Biomedical Sciences Ph.D. Program
Agriculture Building Rm. 5007 Web site: http://www.uwyo.edu/biomedphd/
Program Director: Don Roth, Ph.D.

Degree Offered
Ph.D. in Biomedical Sciences

Biomedical sciences is the study of human biological processes; the complex interactions between physiological, genetic and environmental factors that influence disease and health. It spans the spectrum from fundamental discovery to innovation and application.

Areas of focus may include but not limited to cardiac health, nutrition, reproductive biology, toxicology, diagnostic & imaging and medical engineering.

The PhD program in biomedical sciences is designed to position graduates for long-term competitive success in the rapidly changing and multifaceted health-related arena in the 21st century. It is a comprehensive, interdisciplinary program, making connections between various disciplines to gain new insights, discover and apply new knowledge, and promote self-directed, life-long learning.

Biomedical Sciences is a research & discovery focused program balancing depth and breadth of content knowledge with “enabling” skills including problem solving, innovation, entrepreneurship, communication and leadership.

Program of Study
Rationale: The program of study is designed according to student learning goals and research opportunities. It blends depth and breadth of preparation by providing broad core requirements with electives promoting specialization in a “parent” discipline. This is recognized on program documentation by a Doctorate in Biomedical Sciences/”specialization” area. For example, Doctorate in Biomedical Sciences/Reproductive Biology.

Student Learning Outcomes: The BMS program provides unique array of formal courses and informal discovery experiences focused on ensuring aptitudes, behaviors and skills necessary for leadership and competitive success in the biomedical science arena. Although the foundation enabling innovative, independent thinking and knowledge discovery is deep discipline knowledge, the BMS program is also designed to promote student competency in information assessment, synthesis and integration, communication and translation to the broader community, teamwork, leadership and project management.

The BMS program trains graduates to be competent, skilled experimentalists, problem solvers, critical and independent thinkers, expert in their field, with both depth and breadth of knowledge.

In addition, the program aims to instill characteristics that are essential to long-term professional success, preparing scientists who are effective and dedicated mentors and teachers, organized administrators, exemplars of high ethical standards, and effective collaborators. Upon completion of the program, graduates will demonstrate:

- Independent, critical thinking skills
- Ability to identify appropriate biographical resources
- Knowledge of recent advances in discipline and related areas
- Understanding of a broad spectrum of research methodologies and their applications
- Ability to critically analyze research findings
- Ability to design and independently execute research
- Ability to use appropriate information technology to record, manage, and disseminate information
- Understanding of issues related to researcher and subject rights
- Motivation and aptitude needed to acquire knowledge
- Communication skills that are appropriate for a range of audiences and purposes
- Ability to construct and articulate arguments to a wide range of audiences
- Ability to effectively support the acquisition of knowledge by others when teaching or mentoring students
- Willingness to assume responsibility for their work
- Ability to design and teach undergraduate or graduate courses
- Ability to publish single/first authored papers in peer-reviewed journals

Biomedical Sciences (BMS)
5880. Biomedical Sciences Research Ethics. 2. Introduction to the field of bioethics, including major ethical theories and principles, with an emphasis on understanding the ethical issues that may arise while conducting biomedical research and potential strategies for properly addressing these ethical issues. Prerequisites: none.
5920. Continuing Registration: On Campus, 1-12 (Max. 24). Prerequisite: graduate standing.
5940. Continuing Registration: Off Campus, 1-24 (Max. 24). Prerequisite: graduate standing.
5960. Thesis Research, 1-24 (Max. 24). Designed for students who are involved in research for their thesis project. Also used for students whose coursework is complete and are writing their thesis. Prerequisite: enrollment in a graduate degree program.
5980. Dissertation Research, 1-24 (Max. 24). Designed for students who are involved in research for their thesis project. Also used for students whose coursework is complete and are writing their thesis. Prerequisite: enrollment in a graduate degree program.
5985. Seminar I (Max. 3). A series of weekly seminars presented by faculty from other universities, private or public sector health industries or by Biomedical Science Program faculty and students. Examines current topics and research in biomedical sciences through oral presentations and discussion. Prerequisites: graduate standing and consent of instructor.

Program in Ecology
Berry Center 231 Phone: (307) 766-6240 E-mail: ecology@uwyo.edu Web site: www.uwyo.edu/pie
Program Director: Robert O. Hall, Jr., Ph.D.

Degree Offered
Ph.D. in Ecology

The Program in Ecology prepares doctoral students to lead the discipline of ecology during the coming decades. The program is grounded in the natural history of organisms in their environment, but incorporates tools and perspectives from across the biological, physical, mathematical, computational, and earth sciences. Students develop conceptual, historical, and philosophical perspectives spanning the entire range of subdisciplines in ecology, while receiving advanced training in
the subdiscipline of their individual interest. The program fosters long-term career development by exploring the linkages of ecology with other disciplines, and by scanning the ecological horizon for emerging questions, concepts, and approaches that will shape the field in years to come.

Faculty members from several departments and colleges participate in the Program in Ecology. Their interests span the full range of topics covered in the field of ecology, and students in the program reflect this diversity.

Program Specific Admission Requirements

Only students seeking a doctoral degree will be admitted into the program. Minimum criteria for admission to the Program in Ecology are:

- Minimum score of 900 on the Graduate Record Examination (GRE) general test
- Minimum undergraduate GPA of 3.0
- Agreement by a member of the PIE faculty to sponsor the student, or to co-sponsor the student together with a PIE affiliate
- Admission to a home department at the University of Wyoming

All applications to the program will be reviewed by Graduate Affairs Committee, which has authority on admissions. Students applying to the program who lack a master's degree must show exceptional promise and commitment (e.g., through undergraduate or post-graduate research experiences, peer-reviewed publications, and/or success in competing for research fellowships). Such students are encouraged to consult with their prospective adviser on whether to apply directly to PIE or to master's programs in individual departments of PIE faculty.

