granted for both NATRS 431 and 531. Cooperative course taught by WSU, open to UI students (WLF 531).
- 535 Wildlife Ecology** 4 (3-3) Prereq Bio S 372. The ecology of wildlife species and the contributing biological processes. Overnight field trip required. Credit not granted for both NATRS 435 and 535.
- 536 Advanced Wildlife Management** 4 (3-3) Prereq NATRS 435. Management criteria for wild vertebrate populations. Field trip required. Credit not granted for both NATRS 436 and 536.
- 538 Natural Resource Policy and Administration** 3 (2-2) Development, content, and implementation of federal public land and natural resource policies emphasizing forest, range, wildlife, and wildland recreation. Credit not granted for both NATRS 438 and 538.
- 540 Integrated Forest Management Models** 3 (2-3) Prereq NATRS 313, 410 or 510. Applied mathematical programming techniques for simultaneous multiple product, intertemporal and interspatial decisions in forest planning, procedures to coordinate site projects, area analysis, strategic forest plans, and regional forest resource policies. Credit not granted for both NATRS 440 and 540.
- 541 Population Ecology and Conservation** 4 (3-3) Prereq graduate standing. Course focusing on ecology, conservation, management of vertebrate populations, especially threatened and endangered species; designed for wildlife and conservation biology majors. Graduate level counterpart of NATRS 441; additional requirements. Credit not granted for both NATRS 441 and 541.
- 545 Advanced Ecosystem and Landscape Management** 2 Prereq enrollment in NRI or by interview only. Ecosystems and landscape management principles, assessments, monitoring, design, and practice, incorporating biological and socioeconomic perspectives.
- 546 Upland Game Ecology** 2 Prereq NATRS 435. Ecology and management of wildlife species using forest and rangeland habitats; current management problems and procedures. Cooperative course taught by UI (WLF 546), open to WSU students.
- 547 Predator Ecology and Management** 2 Ecology of predators and predator-prey systems with emphasis on mammalian species, discussion of predation theory and contributions of field studies to understanding the role of predation in natural and altered communities; human-predator conflicts and resolution. One three-day field trip required. Cooperative course taught by UI (WLF 547), open to WSU students.
- 550 Conservation Biology** 3 Ecological and genetic considerations for maintenance of biological diversity and their practical applications to resource management. Credit not granted for both NATRS 450 and 550.
- 551 Range Ecology—Concepts** 3 Prereq two ecology courses. Ecological concepts of dynamics and distribution of plant communities;

secondary succession processes, soil-vegetation relationships and development of vegetation classification schemes. Cooperative course taught by UI (Range 551), open to WSU students.

- 554 Restoration Ecology 2** Prereq NATRS 302. Restoration of disturbed or damaged ecosystems; fundamental principles from stress physiology and community ecology; review of case studies. Cooperative course taught by UI (Range 552), open to WSU students.
- 556 Foraging Ecology of Herbivores 3** Prereq graduate standing or permission of instructor. Synthesis of foraging behavior concepts including nutritive quality of forages, digestive and metabolic constraints, and diet and habitat selection. Cooperative course taught jointly by WSU and UI (Range 556).
- 560 Watershed Management 3** Principles and practices of management of forest and rangelands for protection, maintenance and improvement of water resource values. Credit not granted for both NATRS 460 and 560.
- 575 Advanced Remote Sensing 2** (1-4). Same as Soils 574.
- 588 Advance Topics in Wildlife V** 1-3 May be repeated for credit; cumulative maximum 10 hours. Biology and management of wildlife species. Cooperative course taught jointly by WSU and UI (WLF, For, FWR, Rnge, and RRTT 503).
- 593 Special Topics Seminar 1** May be repeated for credit. Prereq 20 hrs NATRS. Literature and problems.
- 594 Environmental and Natural Resources Issues and Ethics 3** Prereq senior standing. May be repeated for credit; cumulative maximum 7 hours. Ethical systems applied to natural resources; issues of professionalism and ethics in natural resource management. Cooperative course taught by WSU open to UI students (RRT 594).
- 595 Seminar in Natural Resource Sciences 1** May be repeated for credit. Literature review; preparation and presentation of reports in natural resource sciences.
- 600 Special Projects or Independent Study** Variable Credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Neuroscience

Degrees Granted: Master of Science in Neuroscience; Doctor of Philosophy

GRADUATE FACULTY

B. K. Slinker, Director; S. E. Blank, G. A. Burns, M. Chandra, L. G. Churchill, R. M. Craft, M. DeSantis, D. G. Dyck, J. Ellington, P. R. Gavin, H. L. M. Granzier, J. W. Harding, H. Jansen, E. C. Johnson, M. Kibby, J. M. Krueger, M. B. Laskowski, D. Lin, S. B. Moffett, M. M. Morgan, R. C. Newberry, R. Patterson, C. Portfors, R. M. Quock, D. Rector, R. C. Ritter, W. S. Ritter, J. O. Schenk, M. Schmitter-Edgecombe, D. Schneider, H. D. Schwabl, S. M. Simasko, B. A. Sorg, L. Sprunger, D. L. Stenkamp, C. M. Ulibarri, M. D. Varnum, A. Vasavada, P. Whitney, J. W. Wright

The graduate Program in Neuroscience is administered by the Department of Veterinary and Comparative Anatomy, Pharmacology, and Physiology, although other neuroscientists, who are members of the Graduate Faculty, may direct graduate students in the program. The Neuroscience Program is designed to prepare students for careers in research and teaching with both Master of Science and Doctor of Philosophy degrees offered. The objectives of the Program in Neuroscience provide for a broad background, including the major disciplinary subspecialties of neuroscience - neuroanatomy, neurochemistry, neurophysiology, neuropharmacology, neuroendocrinology, molecular neurobiology, and behavior. The study of both vertebrate and invertebrate species is represented in the program opportunities. In addition, the Department and campus provide many graduate educational opportunities in both life and physical sciences that are relevant to selective areas of neuroscience. Furthermore, students will also avail themselves of the expertise of visiting experts via participation in seminars. The program

vides a distinguished training faculty which includes a core of senior neuroscientists who are recognized internationally as leaders in their areas of research. The goals of the program are 1) to educate scientists with an excellent understanding of nervous system structure and function at an organismic, systemic, and cellular level; 2) provide students with the intellectual environment in which to become skilled in generating imaginative concepts that they can then, 3) explore effectively with the variety of technical approaches to which they have been exposed.

To be eligible for admission, candidates must meet the general Washington State University requirements outlined in the Graduate Study Bulletin in effect at the time of their admission, as well as the Neuroscience Program requirements. Applicants for admission to the Neuroscience Program will be required to have a minimum grade point average of 3.0 (A=4.0) either on the basis of the last 60 hours of undergraduate study or on the basic science portion (first 60 credit hours) of a professional curriculum. Applicants generally will be expected to have completed courses in analytical chemistry, organic chemistry, calculus, physics and a minimum of three courses in different areas of the biological sciences. It is advisable that students have taken an introductory statistics course prior to entering the program. Deficiencies in these areas must be cleared during the period of graduate study before the preliminary exam.

Neuroscience

Neuro

- 501 Fundamentals of Graduate Research in the Life Sciences 1** Same as V Ph 501.
- 502 Faculty Research in Pharmacology/Toxicology 1** Same as P/T 502.
- 504 Principles of Pharmacology I 2** Same as P/T 506.
- 505 Principles and Methods of Toxicology 3** Same as P/T 505.
- 506 Generation, Degeneration, Regeneration in the Nervous System 2** Same as Zool 506.
- 507 Principles of Therapeutics 3** Same as P/T 507.
- 513 Advanced Neuroanatomy 4** Same as V An 513.
- 520 Functional Neuroscience 4** (3-3) Prereq instructor permission or graduate standing. Functional aspects of the brain from cell membrane to higher integrative processes.
- 521 Mammalian Neuroscience 3** (2-3) Same as V M 521P.
- 526 Domestic and Exotic Animal Behavior 2** (1-3) Same as VM 526P.
- 528 Behavioral Mechanisms in Physiology 3** Same as V Ph 528.
- 529 Cellular and Molecular Neurobiology 3** Same as V Ph 529.
- 530 General and Comparative Neurophysiology 4** Neural function in vertebrates and invertebrates from the molecular to the behavioral level; emphasis on electrophysiology. Cooperative course taught by WSU, open to UI students (Zool 530).
- 531 Neuroscience Laboratory Rotation 1**(0-3) May be repeated for credit; cumulative maximum 2 hours. Same as V Ph 531.
- 534 Advanced Neurophysiology 3** Same as V Ph 534.
- 537 Physiology and Biochemistry of Neuropeptides 3** Same as V Ph 537.
- 538 Neuroendocrinology 3** Same as V Ph 538.
- 540 Special Topics in Integrative Neuroscience 3** May be repeated for credit; cumulative maximum 6 hours. Concepts and controversies in neuroscience involving integrative properties of cell systems.
- 541 Special Topics in Cellular and Molecular Neuroscience 3** May be repeated for credit; cumulative maximum 6 hours. Concepts and controversies in neuroscience that involve nerve cell function and regulation.
- 542 Special Topics in Disciplinary Neuroscience 3** May be repeated for credit; cumulative maximum 6 hours. Concepts and controversies in neuroscience that revolve around traditional approaches to nervous system study.
- 543 Ion Channels 3** Prereq graduate standing. Examination of structure and function of ion channels from classical descriptions and understandings to modern cellular and molecular insights. Cooperative course taught by WSU, open to UI students (Zool 543).
- 544 Neurobiology of Drug Abuse 3** Prereq 300-400 level or graduate level general pharmacology. Impact of drugs of abuse on the central nervous system, with emphasis on neurobiological mechanisms of addiction. Cooperative course taught by WSU, open to UI students (Zool 544).

- 545 Experimental Design 1** (0-2) May be repeated for credit; cumulative maximum 6 hours. Interpretation of experimental results as the outcome of hypothesis testing and specific results to general explanatory concepts of neuroscience. S, F grading.
- 561 Receptorology 2** Same as P/T 561.
- 564 Brain-Endocrine Interaction 3** Same as V Ph 564.
- 577 Behavioral Pharmacology 3** Same as Psych 577.
- 584 Sensory Basics of Behavior 3** Same as Psych 584.
- 586 Seminar in Physiological/Sensory Psychology 3** Same as Psych 586.
- 590 Seminar 1** Same as V Ph 590.
- 592 Research Seminar 2** Same as V Ph 592.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Dissertation and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Nursing

Degree Granted: Master of Nursing

GRADUATE FACULTY

D. Detlor, Dean; M. A. Armstrong, J. Banasik, R. Bindler, M. A. Bruya, K. D. Busch, R. Cardell, C. Corbett, D. Doutrich, R. J. Emerson, B. Evans, E. P. Gruber, Z. R. Higgs, A. M. Hirsch, R. C. Hoeksel, K. Miller, K. A. Records, M. J. Rice, L. L. Schumann, B. M. Severtsen

The Intercollegiate College of Nursing (ICN), located at Spokane, Washington, was established July 1, 1968, and exists as a joint endeavor of Washington State University, Eastern Washington University, Gonzaga University and Whitworth College. Its cooperative undergraduate program is the first of its kind among colleges and universities in the United States. The graduate program in Nursing at the Intercollegiate College of Nursing was established in 1983.

The Master of Nursing degree program builds upon an undergraduate baccalaureate degree in nursing and provides a basis for further study at the doctoral level. Three areas of concentration are available: (1) psychiatric/mental health nurse practitioner, (2) community based/ population focused nursing, and (3) family nurse practitioner.

ICN's Betty M. Anderson Library is a specialized collection that focuses on nursing practice and nursing research, with special attention given to the graduate program's content areas. It is open six days a week during the academic year. The Library provides, in addition to its own collection, access to the libraries of the sponsoring institutions, as well as to the libraries of many other educational and health care institutions in the region. A full range of services is offered, including interlibrary loan and computerized data base searching.

The Learning Resources Center (LRC) has four components: the audio-visual laboratory, the practice laboratory, the television studio, and the computer laboratory. Faculty and students receive personal assistance in using equipment, software, and models from the LRC. Micro-computers, as well as computer terminals with access to the main-frame computer at Washington State University are provided. The services of a systems analyst/programmer are readily available.

Over three hundred community agencies and institutions in urban and rural settings are available for practicum experiences and research. The Master of Nursing program is open to students who hold a Bachelor of Science in Nursing degree from an accredited program. Admission is granted on the basis of the student's (1) undergraduate GPA, (2) skills in history taking and physical assessment, (3) successful completion of a course in basic descriptive and inferential statistics, (4) eligibility for licensure as a registered nurse in Washington State, (5) recommendations relative to professional nursing competence and prediction of success as a graduate student, and (6) a goal statement congruent with the program offered. Admission to the family nurse practitioner program requires a second selection process.

The programs of study are designed to be completed in 4 academic semesters. Provision is made for part-time matriculation over a longer period of time, subject to policies and requirements of WSU and ICN.

Students entering through Washington State University apply to the Graduate School in Pullman as well as to the ICN Graduate Program Office in Spokane. Program information, determination of student interests and goals, and assignment of a faculty advisor is provided by the Graduate Program Office at the Intercollegiate College of Nursing. Deadlines for applications are March 1 and November 1.

Nursing

NURS

- 504 Methods of Nursing Research 4** Research process as foundational to both conduct of scientific inquiry and utilization of findings.
- 507 Health Care Policy Analysis V 2-3** Prereq graduate standing. Analysis of health care system policy; exploration of issues of clinical management and community resource utilization including advocacy techniques.
- 513 Innovative Leadership and Management V 3, 4 (3-3), or 5 (3-6)** Prereq graduate student in Nursing. Key issues affecting nursing administration; nursing and management theories for application in nursing service settings.
- 517 Financial Management V 2 (2-0) to 3 (2-3)** Application of economic theory and principles of financial management to the role of nurse manager.
- 519 Teaching in the Information Age 3** prereq basic computer skills; permission of instructor. Focus on educational paradigms consistent with distance education; development of a variety of multimedia materials for nursing education.
- 521 Teaching, Learning and Evaluation in Nursing V 3 (3-0) to 5 (3-6)** Prereq graduate standing in Nursing or permission of instructor. Exploration of concepts related to teaching-learning, assessment of diverse learning needs, instructional strategies and design, evaluation of performance outcomes.
- 523 Nursing Education: Past, Present, and Future V 3 (3-0) to 5 (3-6)** Prereq graduate standing in Nursing or permission of instructor. Exploration of curriculum history, development, future predictions; program evaluation, instructional resources, leadership, and policy development in academic and service settings.
- 524 Multimedia Approaches to Instruction and Evaluation V 2-4** Prereq Nurs 521. Group and individualized instruction and evaluation; creating instructional software, use of TV studio, AV, and computers.
- 537 Role Analysis: Advanced Practice 2 (1-3)** Prereq graduate student in Nursing. Emphasis on role analysis including interdisciplinary relationships, consultative skills, responsibility, activities, and functions of the advanced practice nurse.
- 540 Family and Partner Psychotherapy 4 (2-6)** Prereq Nurs 541 and 543 or master's degree in psych/mental health nursing or written permission of instructor. Introduction to theory and practice of family/partner therapy including role of therapist in treatment of family as a unit.
- 541 Psychiatric/Mental Health Nursing: Individuals 4 (3-3)** Prereq graduate standing in Nursing. Psychopathology and appropriate nursing interventions with individuals across age continuum; families, groups, and communities.
- 542 Psychiatric/Mental Health Advanced Practice Role Development 2** Prereq BSN degree. Advanced practice psychiatric/mental health nursing role development emphasizing systems theory and definition of scope and standards of independent and collaborative roles.
- 543 Advanced Psychiatric Nursing Concepts: Group Psychotherapy 4 (3-3)** Prereq Nurs 541, 542 or by interview only. Introduction to theory and practice of group psychotherapy; Milieu and other selected theories are studied and applied to nursing practice.
- 544 Differential Diagnosis of Medical and Psychiatric Mimics 2** Prereq Nurs 581, 582, or *c/l*. Nursing theoretical differential assessment and management principles of physical/psychiatric symptomatology in determining diagnoses and implementing appropriate treatment.
- 545 Advanced Concepts of Psychiatric/Mental Health Nursing; Children and Adolescents 5 (3-6)** Prereq Nurs 541 and 543 or written permission of instructor. Advanced study of intervention models for psychopathologies evidenced during childhood and adolescence; practicum emphasizes assessment, psychiatric diagnosis, and psychotherapeutic intervention.