Students already admitted to doctoral programs in individual departments at the University of Wyoming may apply to transfer to the program. Transfer is not pro forma. Transfer applications are subject to the same criteria as for entering students, and admission to the program for transfer students must be approved by the Graduate Affairs Committee.

Program Specific Degree Requirements

Advisory Committee

Before the end of the second semester of study, the student should nominate a five-member advisory committee to the Office of the Registrar. At least three members of the committee, including the committee chair (usually the student's adviser), will be members of the PIE faculty. One other member, who will serve as Graduate Faculty representative, must be from outside the home department of the major adviser, although s/he can be a faculty member in a department that participates in the program. The committee will advise the student on his/her program of graduate study, execute and evaluate the student's preliminary examination, evaluate the student's dissertation proposal and dissertation, and conduct the student's dissertation defense.

Program of Study

All students are required to take ECOL 5100 or equivalent. This course should be taken during the first year of residency. All students are required to take ECOL 5550 no sooner than the fourth and no later than the eighth semester of study. All students should take ECOL 5550 or its equivalent at least once a year, excepting years when they are enrolled in 5100 or 5550. Exceptions or substitutions of these requirements are subject to approval by the graduate affairs committee.

The program of study must include at least 6 credit hours aimed at developing a tool skill, which except for rare cases shall be in the quantitative/analytical domain (e.g., statistics, modeling, GIS, remote sensing, bioinformatics). Courses relating to research tools should be taken early in the student's residency to ensure that they can be used in thesis research and advanced studies. Specific coursework and tool-skill development for the student's program of study will be developed in consultation with and subject to approval by the student's advisory committee.

Admission to Candidacy

Admission to candidacy for the Ph.D. requires two steps: 1) providing evidence that the student is prepared to identify a research question, design an approach for investigating that question, and a plan for executing the approach, all in the format of an NSF-style research proposal, and 2) illustrating adequate proficiency in the subject matter of ecology through a process involving both written and oral exams.

Proposal

Students must submit a NSF-style proposal to their committee outlining their project, typically by the end of the fourth semester. Each committee member will provide feedback to the student on the proposed research and indicate approval of the proposal or request revision. The proposal must be approved by all committee members prior to starting the preliminary exams.

While this proposal should be a plan for actual dissertation research, unforeseen circumstances may require altering the student's dissertation work after the proposal has been approved by the committee. In the case of a major alteration, the student should formulate a research plan and submit it to the committee in writing for committee approval.

Preliminary Exam

Passing the preliminary exam is the official admission to candidacy.

Written portion of the preliminary exam. The student will take the written exam portion of the preliminary exam no fewer than two weeks following approval of the research proposal. The goal of this exam is to test breadth of knowledge in ecology. The design of this exam will be coordinated by the graduate committee under the leadership of the adviser. Each written exam will cover the following topics:

- Ecological topics ranging from organismal/evolutionary to ecosystem-level perspectives, integrating concepts and perspectives from across the discipline, over a wide range of spatial and temporal scales.
- The philosophical and historical development of ecology.
- The conceptual background of the student's area of specialization.

The exam will consist of four to six questions developed collectively by the committee and organized by the student's major professor. The exam will be open book; however, the answers will be solely the work of the student. Answers should be fully cited and collectively should be no longer than 30 pages double-spaced exclusive of references cited. Students will have one full week (seven days) to complete the exam. Committee members will indicate pass/fail within one week following completion of written exams. Four of five passing votes are required.

Oral Portion of the Preliminary Exam. No sooner than two weeks after successfully passing the written exam, the student may proceed to an oral exam administered by his/her graduate committee. Oral exams center around questions developed collectively by the committee and organized by the student's major professor. The exam will be open book; however, the answers will be solely the work of the student. The exam will be open book; however, the answers will be solely the work of the student. Answers should be fully cited and collectively should be no longer than 30 pages double-spaced exclusive of references cited. Students will have one full week (seven days) to complete the exam. Committee members will indicate pass/fail within one week following completion of written exams. Four of five passing votes are required.

To verify that the student is prepared, conceptually and methodologically, to carry out successful dissertation research. To evaluate the student’s ability to
conceptualize specific questions in a broad, integrative context.

To evaluate the student’s ability to think spontaneously and creatively and to articulate responses about unexpected or novel questions.

The advisory committee will discuss and organize specific questions based on these goals in a short session at the beginning of the exam period before admitting the student to the examination room and starting the exam. Following the exam each committee member will provide non-binding paper votes of pass/fail for each of the three goals of the oral exam. Following discussion of the student’s performance, committee members will each assign a grade of pass/fail for the overall exam. Four of five committee members must vote for passing the overall oral exam.

Students whose performance is unsatisfactory will be given one opportunity for retaking the oral examination. This retake will occur no later than the academic-year semester following the first examination.

Public Seminars

Students are required to give two oral presentations on their research. The purposes of these presentations are to provide the student with practice in oral presentations and to keep the PiE community informed of the student’s progress. The first will describe the student’s dissertation research proposal. This presentation will be given before the student submits his/her thesis proposal. The second presentation will summarize the student’s completed dissertation research, and will normally be given the same semester as the student’s dissertation defense. Under extraordinary circumstances (subject to approval by the Graduate Affairs Committee), this presentation may be given at an earlier time. These presentations must be open to the public, and may comprise part of a departmental or Program in Ecology seminar or brown-bag series.

Ecology (ECOL)

5050. Techniques in Environmental Data Management. 2. Centers on the role of information technology in support of scientific research. Through integration of multiple software packages (e.g. Relational databases, ProgramR and ArcGIS), proven database designs, and SQL scripting, increased efficiency and utility will occur during data analyses. These information science principles are demonstrated using project-based examples. Cross listed with ENR/GEOG 5050. Prerequisite: graduate standing.

5060. Fundamental Concepts in Evolution. 3. Explores fundamental concepts in evolutionary biology including evolutionary ecology, population genetics, and speciation with an emphasis on both theoretical frameworks and practical applications. Discussion included. Cross listed with BOT/ZOOL 5060. Prerequisite: graduate student in good standing.

5100. Ecology as a Discipline. 3. Covers the range of ecological questions, processes, scales, and research approaches, in context of the history and philosophy of science in general and of ecology in particular. Aimed at first-year students in the doctoral program in Ecology, although students in other graduate programs are welcome. Prerequisite: graduate standing.

5350. Seminar in Ecology. 1-3. (Max. 12). Exploration of topical issues in ecology, based on discussions of relevant literature. Prerequisites: graduate standing and consent of instructor.

5540. Microbial Diversity and Ecology. 4. Introduces the diversity and ecology of soil microbes through an integrated lecture and laboratory course. Emphasis on molecular approaches to analyzing microbial diversity and evolution, and student-directed experimental design. Provides a continuum of realistic research experiences in molecular microbial ecology, from field work to evolutionary analysis of DNA sequence data. Cross listed with MOLB 5540. Prerequisite: MOLB 2210.

5550. Ecology as a Scientific Profession. 2. A capstone that prepares doctoral students for success and leadership in their careers as professional ecologists. Intended for students enrolled in the doctoral Program in Ecology in their second or third year. Prerequisite: graduate standing.

5610. Quantitative Modeling in Landscape Ecology. 3. Emphasis on quantitative, spatial analysis of landscapes and application of these quantitative tools to making sound management decisions. Work with real data, acquire high-level quantitative skills, develop problem-solving skills, and discuss management application of model results. Analysis will encompass abiotic, biotic (plant and animal), and human use of ecological systems in a spatial context. Cross listed with REWM 5610. Prerequisites: upper division stats course (e.g., STAT 4015 or STAT 4025) and graduate standing.

5620. Advanced Topics in Ecology. 1-4. (Max. 12). Provides advanced treatment of specific topics in ecology that are not covered in regular courses. Prerequisite: graduate standing and consent of instructor.

5745. Terrestrial Ecosystem Ecology. 3. Advanced course examines fundamental ecosystem functions and their relationship to ecosystem structure using a systems approach. We study cycles of carbon, water and nutrients through ecosystem components with an emphasis on interactions among plants, soil, and the atmosphere. Current readings focus on responses of terrestrial ecosystems to global climate change and human disturbance. Cross listed with BOT 5745. Prerequisite: one course in ecology.

5775. Forest Ecology. 4. Integrative study of the structure, function, and ecological diversity of forested ecosystems, and the physical factors that influence this diversity, including emergent properties of energy flow and nutrient cycling. Special emphasis is given to understanding forest disturbances and succession, and implications for impacts of management and sustainability are discussed throughout. Cross listed with RNEW 5775 and BOT 5775. Prerequisite: LIFE 3400.

5780. Research in Ecology. 1-6 (Max. 12). Designed for doctoral students pursuing exploratory research before they have determined a dissertation project, and for students to pursue independent research that will not comprise part of their dissertation. Research must be conducted under supervision of an Ecology Faculty member or Affiliate. Prerequisite: admission to doctoral Program in Ecology.

5920. Continuing Registration: On Campus, 1-2 (Max. 16). Prerequisite: graduate standing.

5940. Continuing Registration: Off Campus, 1-12 (Max. 16). Prerequisite: graduate standing.

5980. Dissertation Research. 1-12 (Max. 48). Designed for students who are involved in research for their dissertation project. Also used for students whose coursework is complete and are writing their dissertation. Prerequisite: enrollment in a graduate level degree program.
Food Science and Human Nutrition

The interdisciplinary food science and human nutrition master’s degree program affords students the opportunity to pursue graduate work in the area of human nutrition and/or food science. After admission to the program, students will choose a major department and work with a faculty member from that department. Students choosing the interdisciplinary program in food science and human nutrition will gain expertise in theory as well as research in the areas of food microbiology, meat science and food chemistry, human nutrition and metabolism, food product development, and community nutrition. All students will be exposed to laboratory as well as classroom learning experiences.

Program Specific Admission Requirements

Recommended prerequisites for students entering the program:

- One semester of organic chemistry (may include laboratory)
- Human or animal anatomy and physiology
- Introductory statistics
- Coursework in human nutrition

Students may be required to take courses in these areas if not completed as part of their undergraduate programs.

Program Specific Degree Requirements

Master of Science in Food Science and Human Nutrition

Plan A (thesis)

- One semester of biochemistry (may include a laboratory)
- Human or animal anatomy and physiology
- Statistics

Students may be required to take more than the minimum of 30 hours, either because they have to satisfy prerequisites for some courses, or because a student’s committee determines that more than 30 hours will be needed for the student to reach his/her professional objective.

A thesis is required.

All students are required to take courses in biochemistry, laboratory methodology, and statistics.

In addition, at least one credit of graduate-level seminar is required.

Students may request their area of thesis research in food science or in human nutrition.

Students may use the experimental animals and facilities within the animal science department.