- 546 Practicum in Psychiatric / Mental Health Nursing** 4 (1-9) or 5 (1-12) Prereq Nurs 541, 543. Individualized clinical experience/seminar designed to provide advanced competency, accountability, leadership in psychiatric/mental health nursing.
- 547 Practice Management for the Psychiatric Nurse Practitioner** 2 Prereq last semester of NP program. Evaluation of the role of the psychiatric nurse practitioner across a variety of health care contexts. examining current practice issues.
- 548 Psychiatric Nurse Practitioner Internship** V 1-9 Prereq Nurs 546, PharP 525, by interview only. Application and integration of theory, research findings, and interventions in the care of clients with psychiatric disorders.
- 549 Dimensions of Substance Abuse** Prereq Nurs 504, 537, 541, 562, 581, 582. Introduction to assessment, evaluation, prevention, and treatment for substance abuse.
- 550 International, Interdisciplinary, and Transcultural Health Care** 3 Prereq graduate standing in nursing or permission of instructor. Focuses upon diverse health beliefs and practices of clients and members of the interdisciplinary health care team.
- 552 Family Nursing in the Community** V 2-4 Theoretical approaches to the analysis of normal and at-risk families; application of family assessment and intervention models when planning care.
- 554 Epidemiological Approaches to Community Health** 3 Prereq graduate standing in Nursing. Epidemiologic application to health; implications for health promotion, disease prevention. Focus: knowledge and skills required to obtain and use data-bases.
- 555 Community-Based/Population-Focused Nursing Internship** V 1-9 May be repeated for credit; cumulative maximum 9 hours. Prereq Nurs 550, 552, 554, 554, and 556 or permission of instructor. Application and integration of theory, research findings, and community analyses/macro-level intervention strategies in performing community-based/population-focused nursing. S, F grading.
- 556 Community-Based/Population-Focused Role Practicum** V 3 (2-3) or 4 (2-6) to 6 (2-12) Prereq permission of instructor. Culminating analysis, development, and enactment of advanced practice roles in teaching, practice, or administration of community-based/population focused nursing.
- 557 Care Management with At-Risk Infant and Young Child Populations** 3 Prereq graduate standing in nursing or permission of instructor. Analysis of biopsychosocial health risks of infants and young children using models of risk and resiliency in advanced nursing practice.
- 558 Care Management with At-Risk Older Child and Adolescent Populations** 3 Prereq graduate standing in nursing or permission of instructor. Analysis of biopsychosocial health risks of older children and adolescents using models of risk and resiliency in advanced nursing practice.
- 559 Advanced Nursing Practice with At-Risk Child and Youth Populations Practicum** V 2-4 Prereq graduate standing in nursing or permission of instructor; Nurs 557 and 558 or c/. Application of concepts/models of childhood risk and resiliency in advanced nursing practice with community-based at-risk older children and adolescents.
- 560 Promoting Health of Community-Based Adults** V 2 (2-0) to 4 (2-6) Analysis and evaluation of strategies, interventions, and programs to promote the health of at-risk adult community populations.
- 562 Advanced Health Assessment and Differential Diagnoses** 4(3-3) Prereq graduate standing in Nurs. Advanced holistic health assessment/differential diagnosis; analysis of data from biological, sociological, psychological, cultural, and spiritual dimensions.
- 563 Advanced Pharmacological Concepts and Practice** 3 (2-3) Prereq graduate standing in Nurs. Pharmacology for clinical practice including decision-making, prescribing, drug monitoring, and patient education associated with prescriptive authority.
- 564 Health Promotion in Nursing Practice** 2 or 3 Prereq graduate standing in Nursing. Theoretical bases including cultural variations for selected health promotion strategies for neonates through elderly clients.
- 565 Information Management for Nursing Practice** 3 (2-3) Prereq computer competency in word processing/spreadsheets. Application/evaluation of nursing informatics; use for management of patient care data in nursing practice and administration.
- 566 Community Analysis and Program Planning** V 2 (1-3) to 3 (2-3) Prereq graduate standing in Nurs. Application of core public health functions in community analysis, program development and program evaluation.
- 567 Primary Care: Adults and Elders** 4 (2-9) Prereq Nurs 562, 563, 581, or 582. Assessment, differential diagnosis, therapeutic intervention with adults; developmental changes; opportunities to provide diagnostic, maintenance, and follow-up care.
- 568 Primary Care: Infants, Children and Adolescents** 4 (1-9) Prereq Nurs 562, 563, 581, or 582. Assessment, differential diagnosis, and therapeutic intervention with infants, children, and adolescents in rural and urban settings.
- 569 Primary Care: Family** 4 (1-9) Prereq Nurs 562, 563, 581, or 582. Assessment, differential diagnosis, therapeutic intervention with individuals in childrearing, childrearing, and multigenerational families.
- 571 Adult and Elders: Inpatient Management of Chronic Problems** 6 (3-9) Prereq Nurs 562, 563, 581, c// in 575, 582. Diagnosis and treatment of inpatient adults and elders with low to medium acuity.
- 572 Adult and Elders: Inpatient Management of Acute/Critical Problems** 6 (3-9) Prereq Nurs 562, 563, 581, 582, c// in Nurs 575. Diagnosis and treatment of inpatient adults and elders with high to critical acuity.
- 575 Diagnostic Testing and Interpretation** 3 (2-3) Prereq graduate standing in Nurs. Analysis of diagnostic findings across the age continuum for clinical decision making; selected diagnostic and treatment skills for advanced practice.
- 576 Advanced Concepts in Nursing** 2 Prereq graduate standing in Nurs. Exploration of linkage between nursing science concepts and nursing practice through analysis of relevant research.
- 577 Health Care Ethics** 2 or 3 Prereq graduate standing in Nursing. Ethical theories including deontology, teleology, virtue ethics and their applicability to ethical dilemmas in nursing. Credit not granted for both Nurs 477 and 577.
- 578 Plateau Tribes: Culture and Health** 3 (2-3) History, culture and health care needs of the Plateau Indian Tribes are addressed: includes both classroom and practicum experience. Graduate level counterpart of Nurs 478; additional requirements. Credit not granted for both 478 and 578.
- 579 Vulnerable Populations; The Homeless** 3 Prereq graduate nursing status or by permission. Analysis of factors placing persons at risk for homelessness; proposal of policy changes based on research and experiential learning.
- 581 Advanced Physiology and Pathophysiology I** 4 Prereq graduate standing in Nurs. Advanced cellular and system physiology/pathophysiology related to health care of individuals with cardiovascular, renal, and hematological diseases.
- 582 Advanced Physiology and Pathophysiology II** 3 Prereq graduate standing in Nurs. Advanced cellular and system physiology/pathophysiology related to health care of individuals with neuroendocrine, gastrointestinal, and immune diseases.
- 583 Promoting Health of Community-Based Elders** V 2-4 Advanced practice role in assessment, nursing intervention and public policy regarding multidimensional physical, emotional and social problems of community-based elderly.
- 593 Acute Care Internship** V 1-10 Prereq Nurs 562, 563, 581, 582; one of Nurs 571 or 572. Application and integration of theoretical content, research findings, and assessment and intervention strategies into acute care practice.
- 594 Nursing Care of Children in a School Setting** 3 (2-3) Prereq graduate standing in nursing. Assessment of the school age population including high risk students; development, management, and evaluation of school health services.
- 595 Internship** V 1-10 May be repeated for credit; cumulative maximum 10 hours. Prereq Nurs 562, 563, 581, 582; one of Nurs 567, 568, 569, 571, or 572. Application and integration of theoretical content, research findings, and assessment and intervention strategies into primary care practice. S, F grading.
- 596 Post-Master's Psychiatric Nurse Internship** V 1-9 May be repeated for credit; cumulative maximum 9 hours. Prereq prior completion of course work for a clinical nurse specialist in Psychiatric Mental Health Nursing or Psychiatric Nurse Practitioner, malpractice insurance as an ARNP with prescriptive authority, by interview only.

- Supervised performance of the ARNP role in psychiatric nursing care for patients presenting primary psychiatric disorders.
- 597 Advanced Topics in Nursing V 1-3** May be repeated for credit; cumulative maximum 6 hours.
- 598 Advanced Topics in Nursing V 1-3** May be repeated for credit; cumulative maximum 6 hours.
- 599 Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination.** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination.** Variable credit, S, F, grading.

Nutrition

Degrees granted: Doctor of Philosophy
(Home Department - Food Science and Human Nutrition (FSHN))

GRADUATE FACULTY

T. D. Shultz, Chair; K. A. Beerman, B. P. Chew, M. Edlefsen, V. N. Hillers, R. L. Kincaid, L. K. Massey, M. K. McGuire, J. P. McNamara, M. L. Nelson, J. A. Shultz, B. G. Swanson

The Graduate Program in Nutrition is composed of faculty from the Departments of Food Science and Human Nutrition and Animal Sciences in the College of Agriculture and Home Economics. Candidates for the PhD degree in Nutrition may choose: a) the biological nutrition option which emphasizes the biochemical and physiological aspects of nutrition in humans and animals; or b) the behavioral nutrition option which emphasizes nutrition education, community nutrition, and other behavioral aspects of nutrition. Specific areas of research include nutrition and disease, nutrient availability, nutritional requirements, utilization and interactions of nutrients, dietary assessment, food safety and nutrition education.

Doctoral degree requirements for human nutrition students include core courses in biological and behavioral nutrition, biochemistry, physiology, research methods and statistics. Students in the biological nutrition option take additional courses in biochemistry. Those in the behavioral nutrition option select courses in related social science areas of interest. The wide range of graduate courses available in agricultural, biological, pharmacy, veterinary, human development, sociology, education and psychology allow students to develop a course of study that meets their particular needs and interests.

Students applying to the Graduate Program in Nutrition doctoral program should have a master's degree in nutrition, or a closely related field. Baccalaureate holders with exceptional academic records and research experience may be admitted with faculty approval. Students applying for admission should submit WSU application, official transcripts, Graduate Record Examination (GRE) score, TOEFL score of 550+ for those whose English is not their native language, three letters of recommendation, and letter of interest. A limited number of assistantships are available on a competitive basis.

Graduates of the Nutrition Program will be prepared for careers in teaching, research and extension at universities, and as field representatives and researchers for industry, government agencies and other organizations.

For students interested in a PhD in Nutrition degree, and are a resident of one of the following states (Alaska, Arizona, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, South Dakota, Oregon, Utah, Washington, and Wyoming), contact the FSHN Department for in-state tuition opportunities through the Western Interstate Commission for Higher Education (WICHE) program.

The program web address is <http://fshn.wsu.edu>

Nutrition

Nutr

- 500 Seminar in Nutrition 1** May be repeated for credit; cumulative maximum 5 hours. Seminar on current research issues in nutrition.
- 505 Experimental Nutrition 3 (1-6)** Same as A S 505.
- 507 Advanced Nutrient Metabolism 3** Same as A S 507.

- 508 Seminar - Written 2** May be repeated for credit. Same as FSHN 508.
- 513 Mineral and Vitamin Metabolism 4** Same as A S 513.
- 520 Research Methods in Behavioral Nutrition 3** Same as FSHN 520.
- 521 Research Techniques in Nutrition 3 (1-6)** Same as FSHN 521.
- 526 Advanced Community Nutrition 3** Same as FSHN 526.
- 531 Nutrition and Aging 2** Same as FSHN 531.
- 533 Pathophysiology of Human Nutrition 3** Same as FSHN 533.
- 598 Advanced Topics in Nutrition V 1-2** May be repeated for credit. Recent research in nutrition.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or examination** Variable credit. S, F grading.

Pharmacology/Toxicology

Degrees Granted: Master of Science in Pharmacology and Toxicology; Doctor of Philosophy in Pharmacology and Toxicology

GRADUATE FACULTY

Raymond M. Quock, Governing Committee Chair; M. E. Black, S. E. Blank, J. J. Brown, R. Bull, G. D. Clifton, R. Craft, S. Daoud, N. Davies, J. Ellington, C. A. Elstad, J. Exon, M. W. Fariss, J. W. Harding, H. H. Hill, Jr., H. L. Hosick, M. Hu, J. P. Jones, K. Kim, B. P. Lawrence, T. J. Mast, G. G. Meadows, K. E. Meier, K. M. Meyers, R. C. Ritter, W. S. Ritter, J. O. Schenk, D. A. Schneider, S. Simasko, B. Sorg, D. L. Springer, B. D. Thrall, Z. Zhou

Pharmacologists and toxicologists study the interaction of chemicals with biological systems to understand the basis for any beneficial or adverse effects. The sciences of pharmacology and toxicology are important in the development of new drugs and the maintenance of human and animal health, food resources, and environmental quality. The Pharmacology/Toxicology program consolidates the research and teaching expertise of faculty primarily in the Colleges of Pharmacy and Veterinary Medicine and also draws from the Departments or Programs of Chemistry, Entomology, Food Science and Human Nutrition, Genetics and Cell Biology, Neuroscience, Psychology, and Zoology at WSU, the Food Science and Toxicology Department at the University of Idaho and the Pacific Northwest National Laboratories (PNNL). The Graduate Program in Pharmacology and Toxicology is designed to prepare students for careers in academic institutions, governmental regulatory agencies, and the pharmaceutical and biotechnology industries. The program offers both Master of Science and Doctor of Philosophy degrees.

Students entering our program should have completed undergraduate work in biology (including a *300-level organ/mammalian physiology course), chemistry (including organic chemistry and biochemistry), mathematics (through calculus), and an *undergraduate statistics course. We also welcome applications from applicants who have a bachelor's or professional doctorate degree in Pharmacy. Deficiencies may be rectified during the first year of graduate study, but this may hinder the student's ability to take core P/T courses in the first year. Students in both the M.S. and Ph.D. programs are expected to develop an area of emphasis that is consistent with the research capabilities and interests of the faculty.

Each student in the program is required to complete the core curriculum:

	Hours
MBioS 513/514 (514-PhD only)	6
P/T 501	1
P/T 502	1
P/T 505**	3
P/T 506	2
P/T 507**	3

P/T 555 (PhD only)	4
P/T 597	1
VPh 505* (stats)	4

In addition, elective graded coursework (currently 5 credits for M.S. students; 11 credits for Ph.D. students) from advanced courses in pharmacology, toxicology or related subjects are required. The student, in consultation with his/her advisor, selects elective course work that complements each student's research and career interests. Each student is required to write a thesis based upon original laboratory research. The research interests of the faculty span a broad spectrum including: antioxidants; carcinogenesis, cancer chemotherapy and the effects of diet on tumor growth and metastasis; cardiovascular pharmacology and the nutritional and genetic basis of cardiovascular disease; drug transport and metabolism and the role of drug and chemical metabolism in toxicological responses; endocrinology; hepatotoxicology, immunopharmacology, immunotoxicology of drugs of abuse and environmental contaminants; neurobiology, neuropharmacology and behavioral pharmacology; multiple chemical sensitivity; the physiology/biochemistry of neuropeptide transmitters and hormones; and the molecular mechanism of chemically-induced cell death.