A meat processing laboratory, sensory evaluation rooms, experimental kitchens, and a variety of modern facilities for research involving small animals and human subjects are available in the buildings. Major laboratory instruments including high performance liquid chromatographs, electrophoresis equipment, densitometers, gas chromatographs, ultracentrifuges, scintillation counters, differential scanning calorimeters, and histological equipment as well as computer terminals are available in each building.

See the Food Science (FDSC) and Family and Consumer Sciences (FCSC) section of this Bulletin for course listings.

Molecular and Cellular Life Sciences

203 Animal Science/Molecular Biology Complex

Phone: (307) 766-3300
E-mail: mcls@uwyo.edu
Web Address: www.uwyo.edu/mcls

Program Director: David Fay, Ph.D.
Admissions Director: Peter Thorsness, Ph.D.

Degree Offered

Ph.D. in Molecular and Cellular Life Sciences

This interdisciplinary program with more than 40 faculty participants spans a wide range of research topics, such as:

- Biotechnology, bioengineering, biomaterials, and pharmacology
- Cell biology and signaling
- Genetics and development
- Genomics, proteomics, and computational biology
- Microbiology and infectious disease
- Structural biology and biophysics

Coursework focuses on core courses in biochemistry and molecular biology, with electives that include such diverse courses as:

- Topics in Genomics
- Biophysics
- Microbial Physiology and Metabolism
- Cell and Developmental Genetics
- Mass Spectrometry and Analytical Chemistry

Program Specific Degree Requirements

MCLS doctoral students must fulfill the minimum requirements outlined by the university. In addition, students must obtain a high level of proficiency in the core foundations of the molecular and cellular life sciences through required courses in biochemistry/molecular biology, scientific literature analysis proficiency, and the MCLS cornerstone course. Because of the broad range of research interests pursued by MCLS faculty and students, considerable flexibility will be exercised regarding the specific nature of the graduate-level elective courses that students may take.

Students must successfully complete four eight-week rotations in MCLS laboratories of their choice during the first year.

Students must pass a comprehensive assessment exam at the end of the first year. Towards the end of the second year, students will undertake a qualifying examination in order to be formally admitted to graduate degree candidacy. This exam will have both

Biomedical Engineering
Mammalian Endocrinology
Cell Culture and Virology
Introduction to Bioinformatics
Protein Structure and Function
Microbial Genetics
Computational Biology
Quantitative Microscopy

Program Specific Admission Requirements

Admission to MCLS is a two-step process. The first level of evaluation is carried out by the MCLS admissions committee. This step does not require any fee but does require that all requested materials be submitted as described on our website. Applicants who are chosen for admission to the MCLS program will then complete the final application step through the University of Wyoming Admissions office. This latter step does require a $50 processing fee by the university along with the completion of several additional forms. Students are then officially notified by the university of their acceptance into the MCLS program.

We encourage students to submit their completed applications at the very latest by January 15 of each calendar year. However, because our review of applications will begin in the late fall, early submissions are encouraged and may stand a greater likelihood of success. Also note that we will continue to review new applications received after January 15 in the event that additional slots are available.

- Interdisciplinary
written and oral components and will cover areas of science that are relevant to the students' research.

The research and coursework progress of MCLS students will also be monitored and evaluated every year by the MCLS curriculum committee. In addition, an annual meeting with a research-specific dissertation committee will facilitate and evaluate the research progress of MCLS students beginning in the second year.

Students must attend weekly outside seminars on topics in the molecular life sciences for the duration of their studies.

Students must annually present their work at the MCLS Symposium.

For more information, please see the program's Web site at: www.uwyo.edu/MCLS/.

Neuroscience
Phone: (307) 766-6446
E-mail: flynn@uwyo.edu
Web Address: www.uwyo.edu/neuroscience
Program Director: Francis W. Flynn, Ph.D.

Degrees Offered
M.S. & Ph.D. in Neuroscience

The Graduate Neuroscience Program offers training leading to the M.S. and Ph.D. degrees in neuroscience. The Neuroscience Program emphasizes systems and integrative approaches, and our goal is to provide the students with the necessary background to be broadly trained research neuroscientists and carry out independent research in neuroscience. The Neuroscience Program emphasizes continuing interaction with faculty from several departments and we have a low student to faculty ratio. The educational philosophy of the Neuroscience Program is to encourage a problem-oriented rather than a strict discipline-bound approach to research. You will emerge from this program with the scientific and experimental training needed to comprehensively address a very wide range of research questions using a variety of techniques and analytic tools.

The Neuroscience Program is designed to enable graduate students to acquire competence in the various disciplines necessary for research and teaching careers in the neurosciences. The current interests of the neuroscience faculty include auditory neurophysiology, behavioral neuropharmacology, neuroendocrinology, neuroethology, neurodegeneration, somatosensory anatomy and physiology, pain research and cortical development and plasticity.

Program Specific Admission Requirements

University minimum requirements;

- Bachelor's degree in biological sciences from an accredited institution;

- Admission to the doctoral Neuroscience Program is based on GRE scores, transcripts, letters of recommendation, and your personal statement describing your areas of interest and experience. Admission is open to all students in the biological sciences who meet the minimum requirements.

- You will be best prepared for our program if you have successfully completed courses in chemistry, general zoology/biology, physiology, physiological psychology or animal behavior, and biochemistry. Students may be admitted with deficiencies in some of the areas. If so, the student's advisory committee will determine what additional work is necessary during the first year to correct any deficiency.

Program Specific Degree Requirements

Master's Program

After acceptance into the program, each student would select, or be assigned a major adviser and two other faculty advisers, all from the Neuroscience Program faculty. They will serve as the student's graduate committee, devising a set of course requirements (26 credit hour minimum) to best suit the student's educational goals and overseeing the design, execution, and approval of the student's thesis research.