Veterinary Medicine and Pharmacy faculty in the Pharmacology/Toxicology Program are housed primarily in Wegner Hall. Modern instruments available at WSU for pharmacological and toxicological research include: UV-, IR-, CD-, fluorescence-, and FT-NMR spectrophotometers, facilities for NMR, X-ray crystallography, mass spectroscopy, molecular graphic systems, amino acid analysis, oligonucleotide and peptide synthesis, DNA sequencing, flow cytometry, cell sorter and an Electron Microscopy Center are available on campus. Laboratories of individual faculty members in the Pharm/Tox Program are well equipped with: spectrophotometers, digital imaging, gas chromatographs, cell culture facilities, liquid scintillation, high performance liquid chromatographs, real-time quantitative PCR instrument, image analyzer, fluorescence and UV/visible microplate readers, flow cytometer, densitometer, and other instruments to perform their research projects. In addition, the building houses a health sciences library and a vivarium equipped to maintain a variety of research animals. Excellent research facilities house other members of the Pharmacology/Toxicology faculty at WSU, the University of Idaho and the Pacific Northwest National Laboratory. Descriptions of faculty research interests can be found on our website at <http://www.pharmacy.wsu.edu/PharmTox>. Applications for admission to the Program must include: Official GRE scores, official transcripts for all college level work, three letters of recommendation, and a letter discussing career goals and research interests. For students whose native language is not English, official TOEFL scores above 600 (paper based test) or 250 (computer-based TOEFL) are required. Applications and inquiries should be directed to: Admissions Committee, Pharmacology/Toxicology Graduate Program, WSU, P.O. Box 646534, Pullman, WA 99164-6534 or e-mail: pharmtox@wsu.edu.

Pharmacology/Toxicology

P/T

- 501 Fundamentals of Graduate Research in the Life Sciences 1** Same as V Ph 501.
- 502 Faculty Research in Pharmacology/Toxicology 1** Prereq graduate standing. Introduction to faculty research for incoming graduate students. S, F grading.
- 505 Principles and Methods of Toxicology 3** Prereq MBioS 563 or c//. 300-level organ/mammalian physiology (or instructor consent). Basic concepts in mammalian toxicology and the methodology currently employed for toxicological investigations. Cooperative course taught by WSU, open to UI students (FST 505).
- 506 Principles of Pharmacology I 3** Prereq MBioS 513 or c//, college-level physiology course or c//. Mechanisms of drug action and the factors that modify drug responses. Cooperative course taught by WSU, open to UI students (FST 506).
- 507 Principles of Therapeutics 3** Prereq 300-level organ/mammalian physiology; P/T 506. Organ systems pharmacology, including drug actions, effects, side effects and interaction of medications used in therapeutics.

- 510 Advanced Pharmacokinetics / Toxicokinetics 2** Prereq P/T 506. Kinetics of drug absorption, distribution, elimination, and pharmacologic response. Cooperative course taught by WSU, open to UI students (FST 510A).
- 511 Topics in Toxicology V 1-4** May be repeated for credit; cumulative maximum 12 hours. By interview only. Topics of current interest in toxicology and closely related areas. Cooperative course taught by WSU, open to UI students (FST 511).
- 512 Topics in Pharmacology V 1-4** May be repeated for credit; cumulative maximum 12 hours. By interview only. Topics of current interest in pharmacology and closely related disciplines.
- 532 Metabolism of Drugs and Toxins 2** Prereq MBioS 513/514; Rec P/T 506. Pathways, enzymology and mechanisms of metabolism of drugs, environmental contaminants and other xenobiotics; pharmacological and toxicological impact of metabolism. Cooperative course taught by WSU, open to UI students (FST 532).
- 535 Pathophysiology of Blood 2** Same as V Ph 535.
- 555 General and Cellular Physiology 4 (3-3)** Same as V Ph 555.
- 556 Insecticides: Toxicology and Mode of Action 1** Same as Entom 556.
- 557 Herbicides: Toxicology and Mode of Action 1** Same as Entom 557
- 558 Pesticide Topics 1** Same as Entom 558.
- 564 Brain-Endocrine Interaction 3** Same as V Ph 564.
- 572 Fundamentals of Oncology** Prereq MBioS 564. Thorough overview of cancer biology encompassing basic cellular and molecular mechanisms of carcinogenesis and tumor progression, treatment and prevention. Cooperative course taught by WSU, open to UI students (FST 572).
- 597 Pharmacology and Toxicology Seminar 1** May be repeated for credit; cumulative maximum 12 hours. S, F grading. Cooperative course taught by WSU, open to UI students (FST 597).
- 599 Critical Evaluation of Current Pharmacology/Toxicology Research 1** May be repeated for credit; cumulative maximum 6 hours. Prereq P/T 501. Individual study of recent research findings and critical evaluation of these data to instructor and other students.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Pharmacy Practice

PharP

- 531 Clinical Research Methods I: Pharmoeconomics 3** Prereq PharS 533P, PharP 552P. Pharmoeconomics and biostatistics.
- 532 Clinical Research Methods II: Pharmacoepidemiology 3** Prereq PharP 531P, 557P. Pharmacoepidemiology and biostatistics.
- 541 Physical Assessment 2 (1-3)** PharP 538P, 552P, PharS 543P. Collection and evaluation of patient information; monitoring efficacy and toxicity of pharmacotherapy; physical assessment and clinical laboratory values. S, F grading.
- 542 Nonprescription/Herbal Products 3** Prereq Phar P 553P, 558P. Pharmacotherapy of nonprescription medications and herbal products.
- 553 Advanced Therapeutics I** Prereq PharP 552P, PharS 543P. Series of modules that provide the foundation of pathophysiology and treatment of various diseases.
- 554 Advanced Therapeutics II 4** Prereq 552P, PharS 543P. Series of modules that provide the foundation of pathophysiology and treatment of various diseases.
- 557 Clinical Pharmacokinetics V 1 (0-3) to 2 (1-3)** Prereq Phar S 433. Applications of pharmacokinetic principles to safe and effective therapeutic management of individual patients in a clinical setting.
- 558 Literature Evaluation V 1 or 2** Prereq PharP 553 or c//. An overview of the biomedical literature emphasizing how to evaluate the pharmaceutical and biomedical literature to provide better patient care.
- 561 Acute Care Advanced Practice Experience 1 V.** May be repeated for credit; cumulative maximum 12 hours. Prereq Pharm.D. didactic coursework complete. Advanced practice experience in acute care settings.

562 Ambulatory Care Advanced Practice Experience V 1 (0-3) to 5 (0-15) May be repeated for credit; cumulative maximum 12 hours. Prereq Pharm.D. didactic coursework complete. Advanced practice experience in ambulatory care settings.

563 Elective I Advanced Practice Experience V 1 (0-3) to 5 (0-15) May be repeated for credit, cumulative maximum 20 hours. Prereq PharP Pharm.D. didactic coursework complete. Advanced clerkship in various health care settings.

599 Special Projects 2 Laboratory research, clinical research, or comprehensive review of selected subjects. S, F grading.

Pharmaceutical Science

PharS

531 Pharmaceutics I 3 Prereq Chem 340, 342, Math 140. Physiochemical principles underlying the design of dosage forms; survey of materials and methods used in the manufacture of dosage forms.

534 Pharmaceutical Biotechnology 2 Prereq PharS 543P. Pharmacological and pharmaceutical properties of medications derived from biotechnology.

Philosophy

GRADUATE FACULTY

D. Shier, Chair; J. K. Campbell, D. M. Holbrook, M. W. Myers, M. R. Neville, H. S. Silverstein

The Department of Philosophy does not offer advanced degrees, but the following courses may be used as minor or supporting courses for degrees in other departments or programs.

Philosophy

Phil

501 Advanced Logic 3 Graduate-level counterpart of Phil 401; additional requirements. Credit not granted for both Phil 401 and 501.

504 Special Topics in Philosophy 3 May be repeated for credit; cumulative maximum 6 hours. prereq graduate standing. Intensive study of a special topic not otherwise covered in depth in the curriculum.

520 Seminar in Ethical Theory 3 Prereq graduate standing. The major issues, views, and figures of ethical theory from ancient Greece to the present.

522 Seminar in Metaphysics 3 Prereq graduate standing. The nature of reality, through study of key concepts such as God, personhood, free will, causation, space, time, and identity.

524 Seminar in Epistemology 3 Prereq graduate standing. Classical problems, questions, and theories involving the concept of knowledge.

530 Advanced Biomedical Ethics 3 Prereq graduate standing. Current ethical issues in medical practice, medical research, and public policy relating to health issues.

532 Seminar in Business Ethics 3 Prereq graduate standing. The major issues in business ethics, both domestic and international, from general principles to specific cases.

600 Special Projects or Independent Study Variable credit. S, F grading.

Physics

Degrees Granted: Master of Science in Physics; Doctor of Philosophy

GRADUATE FACULTY

S. L. Tomsovic Chair; J. R. Asay, G. S. Collins, S. L. Dexheimer, J. T. Dickinson, G. J. Exarhos, Y. M. Gupta, M. G. Kuzyk, K. G. Lynn, P. L.

Marston, M. D. McCluskey, M. D. Miller, B. B. Pate, L. J. Radziemski, G.E. Tripard, L. S. Wang

The Department of Physics offers programs of graduate study leading to the degrees of Master of Science in Physics (both thesis and non-thesis) and Doctor of Philosophy. A Master of Science (thesis and non-thesis) with a specialization in optoelectronics is also available. The Department also offers graduate study in the Materials Science and Astronomy Programs, and participates in the Computer and Natural Sciences Option.

Requirements for the degree of Master of Science in Physics include formal courses in physics and supporting areas at the graduate level. The thesis master's degree is a project-oriented terminal degree designed to provide the student with research experience. The non-thesis master's is a PhD preparatory degree which qualifies the student to take the doctoral preliminary examination.

Prospective PhD candidates who do not have a master's degree normally complete the non-thesis master's during the first two years of graduate study.

Programs leading to the degree of Doctor of Philosophy require the completion of a core sequence of graduate level course work and advanced graduate level courses in physics. In addition, the student must pass the comprehensive preliminary examination, and must present and defend a dissertation based on original research conducted under the guidance of a member of the Graduate Faculty.

The Department stresses a friendly and informal atmosphere within which graduate students can tailor the program to meet their specific needs and interests. Entering students usually are supported with a teaching assistantship. The TAs direct laboratory work and staff a help room for undergraduates taking courses in the elementary physics curriculum. The Department of Physics also has available a few research assistantships for entering graduate students with exceptional qualifications.

Graduate admission requirements include a bachelor's degree with a record of achievement in physics, chemistry, or mathematics. All applicants must submit scores on the Graduate Record Examination (GRE) General Test and the Subject Test in physics. Foreign students must also arrange to submit scores on the Test of English as a Foreign Language (TOEFL).

The Department of Physics has active research programs in several fields in which graduate students may participate. These include studies in the following:

Acoustics and physical optics: Physical aspects of acoustical and optical wave propagation; radiation pressure of sound; acoustic levitation and applications to microgravity science (on Earth orbiters); scattering of sound; light scattering and diffraction catastrophes; dynamical instabilities of fluids.

Astronomy and Astrophysics: astrophysical and cosmological generation of gravitational waves, strategies for detection of gravitational waves, gravitational wave detection and source modeling, physics of strong gravitational fields, black holes; stellar populations of galaxies, the search for planets, observational cosmology, education and public outreach.

Femtosecond and nonlinear optical physics: Femtosecond time-resolved studies of electronic and vibrational dynamics in condensed matter and molecular systems; novel nonlinear-topical effects and optomechanical effects in polymer optical fibers; laser-probes of mechanical properties of polymers; nonlinear optics of fractal clusters; photorefractive and photonic crystals.

High pressure and shock dynamics: Condensed matter response under high dynamic pressures; time-resolved optical spectroscopy to examine chemical reactions and structural changes in condensed materials; theoretical and numerical analysis of nonlinear wave propagation; experimental studies of equation of state of solids and liquids; continuum, electrical and metallurgical studies under shock loading.

Nuclear solid-state physics: The local atomic and electronic structure of metals and alloys studied using nuclear probe techniques: perturbed gamma-gamma angular correlations, Mössbauer effect, positron annihilation; point defects; equilibrium defects, diffusion and annealing; phase transitions; high temperature ordered alloys, grain boundaries; nanocrystalline materials.

Surface and materials physics: Study of fundamental processes related to electronic and structural properties of interfaces; reaction of active molecules, radicals, and ions with substrates; emission of particles from

materials undergoing fracture; laser etching and ablation at surfaces; quantum hall effect.

Theoretical physics: Statistical mechanics of critical phenomena and the renormalization group; nonlinear dynamics; structure of liquid surfaces and interfaces; quantum liquids and solids; dynamics and spectroscopy of gases, liquids, solids, polymers and molecular clusters; optical phonons in semiconductor double heterostructures; chaos and semiclassical methods; mesoscopic systems, quantum dots and corrals; quantum wells and resonant tunneling diodes; nonlinear optics in polymeric systems; high T_C superconductivity.

Interdisciplinary programs in Materials Science, Engineering Science, Computer and Natural Sciences, and Biophysics can be arranged for students having interest in these areas. Cooperative research programs are being actively pursued with the Materials Science and the Molecular Sciences Departments at the Pacific Northwest Laboratory in Richland, WA.

Physics

Phys

514 Optoelectronics Lab I 1 (0-3) to 3 (0-9) May be repeated for credit; cumulative maximum 3 hours. Prereq graduate standing. Experiments with optical systems: Imaging, interference, coherence, information storage/processing, gas and solid state lasers, optical fibers, and communications systems.

515 Optoelectronics Lab II V 1 (0-3) to 3 (0-9) May be repeated for credit; cumulative maximum 3 hours. Experiments in optical physics, physical properties of light, laser physics, waveguides, quantum confined semiconductor structures and ultrafast dynamics and nonlinear optics.

521 Classical Mechanics I 3 Prereq Phys 320; 571 or *c//*. Laws of motion as developed by Newton, d'Alembert, Lagrange, and Hamilton; dynamics of particles and rigid bodies. Cooperative course taught jointly by WSU and UI (Phys 521).

522 Classical Mechanics II 3 Prereq Phys 521. Continuation of Phys 521. Classical mechanics of liquids and deformable solids; stress, deformation and strain, flow, oscillations and waves.

533 Thermal and Statistical Physics I 3 Prereq Phys 330; Math 440. Thermodynamic laws and potentials, kinetic theory, hydrodynamics and transport coefficients, introduction to statistical mechanics, ensembles, partition functions. Cooperative course taught jointly by WSU and UI (Phys 533).

534 Thermal and Statistical Physics II 3 Prereq Phys 533, 551 or Chem 531, 535. Phase transitions and critical phenomena, Ginzburg-Landau theory, Bose-Einstein condensation, superfluids, Fermi systems, low-temperature expansions. Cooperative course taught jointly by WSU and UI (Phys 531).

538 Topics in Modern Astrophysics 3 May be repeated for credit; cumulative maximum 9 hours. Same as Astr 581 (538).

541 Electromagnetic Theory 3 Prereq Phys 342, 571 or *c//*. Special relativity and the classical electromagnetic field; emission, propagation, and absorption of electromagnetic waves. Cooperative course taught jointly by WSU and UI (Phys 541).

542 Electrodynamics 3 Prereq Phys 541. Interaction of matter and electromagnetic radiation; classical and quantum electrodynamics. Cooperative course taught jointly by WSU and UI (Phys 542).

545 Nonlinear Optics 3 Prereq Phys 534, 542, 551. Nonlinear wave propagation theory applied to several nonlinear-optical phenomena; experimental techniques that probe a material's nonlinearity.

546 Quantum Electronics 3 Prereq Phys 541, 551 or *c//*. The physics of lasers and of coherent optical radiation generation and propagation.

550 Quantum Theory I 3 Prereq Math 440, 441, Phys 450. Introduction to quantum theory; physical and mathematical foundations; application to atomic systems. Cooperative course taught jointly by WSU and UI (Phys 551).

551 Quantum Theory II 3 Prereq Phys 550, 571. Symmetry and invariance; angular momentum theory; approximation methods. Cooperative course taught jointly by WSU and UI (Phys 552)

552 Quantum Theory III 3 Prereq Phys 551. Scattering theory; relativistic wave mechanics; quantum field theory. Cooperative course taught jointly by WSU and UI (Phys 553).

561 Atomic and Molecular Physics 3 Prereq Phys 550. Physics of atoms and molecules using quantum theory. Cooperative course taught jointly by WSU and UI (Phys 561).

563 Physics of the Solid State 3 Prereq Phys 534, 551. Lattice vibrations and defects; ionic and electronic conductivities; band theory; magnetic properties; luminescence. Cooperative course taught jointly by WSU and UI (Phys 563).

565 Nuclear Physics 3 Prereq Phys 465, 551. Nuclei and nuclear interactions from the theoretical and experimental viewpoint, properties of nuclei, two-body problems, complex nuclei, nuclear spectroscopy, reactions, models. Cooperative course taught jointly by WSU and UI (Phys 566).

571 Methods of Theoretical Physics 3 Prereq Math 440, 441. Mathematical methods for theoretical physics; linear algebra, tensor analysis, complex variables, differential equations, integral equations, variational calculus, and group theory. Cooperative course taught jointly by WSU and UI (Phys 571).

573 Physical Applications of Group Theory 3 Prereq Phys 551. Introduction to group theory with application to atoms, molecules, solids, and elementary particles; no previous knowledge of group theory assumed. Cooperative course taught by UI (Phys 573), open to WSU students.

575 Advanced Solid State Physics 3 Prereq Phys 534, 542, 552, or *c//*, 563, 571. Quantum theory of solids; Green's functions, correlation functions and other field-theoretic methods; magnetism, superconductivity and transport properties.

581 Advanced Topics 3 May be repeated for credit; cumulative maximum 12 hours. Topics of current interests in advanced physics. Cooperative course taught jointly by WSU and UI (Phys 581).

590 Seminar 1 May be repeated for credit. S, F grading.

591 Seminar in Computational Physics 1 May be repeated for credit; cumulative maximum 4 hours. Computational physics; numerical methods and physical application to supercomputers, mainframes, mini, and microcomputers. S, F grading.

592 Wave Propagation Seminar 2 Prereq Math 440, 441. May be repeated for credit; cumulative maximum 4 hours. Waves in the continuum; elastic, plastic, and hydrodynamic waves; shock waves. S, F grading.

593 Seminar in Physics of Condensed Matter 1 May be repeated for credit; cumulative maximum 2 hours. Experimental and theoretical methods of study of matter in the condensed state and at interfaces. S, F grading.

594 Seminar in Solid-State Physics 1 May be repeated for credit; cumulative maximum 4 hours. Topics in the physics of solids; the experimental and theoretical study of the electronic and atomic structure of materials. S, F grading.

595 Seminar in Astronomy/Astrophysics 1 May be repeated for credit; cumulative maximum 4 hours. Prereq graduate standing. Current topics in theoretical and observational aspects of modern astrophysics. S, F grading.

596 Seminar in Optical Physics 1 May be repeated for credit; cumulative maximum 3 hours. Current topics in experimental and theoretical aspects of optical physics. S, F grading.

598 Teaching Undergraduate Physics Laboratories 1 May be repeated for credit; cumulative maximum 4 hours. Principles and practices of teaching, planning and management of undergraduate physics laboratories; choice and care of equipment. S, F grading.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis and/or Examination Variable credit. S, F grading.

702 Master's Special Problems, Directed Study and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation and/or Examination Variable credit. S, F grading

Astronomy

Astr

581 (538) Topics in Modern Astrophysics 3 May be repeated for credit; cumulative maximum 9 hours. Prereq Math 315; Phys 202. Problems of current astrophysical interest in the areas of stellar atmospheres, stellar interiors, gaseous nebulae, the interstellar medium and galaxies, gravitation and cosmology.

595 Seminar in Astronomy/Astrophysics 1 May be repeated for credit; cumulative maximum 4 hours. Same as Phys 595. S, F grading.

600 Special Projects or Independent Study Variable credit S, F grading.

Plant Pathology

Degrees Granted: Master of Science in Plant Pathology; Doctor of Philosophy

GRADUATE FACULTY

T. D. Murray, Chair; P. R. Bristow, L. M. Carris, G. A. Chastagner, W. Chen, X. Chen, R. J. Cook, F. Dugan, L. du Toit, K. C. Eastwell, D. A. Glawe, G. G. Grove, L. A. Hadwiger, D. A. Inglis, D. A. Johnson, R. F. Line, M. Mazzola, T. C. Paulitz, T. L. Peever, J. D. Rogers, L. S. Thomashow, D. M. Weller, C. L. Xiao

Graduate study in plant pathology is preparation for a professional career dealing with plant diseases and their causes. Programs offered lead to the degrees of Master of Science in Plant Pathology and Doctor of Philosophy. In order to understand diseased plants, the plant pathologist must understand the healthy plant and the biotic and abiotic causes of disease. The ability to communicate effectively should be developed. Superior undergraduate students with a background in agronomy, biology, biochemistry, botany, forestry, horticulture, or microbiology are usually qualified for graduate study in plant pathology.

The degree of Master of Science in Plant Pathology involves formal courses in plant pathology and the supporting areas, a thesis, and a final oral examination. The degree provides preparation for public or commercial plant pathology, for participation as a member of a research team, or for further study toward the PhD. The degree of Doctor of Philosophy requires further formal courses in plant pathology and the background areas, a preliminary examination to establish the student's qualifications for degree candidacy, a research dissertation, and a final examination including the defense of the research.

The Department of Plant Pathology has excellent facilities for graduate study and research. There are ample teaching and research laboratories, greenhouse facilities, field plots, a large and representative mycological herbarium, an extensive branch library, and adequate facilities for physiological and biochemical investigations. The outlying Agriculture Research Centers provide excellent facilities for research on additional specific plant-disease problems. Different members of the Graduate Faculty are recognized authorities in mycology, soil microbiology, physiology and biochemistry of parasitism, cytology and genetics of fungi, disease resistance, biological control, ecology of pathogens, epidemiology, nematology, plant virology, forest pathology and on the diseases of numerous horticultural and agronomic crops.

Research studies may be conducted in the above-cited areas. Vegetable and fruit crop disease research is mostly conducted at the outlying research centers.

The George W. Fischer Agricultural Sciences Branch Library contains important journals and texts in mycology, virology, and plant pathology as well as in related plant science fields. This is supplemented by a bound collection of over 60,000 reprints of technical papers and by the holdings of the central University libraries.

The Department participates in cooperative research programs with the United States Department of Agriculture, the Agricultural Research Service and the US Forest Service.

Students who anticipate graduate study in plant pathology at Washington State University should include in their undergraduate preparation chemistry through organic and biochemistry; mathematics through calculus; botany including systematics, physiology, ecology, and cytology; genetics; introductory zoology; introductory bacteriology; and physics.

Plant Pathology

PI P

503 Advanced Cropping Systems 3 Graduate level counterpart of PI P 403; additional requirements. Credit not granted for both PI P 403 and 503.

511 Viruses and Virus Diseases of Plants 3 (3-3) Prereq course in biochem, or adv genetics. Nature of plant viruses, vector-virus relationships and virus diseases of plants.

513 Nematodes and Nematode Diseases of Plants 2 (1-3) Prereq PI P 429. Anatomy, identity, and diseases caused by nematodes; techniques and control. (SS)

514 Phytobacteriology 4(3-3) Prereq MBioS 302 and 303. Isolation and characterization of bacteria having a saprophytic, symbiotic or pathogenic association with plants—molecular structure, function, and genetics. Cooperative course taught by WSU, open to UI students (PISc 514).

515 Seminar 1 May be repeated for credit.

521 General Mycology 4 (2-6) The structure, life histories, classification, and economic importance of the fungi. Graduate level counterpart of PI P 421; additional requirements. Credit not granted for both PI P 421 and 521.

525 Field Plant Pathology and Mycology 1(0-3) or 2(0-6) May be repeated for credit; cumulative maximum 4 hours. Prereq plant pathology and/or mycology course; by interview only. Field trips, forays, and demonstrations dealing with various aspects of plant pathology and mycology. (SS)

526 Advanced Fungal Biology 4 (2-4) Prereq PI P 421 or 521 or equivalent and graduate standing. Advanced topics in fungal biology, ecology, systematics, evolution and coevolution via discussions of literature and special laboratory projects. Cooperative course taught by WSU, open to UI students.

529 General Plant Pathology 3 (2-3) Classification, symptoms, causes, epidemiology, and control of plant diseases. Graduate level counterpart of PI P 429; additional requirements. Credit not granted for both PI P 429 and 529.

534 Fungal Genetics 4 (3-3) Prereq MBioS 301. Classical and molecular approaches to genetic analyses in fungi.

535 Molecular Genetics of Plant and Pathogen Interactions 2 Prereq MBioS 301, MBioS 303. Genetic and molecular biological aspects of host-pathogen interactions. Cooperative course taught by WSU, open to UI students (PISc 535).

551 Diseases of Plants 3 (3-0) Prereq PI P 429 or 529. Principles of plant disease epidemiology, control, and ecology of pathogens. Cooperative course taught by WSU, open to UI students (PISc 506).

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis, and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Plant Physiology

Degrees Granted: Master of Science in Plant Physiology; Doctor of Philosophy

GRADUATE FACULTY

J. A. Browse and J. C. Rogers, Co-Chairs; R. J. Cook, R. B. Croteau, J. K. Fellman, K. S. Gill, H. D. Grimes, L. A. Hadwiger, L. K. Hiller, M. L. Kahn, C. Kang, N. R. Knowles, D. M. Kramer, N. G. Lewis, A. G. McCubbin, T. W. Okita, B. W. Poovaiah, C. A. Ryan, C. Steber, L. P. Taylor, M. Tegeger, L. S. Thomashow, D. von Wettstein, J. J. Wyrick

Graduate study leading to degrees of Master of Science in Plant Physiology and Doctor of Philosophy is offered as an interdepartmental curriculum by the Graduate Faculty from the Departments of Crop and Soil Sciences, Botany, Horticulture and Landscape Architecture, Plant Pathology, and Biochemistry/Biophysics, and the Institute of Biological Chemistry. The objectives of the Program are to provide graduate students with a broad knowledge in plant physiology and with research experience in a chosen area within this discipline. The Program is especially strong in the molecular biology and biochemistry of plant-related processes, including cellular and subcellular physiology, photosynthesis and photorespiration, nitrogen fixation, phytochemistry, the physiology of vascular plants, stress metabolism, plant-pathogen interactions, hormo-

nal interactions and growth regulation, crop production physiology, and physiological ecology and in related areas in agriculture and biology.

The Program offers opportunities for students with backgrounds in chemistry, biochemistry, genetics, plant physiology, molecular biology, botany, biology, and the agricultural sciences to pursue advanced training in plant physiology, with independent study and original research in areas of the students' own interest as the single most important component. The flexible and interdisciplinary nature of the Program exposes students to plant physiologists and plant scientists representing a wide range of research interests and provides students with a broad choice of specialized facilities available in the cooperating academic units.

Students entering the Program must have completed their baccalaureate degree with training that includes a year of physics and of elementary biology or botany; at least one semester of both organic chemistry and biochemistry; one semester each of plant physiology and genetics, and mathematics through calculus. A few undergraduate deficiencies may be remedied by taking the appropriate courses after enrollment in the graduate program on a provisional basis.

Degree requirements for both the master's and doctorate include courses in advanced plant physiology, cell biology structure, and biochemistry. Additional courses are chosen by the student and the supervising committee of Graduate Faculty to fit the student's interests, the programmatic goals of the faculty and the requirements of the Graduate School. There is no foreign language requirement. Course work is generally completed, and qualifying examinations taken, during the fifth semester of enrollment. The supervising committee for each student will have at least three (in the case of students seeking the master's) or four (in the case of students seeking the Ph.D.) faculty members of whom at least two (including the advisor) are members of the program in Plant Physiology from separate academic units.

Policies and procedures of the Graduate School apply to all admissions. Interested students can get more information from the Program in Plant Physiology or any of the participating academic units. An interest in the Program in Plant Physiology should be indicated and, if possible, the research area of interest identified. Admission to the Program is based on GRE scores, transcripts, letters of recommendation, and an evaluation of background, experience, goals and objectives of the applicant. Applicants from foreign countries are advised to submit TOEFL scores to demonstrate sufficient English proficiency for graduate study.

The Program will be administered by the academic unit of the student's major advisor. The supervising committee for each student will have at least three (in the case of students seeking the master's) or four (in the case of students seeking the PhD) faculty members of whom at least two (including the advisor) are members of the Program in Plant Physiology from separate academic units. The Program offers opportunities for students with backgrounds in chemistry, biochemistry, genetics, plant physiology, molecular biology, botany, biology, and the agricultural sciences to pursue advanced training in plant physiology, with independent study and original research in areas of the student's own interest as the single most important component. The flexible, interdisciplinary nature of the Program exposes students to plant physiologists and plant scientists representing a wide range of research interests and provides students with a broad choice of specialized facilities available in the cooperating academic units.

Financial support for students in the Program may be within the administering academic unit or through the Program in Plant Physiology. Participating faculty may provide support through individual grants and contracts. Every effort will be made to inform applicants of these opportunities.

Course requirements are drawn from existing courses offered by cooperating departments and programs. In addition, a one-credit seminar is held weekly during each semester. Course work is generally completed, and qualifying examinations taken, during the fifth semester of enrollment.

Plant Physiology

PI Ph

515 Seminar in Plant Physiology 1 May be repeated for credit; cumulative maximum 4 hours. A cross-discipline seminar, including botany, crop and soil sciences, horticulture, plant pathology, and plant physiology.

561 Biochemical Signaling in Plants, Animals and Microorganism 2 Same as MBioS 561.

570 Advanced Topics in Plant Physiology 1 May be repeated for credit; cumulative maximum 3 hours. Oral presentation of a current research paper.

571 Research Proposal 2 May be repeated for credit; cumulative maximum 4 hours. Written and oral presentation of an area of plant physiology.

580 Protein Trafficking in Eucaryotic Cells 3 Prereq MbioS 513; graduate standing. The biochemistry and cell biology involved in protein trafficking among organelles in eucaryotic cells. Cooperative course taught by WSU, open to UI students (WS 580).

587 Advanced Topics in Plant Biochemistry 2 Same as MbioS 571.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Dissertation and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Political Science

Degrees Granted: Master of Arts in Criminal Justice, Master of Arts in Political Science; Master of Public Affairs; Doctor of Philosophy (Political Science)

GRADUATE FACULTY

S. D. Stehr, Chair; A. Appleton, D. C. Brody, C. W. Clayton, T. E. Cook, M. L. Cottam, L. Leloup, C. N. Long, N. P. Lovrich, F. E. Lutz, O. Marenin, K. A. Mason, A. G. Mazur, M. A. Newman, D. C. Nice, J. M. Pickerill, T. Pratt, J. T. Preston, D. Stehr, M. Stephan, M. Smith, P. Thiers, E. P. Weber

The degrees Master of Arts in Political Science and Doctor of Philosophy are offered by the Department of Political Science, and the degree Master of Public Affairs is offered by Political Science in Vancouver. Coursework for Political Science may be taken in the following areas: American Institutions and Processes; International and Comparative Politics; and Administration, Justice, and Applied Policy Studies. Students interested in careers in public affairs or in the Foreign Service can achieve their goal within the above framework by supplementing their programs with carefully selected courses offered by other departments.