In addition to the usual university requirements for the M.S. degree, an original research thesis (4 hours of thesis research; 5960) on a neuroscience problem and final oral examination will be required. Specific course requirements will include 1) Introduction to Neuroscience (NEUR 5280), 2) participation in at least two semesters in the Graduate Neuroscience Seminar (NEUR 5115; the topic and instructor changes each semester), 3) thesis research.

Students are required to take a minimum of two of the following courses: Neurophysiology (NEUR 5685), Structure and Function of the Nervous System (NEUR 5100), Neural Mechanisms of Behavior (ZOO 4290), and Cell Physiology (NEUR 5670). Students are required to earn a minimum grade of B for the required courses. Additional electives include: Pharmacology I and II (PHCY 6230, 6231).

Doctoral Program

All doctoral neuroscience students are required to complete a 30 hour program of core courses that includes the following required courses: Introduction to Neuroscience, Structure and Function of the Nervous System and Neurophysiology. Students are required to take one course in Statistics (e.g. STAT 5050, STAT 5210) and the course that meets this requirement will be arranged with the student's committee. The statistics requirement must be met by the end of the second year. The Neuroscience Program is a research-oriented program and students are expected to take a minimum of 2 to 3 credit hours of research per semester. Students are also expected to enroll in an on-going Seminar in Neuroscience each semester. The Neuroscience Seminar, which meets weekly and is attended by students and faculty members, provides an opportunity for intellectual and social exchange. The topic and the faculty member directing the seminar changes each semester. The remainder of the 30 hour requirement for the doctor of philosophy degree is selected from designated courses in physiology, pharmacology, molecular biology, and psychology.

A grade of B or better is required for all neuroscience courses.

A student is expected to have a graduate adviser at all times. The faculty adviser will be a participating member of the neuroscience faculty. The adviser is responsible for directing the student's research and academic coursework. During the second year, the student will have an advisory committee. The advisory committee will consist of at least three neuroscience faculty members and an outside member. Normally, the student's adviser will chair the committee and help identify members of the committee who best match the student's area of interest. The role of the advisory committee is to oversee all aspects of the student's education after the first year.
In the student’s third year, the advisory committee will set and evaluate the student’s qualifying examination. After completion of the preliminary examination, the committee will evaluate the student’s dissertation proposal and, eventually, the completed dissertation.

The dissertation is the single most important component of the graduate program. It reports the results of the student’s research. As oral defense of the dissertation, the student will deliver a formal 50 minute seminar on original research from the dissertation. The seminar will be followed by an examination by the student’s advisory committee.

Reproductive Biology
Phone: (307) 766-5374
E-mail: gm@uwyo.edu
Web Address: www.uwyo.edu/reprobio
Program Director: Gary Moss, Ph.D.

Degrees Offered
M.S. and Ph.D. in Reproductive Biology

The University of Wyoming offers an innovative program of graduate studies in vertebrate reproductive biology. This interdisciplinary graduate program was established in 1986 and combines the expertise of faculty members who have established records of accomplishment. Areas of emphasis include: ovarian biology, fetal/placental physiology, neuroendocrinology, nutrition/reproduction interactions, reproductive immunology, and the fetal origins of growth efficiency, reproductive function, and adult disease. In this regard, the Center for the Study of Fetal Programming, which was initiated in 2002, has established a link between faculty at the University of Texas Health Sciences Center, San Antonio, Texas, and the UW faculty in this program, emphasizing both biomedical and agricultural-related research.

The opportunity to study in these exciting areas is made available primarily through the collaborative efforts of the faculty in the departments of Animal Science, Molecular Biology, Veterinary Science, and Zoology and Physiology, as well as the School of Pharmacy. Programs are offered leading to the M.S. and Ph.D. degrees in reproductive biology. Qualified students are eligible to compete for a graduate assistantship assigned to the program. Post-doctoral positions provide advanced training in research and teaching.

Both the research and teaching aspects of the program reflect a truly interdisciplinary approach. Research activities range from directly applied to fundamental. Animals used for investigation can include livestock and laboratory species. Modern laboratories are designed for hormonal, chemical, and molecular analysis of biological samples, light, electron and confocal microscopy, incubation of cells, tissues and small animal experimentation. Well-equipped large animal handling and surgical facilities are located a short distance from campus at Red Buttes Research Center and the Animal Science Livestock Center.

Program Specific Admission Requirements
GRE composite score of 900 and 1,000 for M.S. and Ph.D. students, respectively.
GPA of 3.00 (with A=4.00).
TOEFL score of 540 for students whose native language is not English.

Program Specific Degree Requirements
Requirements are based on the university minimum requirements.

Water Resources

College of Agriculture and Natural Resources
Department of Ecosystem Science and Management
8 Agriculture Building
Phone: (307) 766-4274
E-mail: snmiller@uwyo.edu
Web Address: www.uwyo.edu/ware/
Program Director: Scott N. Miller

Degrees Offered
M.A. or M.S. in (Program Name)/Water Resources

Academic departments across the university cooperate to provide master of arts or master of science degree programs that contain multidisciplinary training in water resources. The master’s degree offered through these affiliations is awarded as a major with each of the sponsoring department’s graduate programs. The water resources interdisciplinary major will be acknowledged on the graduate transcript and thereby certify to potential employers that the candidate has completed an in-depth multidisciplinary course program in the broad area of water resources.

The educational underpinnings of this program include the following:
The purpose of the program is to provide multidisciplinary education and to impart a multidisciplinary perspective to candidates.
Training is to be consistent with the rigor of professional water resources demands.