Admission is not confined to students who have majored or minored in political science as undergraduates, although this or a closely related background in the social sciences is highly recommended. General departmental admission eligibility required for regular student status is: a) at least a B grade point average (3.00 on a 4.00 scale) in the last 60 hours of undergraduate work from an accredited college or university, b) Graduate Record Examination scores (verbal and quantitative) and c) undergraduate transcripts. Minimum requirements for departmental admission approval for the master's program is a 3.0 undergraduate GPA and for the doctoral program one must have successfully completed a master's degree with a minimum overall GPA of 3.0. Usually, however, admission is not granted to students with GPA's below 3.3.

Master of Public Affairs. This master's degree is offered at the Vancouver campus and is designed to prepare students for careers in the public and nonprofit sectors, and offers training for working students who desire professional growth and advancement. The MPA degree at WSU Vancouver requires the completion of specific core requirements with additional coursework for the particular concentrations.

Requirements for Master's Degree in Political Science. The MA candidate must be enrolled, at a minimum, in either: a) two semesters; b) two regular semesters and one summer session; c) or three regular semesters, depending upon course load.

Students who plan on applying to the Ph.D. program should design, as much as possible, their coursework to fulfill requirements for the Ph.D. The M.A. candidate must be enrolled and in residence for a minimum of one academic year. Students who have not previously taken a course in statistics will be required to complete at least three semester hours in that field. Recommended courses include Soc 321, Psych 311, or their equivalent. Students are required to write a Master's Essay which will be developed in cooperation with the student's program com-

mittee. The work for this essay should be roughly equivalent to the work for a three credit graduate seminar. At least 15 working days prior to the examination date, the Master's candidate shall provide each member of the examining committee with a final draft of the Master's Essay. The oral examination will feature a defense of the Master's Essay and can also cover the entirety of the candidate's program.

Requirements for PhD in Political Science. A student aspiring to the PhD should expect to spend three to four years, depending on the individual, in study and research beyond the MA degree, of which at least two years must be at Washington State University, at least two consecutive semesters must be spent in residence as a graduate student in Political Science. This degree program is designed for the student entering the graduate program with a MA. Students in the MA program at WSU must submit a regular application to the PhD program.

During his/her second semester of residence, the student shall form a preliminary examination committee. (Note that this committee may be different from the MA committee if the student is coming from this program.) At the end of her/his fourth semester, the student should take preliminary examinations. After successful passage of the preliminary examination the student is admitted to candidacy (ABD status). In the semester following preliminary exams, PhD students who have received their MA from a different institution are required to defend a dissertation prospectus. Normally, the last year of graduate study is devoted entirely to the preparation and defense of the dissertation.

Course Requirements

There are three different types of course requirements for a PhD: core courses, research tool, course field, and preliminary exam field. Core courses consists of general, introductory seminars in a variety of sub-fields of political science. Research tool courses train students in appropriate methodological techniques. Preliminary examination courses are more specialized seminars that students will select in consultation with their program committee.

For specific course requirements for the MA or the PhD please consult literature distributed by the Department. The following is a list of all seminars offered by the Department.

Pol S

- 501 The Scope of Political Science** 3 Prereq 12 hours Pol S. Historical development and present status of the discipline; contemporary issues and future trends. Cooperative course taught by WSU, open to UI students (PolSc 530).
- 502 Seminar in Normative Theory** 3 Elements of normative theory developments; examination of bases of controversies and approaches in the modern literature using historical sources.
- 503 Introduction to Political Science Research Methods** 3 Prereq 12 hours Pol S; Soc 321 Social science research design topics including: measurement, sampling, data sources, experimental and quasi-experimental designs, field and historical designs and content analytic designs.
- 504 Quantitative Methods in Political Science and Criminal Justice** 3 Applied statistical skills to enable understanding of substantive political and social questions.
- 505 Comparative Criminal Justice Systems** 3 Same as Crm J 505. Comparative study of criminal justice systems in the U.S. and selected countries.
- 510 Seminar on American Institutions and Processes** 3 Seminar required of all graduate students using this field as a major or a minor. It is a prerequisite of all other graduate seminars in the field.
- 511 Seminar in American Political Thought** 3 May be repeated for credit; cumulative maximum 6 hours. The genesis and development of political thought in the United States.
- 512 Seminar in American Institutions** 3 May be repeated for credit; cumulative maximum 6 hours. Origin, development, and contemporary issues in political organization and structure in the United States.
- 513 Seminar in Political Behavior** 3 May be repeated for credit; cumulative maximum 6 hours. Theoretical approaches to, and empirical analysis of, mass political behavior in the US.
- 514 Seminar in Public Policy** 3 Examination of central questions in public policy including what is the nature of public policy, what is policy analysis, why does government intervene in society?

- 515 Governmental Policy and Program Analysis** 3 Techniques used to analyze policy alternatives and to evaluate programs; developing program objectives, management by objectives, productivity analysis, program evaluation, and policy analysis. Cooperative course taught by UI (PolSc 556), open to WSU students.
- 516 Seminar on Law, Courts, and Judicial Politics** 3 Prereq graduate standing. Seminar on law, courts, and judicial politics.
- 530 Seminar in Theoretical Approaches to International Relations** 3 Group dynamics, systems analysis, decision making, communications models, game theory, simulations, and rationality models. Cooperative course taught by WSU, open to UI students (PolSc 501).
- 531 Seminar in International Security** 3 International security and arms control politics, negotiations, agreements. Cooperative course taught by WSU, open to UI students (PolSc 561).
- 532 Seminar in International Political Economy** 3 Institutions, politics, and decision making processes in managing international economic relations.
- 533 Topics in Political Psychology** 3 May be repeated for credit; cumulative maximum 6 hours. Psychological influences on political decision making, bargaining, conflict and conflict resolution options.
- 534 Seminar in Comparative Politics** 3 May be repeated for credit; cumulative maximum 6 hours. Cooperative course taught jointly by WSU and UI (PolSc 595).
- 535 Advanced Issues in Comparative Politics** 3 Advanced issues seminar in international and comparative politics.
- 536 Special Topics in Comparative Politics** 3 May be repeated for credit, cumulative maximum 6 hours. Advanced issues seminar in international and comparative politics.
- 537 Concepts and Methods in Comparative Politics** 3 Selected concepts (state, political participation), and methods (cross-national analysis, case study approaches) in comparative politics.
- 538 International Development and Human Resources** 3 Same as Anth 519.
- 539 The Political Science Profession** 1 Methods, problems, and purposes of teaching, research, and vocation in political science. S, F grading.
- 540 Proseminar in Public Administration** 3 Basic theories of administrative organization, relationships, and behavior.
- 541 Seminar in Research Evaluation** 3 Interrelationships of ideological data, policy development, and policy implementation in public policy analysis.
- 542 Proseminar in Administration, Justice and Applied Policy Studies** 3 May be repeated for credit; cumulative maximum of 12 hours. Prereq Pol S 540. Analytical perspectives and theoretical issues in administration, justice and applied policy studies. Cooperative course taught jointly by WSU and UI (PolSc 592).
- 543 Topics in Public Administration and Policy** 3 May be repeated for credit; cumulative maximum 6 hours. Prereq graduate standing. Examination of the literature on the politics of the American public policy process.
- 544 The Politics of Policy Process** 3 American political process; policy making under the constraints of a democratic system; relationship to the (non) achievement of the public interest.
- 547 Seminar in Public Administration** 3 Cooperative course taught by WSU, open to UI students (PolSc 501).
- 552 Administrative Law and Regulation** 3 Rule-making, adjudication, and other modes of regulation of administrative agencies; judicial review and Congressional oversight of administrative acts. Cooperative course taught by UI (PolSc 552), open to WSU students.
- 592 Same as Crm J 592.**
- 597 Graduate Internship** V 2-12 May be repeated for credit; cumulative maximum 12 hours. Prereq graduate student. On/off campus internship in federal, state, or local government institutions; nonprofit or public organizations; written assignments and readings will be required. S, F grading.
- 599 Research Practicum** Variable 1-3 May be repeated for credit, cumulative maximum 6 hours. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Psychology

Degrees Granted: Master of Science in Psychology; Doctor of Philosophy

GRADUATE FACULTY

P. M. Whitney, Chair; T. A. Brigham, G. L. Burns, C. C. Chandler, R. M. Craft, H. A. Dengerink, D. G. Dyck, L. R. Fournier, J. P. Garofalo, M. Gartstein, J. M. Hinson, J. Joireman, M. Kibby, R. R. Kleinhesselink, P. Kwon, S. Lakatos, F. K. McSweeney, M. M. Morgan, P. Ouimette, C. D. Parks, R. Patterson, T. M. Probst, M. Schmitter-Edgecombe, E. Soliday, P. S. Strand, P. M. Whitney, P. Williams, B. R. Wright, J. W. Wright

The graduate program in Psychology leads to the advanced degrees of Master of Science in Psychology and Doctor of Philosophy for qualified students who are interested in eventual employment as psychologists in college teaching, in research, or in professional service. Areas of specialization within the Department include clinical psychology and experimental psychology. The doctoral program in clinical psychology is accredited by the American Psychological Association.

Excellent departmental facilities are available for various kinds of psychological research. These include a community mental health clinic and specially designed facilities for research in learning, memory and cognition, sensory processes, social interaction, and physiological psychology. In addition, cooperative arrangements with other units of the University and with outside institutions make it possible for students to gain first-hand experience in research and professional work. These arrangements involve the University Health Service, Counseling Service, the Pullman Public School system, the University Computing Center, Colleges of Veterinary Medicine and Pharmacy, various mental health service institutions, and industries. The University maintains a comprehensive library of books and journals in psychology and in related fields.

A student entering the program should have completed at least 18 semester hours of psychology, including three hours in elementary statistics and a course in experimental psychology. Amassing a large number of credits in undergraduate psychology courses is not recommended. Rather, it is preferable that the undergraduate years be devoted to building a strong background in mathematics, natural sciences, philosophy, and social sciences. It is possible for a student with fewer than 18 semester hours of psychology to be admitted to the graduate program and to remove deficiencies through undergraduate course work.

Prospective graduate students may obtain further information by writing to the Chair of the Graduate Admissions Committee, Department of Psychology, Washington State University, Pullman, WA 99164-4820. Applicants will need to submit Graduate School and departmental application forms; official transcripts from all previous colleges, verbal, quantitative, and analytic scores on the Graduate Record Examination; and recommendation forms supplied by the Department.

An admissions committee reviews all applications and makes recommendations to the clinical or experimental faculty for the final decision on admissions. Supplementary criteria evaluated for admission include: clinical or research experience; background in physical, biological, and computer sciences; background in mathematics, statistics, and experimental methods; extracurricular activities and jobs related to psychology; and teaching experience, if any.

The doctoral program typically takes four years to complete with an additional year for clinical psychology students in an APA-approved internship. Students are expected to complete requirements for the master's degree by the end of the second year, preliminary examinations by the end of the sixth semester, dissertation and final examination by the end of the fourth year, and internship for clinical students by the end of the fifth year.

Students in clinical psychology must meet basic general psychology requirements of two courses in statistics, one course in the history of psychology, one course in social psychology, and one course in learning or cognition. Additional clinical requirements include courses in personality, psychopathology, intellectual assessment, professional issues, personality assessment, foundations of psychotherapy, clinical child psychology, behavior modification, clinical assessment, foundations of neuropsychology, medical psychology, and cross-cultural psychology. Each student is required also to complete six semesters of supervised practicum and one full year of internship. Beyond these requirements,

other courses are available within and outside the Department for persons who wish additional or more specific training in clinical skills, program evaluation, mental health administration, or research.

Students in experimental psychology work closely with a faculty advisor to build individual programs of study within a specialty area of behavior analysis, cognition, physiological, sensory or social. All experimental students are required to take History of Psychology, two courses in statistics and methodology, six hours of seminar credit, and at least four courses from among Physiological Psychology, Sensory Bases of Behavior, Cognition and Memory, Experimental Analysis of Behavior, and Attitudes and Social Cognition. Further coursework is dependent upon the student's individual needs and goals of the specialty area.

Psychology

Psych

- 502 Research Design V 1 (0-3)-3 (0-9)** May be repeated for credit; cumulative maximum 16 hours. Research design, equipment, data collection, data analysis, and report writing. S, F grading.
- 504 History of Psychology: Theoretical and Scientific Foundations** 3 Roots of scientific explanation in psychology traced through various philosophical schools and psychological movements.
- 505 Teaching Introductory Psychology V 1-3** May be repeated for credit; cumulative maximum 4 hours. Prereq graduate standing. Problems and techniques related to teaching introductory psychology. S, F grading.
- 506 Current Research in Psychology 1** Current research being conducted by psychology faculty and members of associated departments.
- 507 Topics in Psychology 3** May be repeated for credit.
- 508 Special Topics in Psychology V 1-3** May be repeated for credit.
- 511 Analysis of Variance and Experimental Design 3** Prereq Psych 311. Parametric, nonparametric, repeated-measures, and multivariate ANOVA; planned comparisons; confidence intervals and power analysis; experimental design and variants.
- 512 Correlation, Regression, and Quasi-Experimental Design 3** Prereq Psych 511. Simple and multiple correlation and regression; time-series analysis; factor analysis; field research and quasi-experimental design.
- 513 Seminar in Quantitative Methods and Research Design 3** May be repeated for credit. Prereq Psych 512. Advanced topics in specialized quantitative procedures and in design of research in psychology.
- 514 Psychometrics 3** Prereq Psych 512. Scientific construction of behavioral assessment instruments, including validation and reliability; types of scales and responses; statistical scaling; test theory issues.
- 520 Empirical Approaches to Psychotherapy 3** Major therapy systems, research on process and outcome of therapy.
- 521 Behavior Modification 3 (2-3)** Prereq Psych 390, 520. Learning principles applied to modifying behavior of children and adults in institutions, clinics, and schools.
- 522 Applied Behavioral Research 3** Research theory and methodology on development of applied programs.
- 530 Professional Ethical and Legal Issues 3** Application of professional, ethical, and legal issues in clinical psychology to such topics as confidentiality, dual-relationships, research, assessment, and intervention.
- 533 Adult Psychopathology 3** Prereq by interview only. Theoretical and empirical approaches to diagnosis, etiology and treatment of mental disorders. Cooperative course taught by WSU, open to UI students (Psych 575).
- 534 Clinical Psychopharmacology 3** Prereq Psych 533, 574. Classification, clinical application, and mechanisms of psychotherapeutic drugs used in the treatment of mental disorders.
- 535 Clinical Assessment and Diagnosis 3** Diagnostic interviewing, conceptualization of clinical problems, case presentations, and treatment planning.
- 536 Measurement Theory and Personality Assessment 3** Prereq Psych 530, 539. Psychometric theory, theories of personality, objective and projective methods of assessing personality, development of testing and interpretive skills.
- 537 Psychology Clinic Assessment Practicum 3** May be repeated for credit; cumulative maximum 18 hours. Prereq Psych 539 or by in-