The interdisciplinary major program is flexible so as to meet the candidates’ individual professional objectives.

Primary responsibility for student guidance and graduate program formulation resides with the sponsoring department and sponsoring major professor. Once accepted, each candidate’s graduate committee will contain at least one member drawn from the Water Resources Curriculum Committee.

Please refer to latest updated information on the Web site listed above:
Scott Miller, chair, ESM
Don McLeod, Agriculture and Applied Economics
Carol Frost, Geology and Geophysics
William Gribb, Geology
Wayne Hubert, Zoology and Physiology
Drew Johnson, Civil and Architectural Engineering
David Legg, ESM

Upon acceptance to the program, the sponsoring department must assign a member of the Water Resources Curriculum Committee to the candidate’s graduate committee. The Water Resources Curriculum Committee’s representatives on the candidate’s graduate committee shall aid in formulating deficiency requirements, course program design, academic performance criteria, and research objectives throughout the candidate’s tenure in the program.

Program Specific Admission Requirements
University application and fee;
Application fee is valid for three years;
Official documentation indicating bachelor’s degree earned (not necessary if UW is the most recent institution attended);
Potential candidates are encouraged to apply for admission to this program by contacting the participating department and by specifying at the initiation that they desire admission to the water resources interdisciplinary major. Their credentials will be evaluated by the sponsoring department and the department recommends admission of the individual into the program to the UW Admissions office.
Program Specific Degree Requirements

The academic program of study undertaken by the candidate must be designed to enhance the student’s background and expertise through formal graduate level coursework in the areas of: (1) technical hydrology, (2) natural resources economics and/or law, and (3) water quality. To insure a minimum multidisciplinary character, the course program must contain nine hours of coursework with at least three hours of each from the aforementioned areas and at least six of those credit hours must be from outside the student’s sponsoring department, along with a 1 credit hour seminar on water resources organized through the Department of Ecosystem Science and Management. Only Plan A master’s degree programs, which require the writing of a thesis in the water resources area, are acceptable for the water resources degree option.

A. Hydrology (3 hours)
   CE 4800 Hydrology ........................................3
   CE 4820 Groundwater and Drainage Engineering ..........3
   CE 5810 Groundwater Hydrology ..............................3
   GEOG 5050 Fluvial Geomorphology ...........................3
   GEOL 5444 Geohydrology .....................................3
   GEOL 5550 Numerical Methods
       Groundwater Geology ..................................3
   GEOL 5570 Advanced Geohydrology ..........................3
   REWM 5285 Wildland Hydrology ................................3
   SOIL/MATH 5110 Modelling Flow Transport in Soil and Groundwater Systems ........................................4

B. Law/Natural Resource Economics (3 hours)
   AGEC 4710 Natural Resources Law & Policy ..................3
   AGEC 4720 Water Resource Economics ........................3
   AGEC 5630 Advanced Natural Resource Economics .............3
   ECON 4400 Environmental Economics ........................3
   ECON 4410 Natural Resource Economics ........................3
   ECON 5400 Advanced Resource & Environmental Economics 3
   LAW 6660 Environmental Law ................................3
   LAW 6860 Water Rights .....................................3

C. Water Quality (3 hours)
   GEOL 4490 Geochemistry ......................................3
   GEOL 5450 Water Quality Modeling ................................3
   GEOL 5777 Geochemistry of Natural Waters ................3
   REWM 4710/5710 Watershed Water Quality Management ........3
   SOIL 4130/5130 Chemistry of the Soil Environment ..........4
   ZOO 4440 Limnology ........................................3

D. One-Hour Seminar in Water Issues
   REWM 5250. Seminar in Water Resources .1

Each student in the water resources interdisciplinary major program will be required to complete this course once during their graduate program. As part of the requirements for the seminar: (a) students will be required to present a seminar on a current water resource issue in Wyoming and to develop an executive summary of their issue to distribute to class participants. Each student is also required to participate in a discussion group following each seminar which stresses the interdisciplinary nature of the issue; (b) during the course of a student’s graduate program, he/she will be required to present one seminar for the seminar series (preferably on some aspect of their thesis research). This presentation does not have to occur during the semester that the student is officially signed up for seminar credit.

Agricultural Economics/ Water Resources

Department of Agricultural and Applied Economics
206 Agriculture Building
Phone: (307) 766-2386
E-mail: ag-econ@uwyo.edu
Web Site: www.uwyo.edu/agecon/

The objective of this program is to provide students with specialized study in water resources and to signify this specialization by the designation of the water resources interdisciplinary major on the transcript.

Coursework and Thesis

Students must complete the 24 credit hour agricultural and applied economics including M.S. core requirements plus 4 thesis hours and 9 credit hours in water resources approved courses.

Achieve a cumulative 3.0 GPA in the AGEC M.S. core requirements.

The candidate’s graduate committee, nominated by the major professor, the student and the department head determine the final program of study and thesis research topic, which must be in the water resources area.

Presentation of research results at a formal public seminar.

Completion of an oral examination covering the student’s thesis research administered by the graduate committee.

Oral Exam Requirement

In addition to coursework and a Plan A Thesis, students must pass a final oral examination. The student’s committee may also require a written examination.

Interdisciplinary Component

nine hours

(see Water Resources degree requirements)

Botany/Water Resources

Department of Botany
114 Aven Nelson Building
Phone: (307) 766-2380
Web Address: www.uwyo.edu/botany

In addition to the general requirements for admission to the existing master’s program in botany, the master of science in botany/water resources interdisciplinary major requirements will include the following variations:

Coursework and Thesis

16 semester hours are required in botany, plus 9 semester hours in water resources courses. Other courses in mathematics, physics, chemistry, and statistics also may be required as the special program and undergraduate preparation require.