- interview only. Supervised practice in psychological assessment in the Psychology Clinic. S, F, grading.
- 538 Child Therapy Practicum** 3 May be repeated for credit; cumulative maximum 18 hours. Prereq Psych 520, 530, 533, 535, 536, 539, 543, or by interview only. Supervised practice in the clinical application of psychology with children and families. S, F grading.
- 539 Measurement Theory and Intellectual Assessment** 3 Psychometric theory theories of intelligence, methods of appraising intelligence in children and adults, and development of testing and interpretive skills.
- 540 Group Psychotherapy** 3 By interview only. Psychotherapeutics in the context of the group.
- 541 Marriage and Marital Therapy** 3 Prereq Psych 530, 535, graduate standing. Introduction to research on marital relationships, clinical models of marital dysfunction, and methods of intervention with distressed couples.
- 542 Community Psychology** 3 Examination of community and its effects on health and behavior; organization of community based mental health services.
- 543 Child Clinical Psychology: Empirical Approaches to Assessment and Therapy** 3 Research on developmental psychopathology, child assessment, and child therapy.
- 544 Medical Psychology: Psychological and Pharmacological Interventions** 3 Psychological factors and their influence upon the causes and/or course of medical illnesses as well as relevant clinical interventions. Cooperative course taught by WSU, open to UI students (Psych 544).
- 545 Psychology Clinic Adult Therapy Practicum** 3 (0-9) May be repeated for credit; cumulative maximum 18 hours. Prereq Psych 520, 530, 535, 536, 539, or c//. By interview only. Supervised practice in the clinical application of psychology with adults in the Psychology Clinic. S, F grading.
- 546 Counseling Service Practicum** V 1-3 May be repeated for credit; cumulative maximum 12 hours. Prereq Psych 545 or c//. By interview only. Supervised practice in the clinical application of psychology; at the WSU Counseling Service. S, F grading..
- 547 Medical Psychology Practicum** 3 May be repeated for credit; cumulative maximum 18 hours. Supervised practice in the clinical application of psychology at the WSU University Health Service. S, F grading.
- 548 Behavioral Medicine Practicum** 3 May be repeated for credit; cumulative maximum 18 hours. Supervised practice in the clinical application of psychology at the Sacred Heart Medical Center and St. Luke's Rehabilitation Center. S, F grading.
- 550 Attitudes and Social Cognition** 3 Attitude structure, function, and change. Social cognition and motivation, and attributions. Cooperative course taught by WSU, open to UI students (Psych 520).
- 551 Group and Interpersonal Processes** 3 Theories and research in interpersonal dynamics; cognitive, learning, equity, and attributional concepts. Group performance and interpersonal interaction, social influence, distributive and procedural justice, helping, and attraction.
- 552 Diversity Issues in Psychology** 3 Research, theories, and controversies regarding the role of human diversity in psychotherapy, psychological assessment, and clinical research.
- 553 Theories of Personality** 3 Classical (e.g., psychoanalytic, ego psychology) and contemporary (e.g., object relations social learning, psychological behaviorism) views of personality development.
- 554 Physiological Psychology** 3 May be repeated for credit. Neuroanatomical, neurochemical, and other biological cases of human and animal behavior.
- 555 Foundations of Neuropsychology** 3 Foundations in brain/behavior relationships and neuropathological syndromes; preparation for advanced training in neuropsychological assessment.
- 556 Neuropsychological Assessment** 3 Prereq Psych 574 and Psych 575. Brain-behavior relationships in humans and the evaluation of cognitive, behavioral, and emotional changes accompanying a variety of neuropsychiatric syndromes.
- 557 Behavioral Pharmacology** 3 Prereq Psych 574. Survey of drugs which affect brain function with emphasis on animal models and clinical applications.
- 559 Behavioral Neuroscience** 3 Prereq Psych 574. Advanced topics in neurochemistry, neurophysiology and neuroanatomy.

- 584 Sensory Bases of Behavior** 3 Prereq Psych 384. Sensory and physiological aspects of vision, audition, and other senses.
- 586 Seminar in Physiological/Sensory Psychology** 3 May be repeated for credit. Advanced current topics in physiological/sensory psychology.
- 591 Models of Learning** 3 Historical and current theory and research in learning and cognition.
- 592 Cognition and Memory** 3 Experimental approaches to human information processing, memory, and cognition.
- 593 Experimental Analysis of Behavior** 3 Operant conditioning in relation to the experimental evidence currently available; examination of research strategies.
- 594 Seminar in Learning/Cognition** 3 May be repeated for credit. Advanced current topics in learning/cognition.
- 595 Clinical Internship in Psychology** V 2-16 May be repeated for credit; cumulative maximum 16 hours. Prereq passing of prelims and completion of course work for PhD. Clinical training in an internship approved by American Psychological Association or by WSU. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Rural, Land Use and Regional Planning

(See Environmental Science and Regional Planning)

Sociology

Degrees Granted: Master of Arts in Sociology; Doctor of Philosophy

GRADUATE FACULTY

G. M. Hooks, Chair; M. P. Allen, S. R. Burkett, A. Kirschner, D. A. Dillman, H. L. Freese, L. N. Gray, M. K. Johnson, R. A. Jussaume, M. Konty, J. Kmec, L. J. McIntyre, C. J. Mosher, T. Munch-Rotolo, E. Rosa, D. A. Sonnenfeld, A. S. Wharton

The graduate program in Sociology prepares candidates for professional roles by offering the degrees Master of Arts in Sociology and Doctor of Philosophy. Specialized programs exist in deviant behavior, sociology of the family, social psychology, and environmental sociology. Other specializations cover a broad range of sociological interests, such as demography, human ecology, social policy and evaluation research, community organization, social stratification. Advanced work in all specializations includes courses in theory, statistics, and research methods. Although the program prepares graduates for academic positions, increasing numbers are being placed in government and private agencies as applied sociologists.

Resources of special note which are available to students include the Social and Economic Sciences Research Center, which coordinates a variety of interdisciplinary projects including a Public Opinion Laboratory equipped for large-scale telephone surveys; a small groups research laboratory with observation rooms; a Data Processing Center with access to the campus Computing Center, and technical programming assistance. The University Library has a wealth of materials necessary for sociological study and research including the Human Relations Area files, professional journals and monographs.

Undergraduates contemplating graduate study in sociology are advised to obtain as broad an education as possible, as well as basic preparation in sociology, statistics, and research methods. Admission requirements include submission of GRE scores, three letters of recommendation and a general "Statement of Purpose."

Sociology

Soc

- 510 Development of Social Theory** 3 Foundations of sociological theory; exposes students to original works of theorists. Graduate level counterpart of Soc 410; additional requirements. Credit not granted for both Soc 410 and 510.
- 511 Theories of Social Organization** 3 Major theories of social organization in historical perspective.
- 512 Theory Construction and Formalization** 3 Testing; formalization of theoretical systems; adaptation of general models to specific problems.
- 517 Seminar in Contemporary Sociological Theory** 3 Recent developments in sociological theory, analysis, application and appraisal of specific theoretical systems.
- 519 International Development and Human Resources** 3 Same as Anth 519.
- 520 Research Methods in Sociology** 3 Methodology of social research at the professional level.
- 521 Regression Models** 3 Prereq Soc 421. Simple and multiple regression, structural equation models, non-linear applications, applications for discrete dependent variables.
- 522 Advanced Sociological Methods** 3 May be repeated for credit; cumulative maximum 12 hours. Prereq Soc 521. Scaling theory, sampling theory, experimental design, measurement of association, multivariate analysis, current methods and techniques.
- 523 Qualitative Methods Practicum** 3 Prereq graduate standing. Introduction to qualitative research methods as used in social sciences; epistemological underpinnings and empirical techniques.
- 524 Sociology and Public Policy** 3 Relationship between sociology and public policy; effective utilization of concepts and methods in applied settings. Credit not granted for both Soc 424 and 524.
- 525 Practicum in Survey Research** 3 Prereq Soc 520. Practical experience in design and implementation of telephone and mail surveys; participation in all aspects of conducting a survey.
- 530 Demography** 3 Population studies; causes, effects, and measurement of changes in fertility, mortality, and migration; population estimation and projection.
- 531 Human Ecology** 3 Ecosystem context of human life; change viewed ecologically; sociological use and misuse of ecological concepts; issues in theory and research.
- 532 Environmental Sociology** 3 Societal-environmental interactions; impacts of human societies on the physical environment; environmental impacts on human behavior and social organization.
- 533 Social Impact Assessment** 3 Sociology's contribution to environmental impact assessments; methods, contents, and contexts of assessing social impacts of proposed developments. Cooperative course taught by WSU, open to UI students (RRT 504).
- 534 Energy and Society** 3 Energy and societal evolution; energy consumption patterns and quality of life; social impacts of energy shortages and alternative energy systems.
- 535 Technology and Society** 3 Prereq graduate standing. Analysis of sociotechnical systems; effects of technology on society; the social shaping of technologies and their environmental impacts.
- 536 Special Topics in Environmental Sociology** V 1-3 May be repeated for credit; cumulative maximum 9 hours. Special Topics in Environmental Sociology.
- 542 Theories of Social Stratification** 3 Marx, Dahrendorf, Weber, Sorokin, Mills, Pareto; problems of stratification research; social class and social policy.
- 544 Sociology of Religion** 3 Role of religion in social structure, process and change; analysis of religious behavior.
- 545 Sociology of Community** 3 Community stability and change: interaction processes; decision-making; societal linkages; effects on well-being.
- 546 Medical Sociology** 3 Social factors related to health and illness; organization and change in health care; impacts of health care reform, rising costs, and aging. Credit not granted for both Soc 446 and 546.
- 548 Political Sociology** 3 Systematic survey of theories and the major research literature in political sociology.
- 550 Survey of Social Psychology** 3 Survey of theories, findings, and methods; self and identities, interaction processes, socialization, emotions, gender relations, group processes and network relations.
- 551 Comparative Family Systems** 3 Comparative research on and theory of marital, family, and kinship relations and behavior.
- 552 Practicum in Family Research** V 1-4 May be repeated for credit; cumulative maximum 12 hours. Research design, measurement, data collection, analysis, and manuscript writing.
- 553 Social Organization and the Family** 3 The family as a social institution; principles of social organization applied to family relationships; macro-level analyses of family structure.
- 554 Social Psychology of the Family** 3 The family as an interacting group; social psychological theories and research applied to family relationships; effects of families on individuals.
- 555 Sociology of Gender** 3 Sociological theory and research on gender and gender inequality in American society.
- 556 Sociology of Aging** 3 Theory and research on changes that individuals undergo over the life course as a function of socialization and maturational processes.
- 560 Problems of Deviance Theory** 3 Development of theories of deviant behavior; new issues in the study of deviance.
- 561 Sociology of Law** 3 Social factors affecting the development and maintenance of legal structures and the process of administration of justice.
- 567 Seminar in Crime and Delinquency** 3 Contemporary theory and research in crime and delinquency.
- 568 Adolescent Deviance** 3 Contemporary sociological theory and research in adolescent deviance; action programs, and emerging issues.
- 571 Small Group Theory and Research** 3 Theory and methods of small group research; types of groups, formation, and development of communication networks; socialization in group situations.
- 572 Socialization** 3 Theories of childhood and adult socialization; personality development; symbolic interaction; learning; agents of socialization.
- 573 Group Processes** 3 Sociological theory and research dealing with overt behavior in human interaction settings and its cognitive antecedents.
- 580 Sociology of Race Relations** 3 Basic understanding of relations, major sociological concepts and theories regarding minority and majority group relations. Credit not granted for both Soc 480 and 580.
- 590 Special Topics in Sociology** 3 May be repeated for credit; cumulative maximum 9 hours.
- 591 The Sociology Profession** 1 May be repeated for credit; cumulative maximum 2 hours. Requirements, operations, problems, and possibilities of the sociology profession. S, F grading.
- 592 Special Topics in Sociology** 3 May be repeated for credit; cumulative maximum 9 hours.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. S, F grading.

Soils

(See Crop and Soil Sciences)

Speech and Hearing Sciences

Degrees Granted: Master of Arts in Speech and Hearing Sciences

GRADUATE FACULTY

G. D. Chermak, Chair; E. Inglebret, J. M. Johnson, C. L. Madison, J. Ray

The Department of Speech and Hearing Sciences offers graduate work for the Master of Arts degree in the areas of speech-language pathology and audiology and is based at WSU Spokane. A bachelor's degree in Speech and Hearing Sciences is not mandatory; however, students entering the graduate program with undergraduate majors in related fields must complete a core of undergraduate prerequisites including 34 hours of undergraduate courses.

The Department of Speech and Hearing Sciences offers academic course work and clinical practicum to prepare professional personnel to meet the diagnostic and therapy needs of individuals of all ages evidencing a wide variety of speech, language, learning, and hearing problems. Students are prepared as speech-language pathologists and audiologists to provide direct and consultative services in educational and medical settings. The course of study emphasizes the physiological, behavioral, neurological, and psychological dimensions of normal development, the fundamental communication processes, and the disorders of communication. The academic teaching and learning culture is student-centered, research-based, and writing-intensive. By applying science and research to clinical practice in the department's campus clinics as well as clinical placements across the state, graduate students develop proficiency in reasoning and problem solving relative to clinical principles and procedures in diagnosis and treatment. Two graduate programs are available: the master's with thesis, designed to develop a student's research capability preparatory to doctoral study; and the master's non-thesis for the student focusing on clinical competence. Both programs provide the basis for the Certification of Clinical Competence in Speech-Language Pathology and Audiology. The master's degree specializations in speech-language pathology and audiology are accredited by the Council on Academic Accreditation, American Speech-Language Hearing Association. The programs are recognized by the State Board of Education.

The non-thesis master's program includes 33 hours of credit in department courses plus SHS 566 (off-campus practicum), SHS 575 (Clinical Practicum), SHS 570 (Advanced Internship), and SHS 702 (Directed Study/Research Project). The MA program with thesis involves similar coursework including a minimum of 4 hours of SHS 700 (Thesis/Exam).

The supporting facilities for the graduate programs are located in both Pullman and Spokane and include primary and secondary materials held in the Owen Science and Engineering, Education, and Holland Libraries and the Cooperative Academic Library Service (CALs); the clinics and research complexes in Daggy Hall and the Health Sciences Building at the WSU Spokane Riverpoint Campus; the WSU Computing Center; and related university research units such as the Social and Economic Sciences Research Center and off-campus internship sites. Additional library resources are maintained at Eastern Washington University, Gonzaga University, and the Intercollegiate College of Nursing.

Speech and hearing sciences graduate programs are operated cooperatively with Eastern Washington University, thereby providing a varied curriculum and faculty. The University Programs in Communication Disorders (UPCD) operates on a calendar of three blocks per academic year; one fall block and two spring blocks. Courses also are offered during summer sessions. The UPCD schedule is published in the WSU Spokane time and course schedule each semester.

Communication Disorders

SHS

- 501 Research Methods I** 2 Philosophy of research, types of literature.
- 502 Computers in Clinical Practice** 1 Microcomputer basics and hardware and software available for evaluation and treatment of speech and hearing disorders.
- 503 Research Methods II** 2 Experimental and descriptive designs, application of statistics, analysis of statistical results.
- 540 Special Topics in Speech and Hearing Sciences** V 1-3 May be repeated for credit; cumulative maximum 9 hours. Advanced study of specialized topics in speech and hearing sciences.
- 542 Infant and Toddler Communication and Language** 3 Prereq SHS 371. Typical development of communication and language in the birth to 5 year-old population; impairments affecting development; disorders; assessment; intervention.
- 550 Special Topics in Speech and Hearing Sciences** V 1-3 May be repeated for credit; cumulative maximum 9 hours. Study of specialized topics in speech and hearing sciences.