Due to the various, potential subspecialities that students might follow in connection with a botany/water resources interdisciplinary major, no particular botany courses are prescribed. An appropriate array of courses for the desired specialty will be determined by agreement between the advisory committee, graduate student adviser, student, and with the approval of the Water Resources Curriculum Committee.

For the water resources interdisciplinary major, a Plan A Thesis is required. The student must present his or her research in a seminar before the department, and must pass an oral exam on the thesis research.

Interdisciplinary Component

9 hours

(see Water Resources degree requirements)

Civil Engineering/Water Resources

Department of Civil and Architectural Engineering
3074 Engineering Building
Phone: (307) 766-5255
E-mail: ceinfo@uwyo.edu
Web Address: www.eng.uwyo.edu/civil/
The purpose of this program is to broaden the students’ master of science program in the water resource area in civil engineering.

Plan A Thesis Requirement

Only students with a M.S. Plan A thesis option are eligible. The student’s graduate committee will include at least one member of the Water Resources Curriculum Committee.

Coursework and Thesis

Each student must complete a minimum of 28 hours of graduate level coursework and a thesis under Plan A (4 credit hours) to qualify for the master of science in civil engineering/water resources.

The student must obtain at least 18 credit hours of graduate level coursework in engineering, emphasizing a concentration of core courses in a particular area of emphasis in civil engineering. The core course areas of emphasis for this program are hydrologic and hydraulic engineering. The particular set of courses for a given area of emphasis will be designated by the faculty in the water resources area for these areas of emphasis with the approval of the Civil Engineering Graduate Committee.

Interdisciplinary Component

9 hours
A. Technical Hydrology (3 hours)
GEOL 5444 Geohydrology .........................3
GEOL 5550 Numerical Methods in Groundwater Geology I .........................3
GEOL 5570 Advanced Geohydrology ............3
REWM 5285 Wildland Hydrology ..................3
REWM 5280 Stream Habitat Management ..........3
B. Law/Natural Resource Economics ..........3
(please refer to the general degree requirements for a list of courses)
C. Water Quality (three hours)
GEOL 5450 Water Quality Modeling ............3
GEOL 5777 Geochemistry of Natural Waters ..................................3
MOLB 4410 Water Microbiology ..................3
MOLB 4500 Microbial Ecology ......................3
ZOO 4440 Limnology ................................3

Entomology/Water Resources

Department of Ecosystem Science and Management
2013 Agriculture Building
Phone: (307) 766-3114
Web Address: www.uwyo.edu/esm
Ecosystem Science and Management E-mail: esm@uwyo.edu

The purpose of this program is to enhance the cross-disciplinary linkage between entomology and water resources, and to provide students an entomology degree program which emphasizes the important issues in water resources. Aquatic insects are increasingly being used as bioindicators of aquatic ecosystem health. This is an area of environmental assessment that is rapidly expanding, as is the job market for scientists with this blend of skills.

Coursework and Thesis

Each student must complete a minimum of 26 credit hours of graduate level coursework and 4 thesis credit hours of ENTO 5960 to qualify for a master of science degree in entomology/water resources. Specific coursework will be determined by the student’s graduate committee; however, each student is required to enhance his/her background and expertise in the water resources area through specialized coursework and a seminar as shown below.

A. ENTO 5678 Aquatic Entomology (3)
B. Interdisciplinary component
9 hours
(see Water Resources degree requirements)

Plan A Thesis Requirement

Only Plan A thesis students are eligible. In addition to coursework and a Plan A thesis, students must pass a final oral examination. The student’s committee may also require a written exam. The student’s graduate committee will include at least one member of the Water Resources Curriculum Committee.

Coursework and Thesis

Each student must complete a minimum of 30 hours of graduate level coursework and a thesis under Plan A (GEOG 5960 for four credit hours). Specific requirements are outlined below, with course credit hours shown in parentheses.

A. Core requirements
GEOG 4280 or 5000 level (4)
Any two of the following methods courses (6-8 credit hours):
GEOG 4000 Terrain Analysis .......................3
GEOG 4150 Cartography and Digital Map Design ..................................4
GEOG 4200 Intro to Geographic Information Systems ................................3
GEOG 4210 Advanced Geographic Information Systems ..........................3
GEOG 4860/5000 level ..........................1-6
GEOG 4865/5000 level- Research seminar (4 credit maximum allowed in the core requirement)
GEOG 5790 Research Methods ...............1-3
All students must have committee approval to initiate research on their theses/professional papers and must successfully complete an oral defense of their theses/professional papers. The student’s committee may also require a

Geography/Water Resources

Department of Geography
207 Arts and Sciences Building
Phone: (307) 766-3311
Web Address: www.uwyo.edu/geog

The master of arts in geography/water resources is consistent with traditional emphases and long-term goals of the Department of Geography in natural resource management and studies of the Rocky Mountain-Great Plains environment.

Prerequisites

15 credit hours in geography, including: 3 hours in Maps and Mapping, 3 hours in Human Geography, and 3 hours in Physical or Environmental Geography. These credits will not count toward the master’s degree.

Plan A Thesis Requirement

Only students with a Plan A thesis option are eligible. In addition to coursework and a Plan A thesis, students must pass a final oral examination. The student’s committee may also require a written exam. The student’s graduate committee will include at least one member of the Water Resources Curriculum Committee.

Coursework and Thesis

Each student must complete a minimum of 30 hours of graduate level coursework and a thesis under Plan A (GEOG 5960 for four credit hours). Specific requirements are outlined below, with course credit hours shown in parentheses.