- 552 Advanced Audiological Rehabilitation** 3 Prereq SHS 477. Practices and research in communication strategies training; speech and listening technology; exploration of current issues.
- 556 Problems in Stuttering** 2 Prereq SHS 474. Historical and current literature; problem-solving strategies applied to theoretical and clinical problems in stuttering.
- 557 (573) Cleft Palate and Craniofacial Disorders** 2 Prereq SHS 377. Speech and voice problems associated with clefts of the lip and palate.
- 560 Special Topics in Speech and Hearing Sciences** V 1-3 May be repeated for credit; cumulative maximum 9 hours. Advanced study of specialized topics in speech and hearing sciences.
- 561 Advanced Speech and Hearing Sciences** 3 Prereq SHS 372, 377. Theory, measurement, and instrumentation in acoustics, normal speech production, and audition.
- 562 Motor Speech Disorders** 2 Prereq SHS 377. Underlying processes of neuromuscular control and feedback; results of damage and disease on neuromotor system.
- 563 Dysphagia** 3 Prereq SHS 377. Anatomy and physiology of swallowing; evaluation and treatment of swallowing disorders.
- 564 Language of Children with Hearing Impairment** 3 Prereq SHS 371, 477. Speech production and speech perception abilities and language development and intervention strategies with the hearing impaired.
- 565 Augmentative Communication** 3 Prereq SHS 478, 482. Augmentative communication theory; implementation, training strategies, ongoing adjustments, and evaluating effectiveness.
- 566 Off-Campus Clinical Practice** V 2 (0-6)-6 (0-18) May be repeated for credit; cumulative maximum 15 hours. Prereq SHS 575. By interview only. Advanced clinical practice in off-campus setting; evaluation and treatment of speech, language, and hearing disorders.
- 567 Issues in Public School Service Delivery** 3 Prereq *c//* in SHS 575. On-site and off-site clinical operations, policies, procedures; legal, ethical, and professional issues for schools and medical settings.
- 570 Advanced Internship in Speech-Language Pathology and Audiology** V 1-18 May be repeated for credit. Prereq SHS 471 or 525; 566 or 575. By interview only. Advanced practicum in diagnosis of and therapy for communication disorders. S, F grading.
- 571 Seminar in Speech Pathology and Audiology** 3 May be repeated for credit; cumulative maximum 9 hours. Exploration of ideas derived from current writings and research in speech pathology and audiology.
- 572 Hearing Aids** 3 Prereq SHS 472, 477. Hearing aid technology, evaluation and fitting; programmable hearing aids; probe microphone measurement; prescriptive techniques.
- 574 Neuropathologies of Language** 3 prereq SHS 377, 478. Advanced study of language disorders resulting from brain insult after birth; emphasis on aphasia and related disorders.
- 575 Advanced Clinical Practice** V 2 (0-6) to 6 (0-18) Prereq by interview only, SHS 567 or *c//*. May be repeated for credit; cumulative maximum 15 hours. Advanced clinical practice in evaluation and treatment of speech, language, and hearing disorders.
- 576 Voice Disorders** 2 Prereq SHS 377. Functional and organic voice disorders resulting from various etiologies.
- 577 Auditory Perception** 3 Prereq SHS 472, 477. Psychoacoustic and psychophysiological bases of auditory perception relationship between language and auditory processing.
- 578 Professional Issues in Speech-Language Pathology and Audiology** 3 May be repeated for credit; cumulative maximum 9 hours. Contemporary philosophical and professional issues in the field of communication science and disorders.
- 580 Special Topics in Speech and Hearing Sciences** V 1-3 May be repeated for credit; cumulative maximum 9 hours. Advanced study of specialized topics in speech and hearing sciences.
- 582 Clinical Perspectives** 3 Theory and clinical experience designed to assist students in integrating course work into a clinical perspective.
- 584 Advanced Audiometric Procedures** 3 Prereq SHS 472. Behavioral and physiological principles and procedures in audiology for the differential diagnosis of auditory pathologies.
- 585 Hearing Conservation in Industry and Society** 3 Prereq SHS 472. Prevention and management of noise-induced hearing loss; in-

teractions between noise and other ototraumatic agents and physical characteristics of the individual.

- 586 Pediatric Audiology** 3 Prereq SHS 472. Developmental anatomy and physiology of the human auditory system; auditory behavior and pathologies in children; assessment of infants and children.
- 587 Speech-Language Pathology in the Medical Setting** 2 Prereq SHS 574 and by interview only. Report writing and charting, collaborating with the medical team, establishing prognosis and assessing efficacy of treatment, and third-party reimbursement.
- 588 Phonological Acquisition and Behavior** 3 Prereq SHS 376. Current literature in articulatory development and deviancy; diagnosis and therapy.
- 589 Professional Development in Speech-Language Pathology and Audiology** 1-2 Prereq SHS 476, 570. Planning and implementing a program of continuing education in speech language pathology and audiology leading to the Continuing Level ESA Certificate from OS-PI. S, F grading.
- 590 Special Topics in Speech and Hearing Sciences** V 1-3 May be repeated for credit; cumulative maximum 9 hours. By interview only. Advanced study of specialized topics in speech and hearing sciences.
- 594 Medical Audiology** 3 Otoaudiologic and neurologic considerations in differential diagnosis of auditory and vestibular disorders; audiologic test battery interpretation; medical intervention options.
- 596 Electrophysiological Procedures** 3 Prereq SHS 472. Principles, protocols, and clinical applications of auditory evoked potentials.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.

Statistics

Degrees Granted: Master of Science in Statistic

GRADUATE FACULTY

M. A. Jacroux, Director; S. K. Ahn, J. R. Alldredge, R. B. Bendel, N. S. Cardell, N. Dasgupta, M. A. Evans, S. B. Fotopoulos, V. K. Jandhyala, R. C. Mittelhammer, F. G. Pascual, D. A. Sclar, R. K. Steinhorst, M. C. Wang, H. Zhang

The graduate Program in Statistics is an interdisciplinary arrangement with unified Graduate Faculty across the campus who are involved in statistics teaching, research and consulting. The College of Agriculture and Home Economics and the Departments of Management and Decision Sciences, Economics, and Mathematics are each represented among the current faculty. In addition, liaison is maintained with the Division of Statistics at the University of Idaho and with the Mathematics and Statistics Program at WSU Tri-Cities, WSU Spokane and WSU Vancouver.

The department currently offers coursework leading to a Master of Science in Statistics. Requirements for this degree include at least 31 hours of graduate work. Degree candidates must take 15 hours of "core" material including Stat 443, Stat 456/556, Stat 512, Stat 530 and Stat 533, take a statistical computing course, take three courses from selected field areas, and pass an oral exam over their coursework. In addition, each candidate must participate in two credit hours of consulting seminar and carry out a four credit special project. Persons interested in pursuing an MS in Statistics at WSU are encouraged to request detailed information about the degree and the supporting staff and facilities from the Chair of the Department of Statistics.

As preparation for work toward a Master of Science Degree in Statistics, a student must have completed one or more courses in statistical methods, mathematics through multivariable calculus, linear algebra and have Fortran or C programming capability. A course in advanced calculus is also strongly recommended.

Statistics

Stat

- 504 Special Topics** 3 Prereq Stat 456. Cooperative course taught by UI (Stat 504), open to WSU students.
- 507 Experimental Design** 3 Prereq Stat 512. Methods of constructing and analyzing designs for experimental investigations; analysis of designs with unequal subclass numbers; concepts of blocking randomization and replication; confounding in factorial experiments; incomplete block designs; response surface methodology. Cooperative course taught by UI (Stat 507), open to WSU students.
- 510 Topics in Probability and Statistics** 3 Graduate-level counterpart of Stat 410; additional requirements. Credit not granted for both Stat 410 and 510.
- 511 Statistics for Economics** Same as Ag Ec 510.
- 512 Analysis of Variance of Designed Experiments** 3 (2-2) Prereq Math 360 or Stat 412 or equivalent. Principles of experimental design and analysis and interpretation of data.
- 513 Advanced Econometric Application** 3 Same as Ag Ec 590.
- 514 Nonparametric Statistics** 3 Prereq Stat 512. Conceptual development of basic nonparametric tests including their power and efficiency. Cooperative course taught by UI (Stat 514), open to WSU students.
- 515 Statistical Packages** 3 (2-3) Prereq statistical methods course. No previous computer experience required. Computer techniques for statistical methods; comparison of capabilities of major statistical packages; analysis techniques, graphics, terminal use, data structures, numerical algorithms.
- 516 Time Series** 3 Same as DecS 516. Cooperative course taught by WSU, open to UI students (Stat 539).
- 518 Techniques in Sampling** 3 Same as DecS 518.
- 519 Applied Multivariate Analysis** 3 Same as DecS 519. Cooperative course taught jointly by WSU and UI (Stat 521).
- 520 Statistical Analysis of Qualitative Data** 3 Prereq Math 140, 172 or 202; statistics course. Binomial, Poisson, multinomial distribution; contingency tables. Fisher's test, loglinear models; ordinal data; applications in biology, business, psychology and sociology. Credit not granted for both Stat 420 and 520. Cooperative course taught by WSU, open to UI students (Stat 520).
- 523 Statistical Methods for Engineers and Scientists** 3 Prereq graduate standing. Graduate level counterpart of Stat 423; additional requirements. Credit not granted for both Stat 423 and 523.
- 530 Applied Linear Models** 3 (2-2) Prereq Math 360 or Stat 412 or equivalent. The design and analysis of experiments by linear models.
- 531 Econometrics** 3 Same as Econ 511. Cooperative course taught by WSU, open to UI students (Stat 531).
- 533 Theory of Linear Model** 3 Prereq Stat 430 or 444; Math 420. Theoretical basis of linear regression and analysis of variance models; a unified approach based upon the generalized inverse. Cooperative course taught jointly by WSU and UI (Stat 533).
- 535 Regression Analysis** 3 Prereq Stat 444 or 430. Conceptual development of regression; estimation, prediction, tests of hypotheses, variable selection, diagnostics, model validation, correlation and nonlinear regression. Cooperative course taught jointly by WSU and UI (Stat 510).
- 536 Statistical Computing** 3 (2-3) Prereq Stat 443 and 530, or Stat 523, or with instructor's permission. Generation of random variables, monte carlo simulation, bootstrap and jackknife methods, EM algorithm, markov chain monte carlo methods.
- 542 Applied Stochastic Models** 3 Same as DecS 542.
- 544 Applied Stochastic Processes** 3 Prereq Stat 430 or 443. Poisson and Markov processes; queuing theory; auto-covariance; stationarity; power spectra; harmonic analysis; linear mean-square predictions. Cooperative course taught jointly by WSU and UI (Stat 544).
- 547 Statistical Pattern Recognition** 3 Same as Cpt S 547.
- 548 Statistical Theory I** 3 Prereq Math 273; Stat 430 or 443. Probability spaces, combinatorics, multidimensional random variables, characteristic function, special distributions, limit theorems, stochastic processes, order statistics. Cooperative course taught by WSU, open to UI students (Stat 548).
- 549 Statistical Theory II** 3 Prereq Stat 548. Continuation of Stat 548. Statistical inferences; estimation and testing hypotheses; regression analysis; sequential analysis and nonparametric methods. Cooperative course taught by WSU, open to UI students (Stat 549).
- 552 Advanced Econometrics** 3 Same as AgEc 512.

- 555 Statistical Ecology** 3 Prereq Stat 443. Ecological stochastic models, population dynamics and genetics, sampling, spatial analysis, discrete/continuous distributions, birth-death processes, diffusion processes. (a/y) Cooperative course taught by UI (Stat and WLF 555), open to WSU students.
- 556 Introduction to Statistical Theory** 3 Prereq graduate standing. Graduate level counterpart of Stat 456; additional requirements. Credit not granted for both Stat 456 and 556.
- 573 Reliability Theory** 3 Prereq Stat 430, 443. Statistical concepts; stochastic material strengths and lifetimes; strength versus safety analysis; reliability of coherent systems; maintenance models; complex systems. Cooperative course taught jointly by WSU and UI (Stat 571).
- 586 Applied Multiple Time Series Analysis** 3 Same as DecS 586.
- 590 Statistical Consulting Practicum** 1 or 2 Prereq three courses in statistics, including one methods course or by interview only. Theory and practice of statistical consulting; participation in consulting sessions.
- 600 Special Projects or Independent Study.** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. S, F grading.
- 702 Master's Special Problems, Directed Study, and/or Examination** Variable credit. S, F grading.

Teaching and Learning

(See Education)

Theatre Arts and Drama

(See Music and Theatre Arts)

Veterinary Science

Degrees Granted: Master of Science in Veterinary Science; Doctor of Philosophy

GRADUATE FACULTY

W. M. Bayly, Dean, College of Veterinary Medicine; J. E. Alexander, R. S. Bagley, T. J. Baldwin, D. D. Barbee, G. M. Barrington, T. V. Baszler, T. E. Besser, S. E. Blank, M. K. Borucki, W. C. Brown, G. A. Burns, D. Call, K. B. Campbell, M. Chandra, W. P. Cheevers, L. Churchill, T. B. Crawford, C. Davies, W. C. Davis, A. S. Dhillon, J. E. Ellington, J. F. Evermann, W. J. Foreyt, L. K. Fox, P. R. Gavin, C. C. Gay, J. M. Gay, H. L. M. Granzier, D. D. Hancock, J. W. Harding, Jr., S. A. Hines, H. Jansen, D. P. Jasmer, R. D. Keegan, D. P. Knowles, J. M. Krueger, M. B. Laskowski, C. W. Leathers, H. Li, J. D. Lincoln, N. S. Magnuson, F. Martin, T. F. McElwain, T. C. McGuire, K. Mealey, M. A. Memon, K. M. Meyers, R. Newberry, J. L. Oaks, G. H. Palmer, S. Parish, K. A. Potter, D. J. Prieur, R. M. Quock, M. H. Ratzlaff, D. Rector, R. C. Ritter, W. S. Ritter, F. R. Rurangirwa, R. D. Sande, D. Schneider, D. Sellon, R. Sellon, S. M. Simasko, B. K. Slinker, B. A. Sorg, L. Sprunger, E. H. Stauber, D. M. Stone, S. Tibary, C. M. Ulibarri, M. D. Varnum, K. J. Wardrop, K. K. White, C. S. Zamora

Veterinary science is the field of graduate study offered by the College of Veterinary Medicine. Graduate programs leading to the degree Master of Science and Doctor of Philosophy are available. Students may elect to specialize in areas of anatomy, physiology, pharmacology, toxicology, microbiology, pathology, immunology, and clinical medicine. Combinations of these areas can be developed. The Master of Science program is designed to provide broad training in the specific aspects of the veterinary sciences and related disciplines in order to prepare students for careers in teaching, research, and service. A supporting area outside of veterinary medicine may be selected.

The master's thesis program must consist of not less than 30 hours of credit including a master's research thesis and/or examination and a minimum of 21 hours of course work, including seminars numbered 500 or above which are graded other than P/F or S/F. A minimum of 11 hours of 400- and 500-level courses must be included in the program. All courses utilized must have been approved for graduate credit.

Programs leading to the degree of Doctor of Philosophy are designed to provide intensive study toward a career in biomedical research, research on animal diseases, or research and teaching in these areas. One or more minor fields may be selected outside the area of veterinary medicine. Considerable specialization in some field of veterinary science is encouraged.

The minimum number of credits required in the PhD research, thesis and/or examination, special projects and problems, allowed transfer credit and supporting courses. The number of 300-series courses which may be included in the additional studies is limited to 12 hours.

The College of Veterinary Medicine has facilities for rearing, maintenance and experimental manipulation of a variety of animal species. These include diseased animals from the field or animals reared within breeding colonies maintained by the College. Students may be exposed to a variety of diagnostic, research or teaching experiences. The varied activities available include basic and applied research, case exposure and diagnostic problems, formal course work in various disciplines, ongoing seminars, and guest speaker programs. The physical facilities and equipment available encompass a large scope of diverse activities found in most biomedical complexes. Post-DVM students may select training for board certification in conjunction with formal degree program.

The College of Veterinary Medicine houses a branch library with subscriptions to more than 600 journals. Major journals in associated fields can be found in the University Library.

Students who contemplate graduate study in veterinary science at Washington State University must meet the entrance requirements of the Graduate School and have the degree of Doctor of Veterinary Medicine or the Bachelor of Arts or the Bachelor of Science in allied fields. For students without the degree of Doctor of Veterinary Medicine, graduate study is available only in the preclinical fields. Each applicant for admission is required to submit a statement of goals and objectives; the Graduate Record Examination is required of those applicants who are not graduates of AVMA-accredited Colleges of Veterinary Medicine. The undergraduate preparation must include two semesters of organic chemistry or one semester of organic and one semester of physiological chemistry; one year of general physics or one semester of physics and one semester of college algebra; one semester of comprehensive and vertebrate anatomy and one semester of general or comparative physiology. Graduation from an accredited veterinary college with sufficiently high grades meets the minimal requirements of Post-DVM's. Admission to graduate work in the College depends upon the applicant's previous scholastic record, availability of graduate student positions, the needs of the individual applicant, and the ability of the College to supply the type of training desired. Special program requirements have been established which may require the student to participate in teaching and seminars in addition to specific course requirements. A first level examination may be required also. All of the recent graduates have either continued their graduate training or are employed in industry, government, research, or teaching.

Veterinary Anatomy

V An

513 Advanced Neuroanatomy 4 Prereq anatomy or physiology course that includes neuroanatomy. Advanced gross and microscopic anatomy of the mammalian central nervous system. Cooperative course taught by WSU, open to UI students (Zool 513).

592 Seminar 1 May be repeated for credit. Cooperative course taught by WSU, open to UI students (VS 592).

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis, and/or Examination Variable credit. (For MS in veterinary science only.) S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. (For PhD in veterinary science only.) S, F grading.

Veterinary Medicine

V M

- 520 Veterinary Physiology** 5 Prereq V M 519. Physiology of domestic animals. Cooperative course taught by WSU, open to UI students (VS 518).
- 521 Mammalian Neuroscience** 3 (2-3) V M 510 Neuroanatomical and neurophysiological bases of veterinary neurology, emphasizing central and peripheral sensory and motor systems.
- 534 Veterinary Immunology** 3 (2-3) Prereq major in Vet Med or graduate student in Vet S. Immunology for the professional veterinary student. S, F, grading.
- 535 Veterinary Virology** 3 Prereq major in Vet Med or graduate student in Vet S. Virology for the professional veterinary student.
- 545 Pathology I** 3 (2-3) Prereq V M 520. Structural and functional alterations in disease; elementary oncology designed for veterinary students who need the writing in the major requirement for the BS degree. Cooperative course taught by WSU, open to UI students (VS 445).
- 546 Pathology II** 6 (5-3) Prereq V M 545. Principles of system and organ response to injury, and the effects of injury/disease on the animal host.

Veterinary Pharmacology and Toxicology, and Physiology

V Ph

- 501 Fundamentals of Graduate Research in the Life Sciences** 1 Prereq consent of the instructor. Seminars/discussions of practical issues confronting life science researchers with emphasis and overviews of disciplines related to biomedical research. S, F grading.
- 505 Design and Analysis of Biomedical Experiments** 4 Prereq Math 107, statistics course. Design of experiments with application to clinical and basic biomedical research; choosing, applying, and evaluating appropriate data analysis methods.
- 521 Cardiorespiratory Systems** 3 (2-3) A system and quantitative treatment of physiological processes in the heart, blood vessels, and lungs.
- 525 Special Topics in Veterinary and Comparative Pharmacology** 1 (0-3) Prereq V M 522. Practical veterinary pharmacology techniques and clinical application.
- 528 Behavioral Mechanisms in Physiology** 3 Examination of the physiological transduction mechanism which enable animals to interact behaviorally with their environment. Cooperative course taught by WSU, open to UI students (Zool 528).
- 529 Cellular and Molecular Neurobiology** 4 Prereq biochem. course. Basic biochemical processes in the nervous system and their significance for normal and abnormal function. Cooperative course taught by WSU, open to UI students (Zool 529).
- 530 General and Comparative Neurophysiology** 4 Same as Zool 530.
- 531 Neuroscience Laboratory Rotation** 1 (0-3) May be repeated for credit; cumulative maximum 2 hours. Prereq graduate standing. Ten-week rotation through each of three research laboratories; learning procedures and techniques in neuroscience. S, F grading..
- 534 Advanced Neurophysiology** 3 Nervous system from molecular to the behavioral level; electrophysiology. Cooperative course taught by WSU, open to UI students (Zool 534).
- 535 Pathophysiology of Blood** 2 Physiology of erythron, hemostatic system and transfusion medicine.
- 537 Physiology and Biochemistry of Neuropeptides** 3 Prereq BC/BP 563, V M 517, or Zool 553. Synthesis and metabolism, use as neurotransmitters and neurohormones mechanisms of receptor interactions. Cooperative course taught by WSU, open to Idaho students (VS 537).
- 538 Neuroendocrinology** 3 Role of the central nervous system in controlling reproductive functions, stress, growth, biological rhythm and behavior. Cooperative course taught by WSU, open to UI students (AVS 538).
- 541 Biochemistry** 3 Prereq Chem 342. Intermediate biochemistry; introduction to metabolism and the chemical and physical properties of biomolecules. Cooperative course taught by UI (MMBB 541), open to WSU students.
- 542 Biochemistry** 3 Prereq Chem 342. Intermediate biochemistry; introduction to metabolism and the chemical and physical properties of biomolecules. Cooperative course taught by UI (MMBB 542), open to WSU students.
- 545 Experimental Design** 1 (0-2) May be repeated for credit; cumulative maximum 6 hours. Same as Neuro 545. S, F grading.

- 555 General and Cellular Physiology** 4 (3-3) Prereq cell physiology or genetics course. Physiochemical mechanisms of cellular functions.
- 557 Advanced Mammalian Physiology** 4 Prereq V Ph 555. Function and control of mammalian organ systems.
- 564 Brain-Endocrine Interaction** 3 Neuroanatomy, physiology, neuropharmacology and role of neuroendocrinology, the integrative regulation of endocrine and visceral functions. Cooperative course taught by WSU, open to UI students (Zool 564).
- 590 Seminar** 1 May be repeated for credit; cumulative maximum 4 hours. Seminar by advanced graduate students and faculty both in VCAPP and around WSU on their research areas. S, F grading.
- 592 Research Seminar** 2 May be repeated for credit; cumulative maximum 6 hours. Concepts and controversies within a specific and highly focused domain of physiological research; research presentation.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. (For MS in veterinary science only.) S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. (For PhD in veterinary science only.) S, F grading.

Veterinary Clinical Medicine and Surgery

VMS

- 582 Seminar in Clinical Medicine** 1 May be repeated for credit.
- 583 Advanced Anesthesiology** 2 Prereq DVM degree. Advanced veterinary anesthesiology as applied to clinical practice.
- 584 Comparative Theriogenology** 1 Prereq DVM degree. Lectures from WSU College of Veterinary Medicine and Department of Animal Sciences and from UI Department of Animal and Veterinary Science.
- 585 Selected Topics in Advanced Clinical Neurology** 1 or 2 Prereq DVM degree. May be repeated for credit; cumulative maximum 10 hours. Advanced veterinary neurology as applied to clinical practice.
- 587 Hospital Rotation** 3 (0-9) May be repeated for credit; cumulative maximum 6 hours. Prereq DVM degree. Supervised practical experience in all service areas of the veterinary hospital. Cooperative course taught by WSU, open to UI students (VS 587).
- 589 Advanced Clinical Veterinary Medicine** V 1-3 May be repeated for credit; cumulative maximum 6 hours. Prereq DVM degree. Special topics.
- 591 Advanced Clinical Diagnosis** V 1-3 May be repeated for credit; cumulative maximum 6 hours. Prereq DVM degree. Advanced course in systems clinical and laboratory examination.
- 592 Seminar** 1 May be repeated for credit. Cooperative course taught by WSU, open to UI students (VS 592). S, F grading.
- 593 Anesthesia Seminar** 1 Prereq DMV degree or equivalent. Critical review of current topics in veterinary anesthesia.
- 594 Advanced Small Animal Surgery** 3 (2-3) May be repeated for credit; cumulative maximum 6 hours. Prereq DVM Degree. Clinical experimental techniques.
- 595 Advanced Laboratory Diagnosis** V 1-3 May be repeated for credit; cumulative maximum 6 hours. Prereq DVM degree. Advanced clinical laboratory diagnosis and interpretation.
- 596 Advanced Radiology** 2 (1-3) Prereq DVM degree. Advanced study in the field of veterinary radiology and radiation treatment.
- 597 Diagnosis and Treatment of Surgically Correctable Soft Tissue Diseases in Small Animals** V 1-2 May be repeated for credit; cumulative maximum 6 hours. Prereq DVM or equivalent or preapproval. Review of recent advances in diagnosis and treatment of diseases in the field of small animal surgery.
- 598 Surgery Residents Seminar** 1 Prereq DVM degree. May be repeated for credit. Surgery residents' and interns' presentations of case reports, literature reviews and research. S, F grading.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable credit. (For MS in veterinary science only.) S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. (For PhD in veterinary science only.) S, F grading.

Veterinary Microbiology

V Mic

- 531 Mechanisms of Immune Regulation in Laboratory and Domestic Animals** 3 Prereq Micro 412. Analysis of immune regulation in vertebrates; ontogeny, phylogeny, immune regulation.
- 532 Virology** 3 Prereq V M 535P or Micro 414 and BC/BP 364. Advanced topics in basic virology.
- 535 Advanced Readings in Veterinary Microbiology** 1 (0-3) May be repeated for credit. Prereq senior in Vet Med or graduate student in Vet S. Supervised reading program which peruses publications of intermediate technical difficulty and advanced textbooks.
- 536 Diagnostic Microbiologic Conference** 1 (0-3) May be repeated for credit. Prereq graduate student in Vet S. Identification of animal pathogens in clinical material.
- 537 Diagnosis of Viral and Rickettsial Diseases of Domestic Animals** 3 (1-6) Prereq V M 534P, 431, 446. Clinical, pathological, and laboratory diagnosis of viral and rickettsial diseases of domestic animals.
- 541 Advanced Diagnostic Microbiology** 1 (0-3) May be repeated for credit; Prereq V M 534P, 535P, 536P. Microbiology laboratory for performing and interpreting virologic, serologic, and related tests for the diagnosis of animal diseases.
- 562 Molecular Diagnostic Microbiology** 1 (0-3) May be repeated for credit; cumulative maximum 3 hours. Prereq V Mic 541 or *c//*. Discussion and molecular laboratory for detection and identification of infectious agents for the diagnosis of animal diseases.
- 572 Advanced Topics in Microbiology, Parasitology, or Immunology** V 1-3 May be repeated for credit; cumulative maximum 4 hours. Advanced topics in microbiology, parasitology, or immunology presented in short-course, or workshop, format.
- 591 Seminar in Diagnostic Microbiology** 1 May be repeated for credit. Seminar in diagnostic veterinary microbiology.
- 592 Advances in Immunobiology** 1 May be repeated for credit. Cooperative course taught by WSU, open to UI students (VS 592).
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis and/or Examination** Variable credit. (For MS in veterinary science only.) S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. (For PhD in veterinary science only.) S, F grading.
- 525 Introductory Readings in Veterinary Pathology** 1 (0-3) May be repeated for credit; cumulative maximum 2 hours. Supervised introductory readings of publications, books, and research proposals.
- 542 Advanced Diagnostic Pathology** V 1 (0-3)-4 (0-12) May be repeated for credit. Prereq V M 546P. Necropsy laboratory for techniques and skills in performing and interpreting necropsy material.
- 543 Laboratory Animal Pathology** 3 May be repeated for credit; cumulative maximum 6 hours. Prereq V M 559P. Pathology of principle disease of laboratory animals.
- 544 Immunopathology** 3 (2-3) Prereq V M 545P and VM 534P or a similar immunology course. Experimental design involving the role of immune responses in protection against disease and in causing disease processes.
- 545 Mechanisms of Disease** 5 Prereq V M 545P, 537P or Micro 412. Biochemical and immunological mechanisms involved in disease processes from the comparative standpoint.
- 547 Advanced Veterinary Parasitology** 3 Prereq graduate or advanced undergraduates. Mechanisms involved in host-parasite relationships important to control of parasitic infections.
- 548 Introduction to Research** 1 Introduction to research.
- 555 Research in Progress Seminar** 1 May be repeated for credit. Cumulative maximum 8 hours. Presentation of on-going student research project results.
- 569 Research Proposal** 1 (0-3) May be repeated for credit; cumulative maximum 2 hours. Written preparation and oral presentation of a research proposal.
- 571 Advanced Topics in Pathology** V 1-3 May be repeated for credit; cumulative maximum 4 hours. Advanced topics in pathology presented in short-course, or workshop, format.
- 592 Anatomic Pathology Seminar** 1 May be repeated for credit. Histo-pathologic description and diagnosis.
- 600 Special Projects or Independent Study** Variable credit. S, F grading.
- 700 Master's Research, Thesis, and/or Examination** Variable Credit. (For MS in veterinary science only.) S, F grading.
- 800 Doctoral Research, Dissertation, and/or Examination** Variable credit. (For PhD in veterinary science only.)

Veterinary Pathology

V Pa

- 501 Case-based Learning in Veterinary Pathology** 1 (0-3) to 3 (0-9) Prereq second year Vet Med or DVM degree. Principles of pathophysiology, infectious disease, laboratory diagnosis, zoonoses, and food safety learned through the development of multistep teaching cases.

Graduate Faculty

The purpose of Graduate Faculty is to assure that graduate students are advised by faculty members who have experience conducting research and training students and to also assure that the graduate program within a unit is supervised by faculty who are active scholars or researchers.

The minimum criteria that have been established by the Graduate Studies Committee and approved by the Faculty Senate are those with which all degree-granting units must comply. To be considered for membership, nominees must meet the following standards. These activities may have occurred at Washington State University or elsewhere.

- A. Show evidence of past and continuing scholarly or creative work within the past five years. Criteria shall be developed by the unit and approved by the Graduate Studies Committee of its agent.
- B. Show evidence of substantial involvement in graduate education within the past five years, e.g., by directing graduate student research and/or graduate teaching. (New faculty members without previous involvement in graduate student advising can satisfy this requirement by having a named mentor. The mentor must be a member of the Graduate Faculty. The role of the mentor is to help the new faculty member advise and direct graduate students.)
- C. Possess an advanced degree appropriate to the unit making the nomination.

Beyond the minimum standards stated above, each unit shall establish its own specific criteria for election to Graduate Faculty. The unit's criteria shall embody recognition of current creative and/or scholarly productivity by the nominee.

In general, appointments and terminations from the Graduate Faculty will be administered by the Graduate School using the guidelines provided by the Graduate Studies Committee. The responsibility for nomination and election to the Graduate Faculty shall be transferred to the degree-granting unit concerned.

- A. The chair is responsible for carrying out the election and conducting the balloting of the Graduate Faculty in the unit.

- B. All current Graduate Faculty members of the unit, excluding courtesy appointees, shall be allowed to vote. A majority vote of the Graduate Faculty in the unit is required for election.
- C. A resume, a list of graduate courses taught during the last five years, and a list of graduate students advised during the last five years or the name of the mentor shall be submitted to the Graduate School.
- D. The chair of the degree-granting unit will complete the 'Recommendation Form for Graduate Faculty Membership' and forward it through the academic dean to the Dean of the Graduate School with the material listed in 'C' above.

Programs are reviewed by the Graduate Studies Committee every five-seven years. As part of the process of reviewing a unit's graduate program, the Graduate Faculty will be reviewed also. Faculty who no longer meet the minimum criteria will not be reappointed. In some cases, a conditional membership on the Graduate Faculty may be granted.

Graduate Faculty Requirements for Graduate Program

- A. Schools, divisions, and colleges should have either a single Graduate Faculty identified by the title of the school or college, or multiple Graduate Faculties identified by the titles of the graduate degree-granting units within the school or college.
- B. Departments and programs may have single Graduate Faculties identified by the titles of the graduate degree-granting units.
- C. Only units with at least five faculty members on the Graduate Faculty can offer a graduate program.

To access the graduate faculty nomination form, and also a current list of graduate faculty members, please see <http://www.wsu.edu/~gradsch/gradfac.htm>.

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