A. Core requirements
GEOG 4280 or 5000 level (4)
Any two of the following methods courses (6-8 credit hours):
GEOG 4000 Terrain Analysis .......................3
GEOG 4150 Cartography and Digital Map Design ..................................4
GEOG 4200 Intro to Geographic Information Systems ................................3
GEOG 4210 Advanced Geographic Information Systems ..........................3
GEOG 4860/5000 level ..........................1-6
GEOG 4865/5000 level- Research seminar (4 credit maximum allowed in the core requirement)
GEOG 5790 Research Methods ...............1-3
All students must have committee approval to initiate research on their theses/professional papers and must successfully complete an oral defense of their theses/professional papers. The student’s committee may also require a
Coursework and Thesis

Each student must complete a minimum of 26 credit hours of graduate level coursework and 4 thesis credit hours of SOIL 5960 to qualify for a master of science degree in soil science/water resources. Specific coursework will be determined by the student’s graduate committee; however, each student is required to enhance his/her background and expertise in the water resources area through specialized coursework and a seminar as shown below.

A. Core courses - Students must take or have taken equivalent courses in the four soils disciplines: physics, pedology, chemistry, and microbiology.
   - SOIL 5100 Soil Physics (4)
   - SOIL 5120 Genesis, Morphology and Classification of Soils (3)
   - SOIL 5130 Chemistry of the Soil Environment (3)
   - SOIL 5140 Soil Microbiology (4)

B. Enhancement courses - Students must take at least one of the following courses:
   - SOIL 5110 Modeling Flow Transport in Soil and Groundwater Systems
   - SOIL 5150 Forest and Range Soils
   - SOIL 5160 Soil Fertility and Fertilizers
   - SOIL 5170 Analytical Methods for Water Resources (1)
   - SOIL 5180 Soil and Groundwater Systems: 3

C. Interdisciplinary component
   - 9 hours
   (see Water Resources degree requirements)

Plan A Thesis Requirement

Only Plan A thesis students are eligible for the master of science in soil science/water resources. In addition to coursework and a Plan A thesis, students must pass a final oral examination. The student’s graduate committee will include at least one member of the Water Resources Curriculum Committee to help ensure adherence to the master of science in soil science/water resources degree requirements and that research efforts are in the water area.
The purpose of this program is to broaden the master of science program in the water resources area by having students take 10 semester hours of coursework associated with water resources.

Coursework and Thesis
Each student must complete a minimum of 26 hours of graduate level coursework and 4 hours of Plan A thesis credit to qualify for the master of science in zoology and physiology/water resources. Specific coursework requirements will be determined by the student’s graduate committee. The student must obtain at least 10 credit hours as indicated. Depending upon the student’s undergraduate background and career interests, the graduate committee may require that these 10 credits be part of, or in addition to, the 26 credit hours required for a master of science in zoology and physiology.

Interdisciplinary Component
9 hours
(see Water Resources degree requirements)

The Willard C. and Elaine N. Rhoads Scholarship for Graduate Students in Water Resources at the University of Wyoming

The Willard C. and Elaine N. Rhoads Scholarship for Graduate Studies in Water Resources was established to honor Willard Rhoads, a member of the Research Review and Priorities Committee for the Wyoming Water Resources Center and a long-time member of the Wyoming Water Development Commission. Funds for the Rhoads Scholarship were donated to the University of Wyoming by Mrs. Rhoads and her family and friends, with some matching funds provided by the university. Two annual awards for the academic year will be made in the amount of $1,000 to a master’s degree candidates for use in furthering research on Wyoming’s water resources.

Eligibility Requirements and Evaluation Procedures
The applicant must be accepted into the interdisciplinary water resources major program administered by the student’s academic department.

The applicant must agree to take a minimum of 9 credit hours (including thesis credits) in each of the two semesters for which the award applies.

Applicants for the scholarship can apply more than once, with the exception of past recipients.

The recipient will be chosen by a selection committee appointed by the Water Resources Curriculum Committee.

Applicants meeting the eligibility requirements above will be judged on the basis of promise of academic excellence as evident in grades for graduate level courses, and a recommendation from the student’s graduate adviser.

Funds for the academic year will be dispersed to the recipient equally in the fall and spring semesters for half of the total amount.

Application Guidelines
Applicants meeting the above requirements should submit the following:
Application deadline is April 1.
A letter from the applicant listing the name of the scholarship for which he/she is applying, which includes a statement that the applicant agrees to enroll for a minimum of nine hours of graduate level courses (including thesis credits) in each of the two semesters for which the award applies, and a statement of academic and career goals related to water research. The applicant must also state the purpose for which the scholarship funds will be used.
An official transcript of grades for graduate level courses earned at the University of Wyoming or other institutions.
A note from the academic department, verifying that the applicant has been accepted into a water resources interdisciplinary major program.
A confidential letter of recommendation from the applicant’s graduate adviser addressing the applicant’s promise for attaining academic and career goals through his/her research in water resources. Up to two additional letters of recommendation can be provided at the applicant’s discretion.
The applicant should arrange for all materials to be sent to:
K.J. Reddy
Chair, Rhoads Scholarship Committee
Department of Ecosystem Science and Management
Dept. 3354, 1000 E. University Ave.
Laramie, WY 82071-3354

Water Resources Program
Executive Committee Members:
Scott N. Miller, Chair, Ecosystem Science and Management
Don McLeod, Agricultural and Applied Economics
Carol Frost, Geology and Geophysics
William Gribb, Geography
Wayne Hubert, Zoology and Physiology
Drew Johnson, Civil and Architectural Engineering
David Legg, Ecosystem Science and Management

Interdisciplinary 516